LMS/LKD/S00597-0.0

Long-Term Surveillance Plan for the UMTRCA Title I Lakeview, Oregon, Disposal Site

January 2026

U.S. DEPARTMENT OF ENERGY | Legacy Management

This document has been designed for online viewing.

Contents

Figures

Tables

Appendixes

Abbreviations

CFR	*Code of Federal Regulations*
cm/s	centimeters per second
D_{50}	mean diameter
DOE	U.S. Department of Energy
EDA	energy dissipation area
EMS	Environmental Management System
ft	feet
IC	institutional control
LM	Office of Legacy Management
LTS&M	long-term surveillance and maintenance
LTSP	Long-Term Surveillance Plan
MCL	maximum concentration limit
mg/L	milligrams per liter
NRC	U.S. Nuclear Regulatory Commission
PMP	probable maximum precipitation
UMTRCA	Uranium Mill Tailings Radiation Control Act
USC	*United States Code*

1.0 Introduction

1.1 Purpose and Scope

This Long-Term Surveillance Plan (LTSP) details how the U.S. Department of Energy (DOE), will fulfill general license requirements of Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27) as the long-term custodian of the Lakeview, Oregon, Disposal Site in Lake County, Oregon. The Office of Legacy Management (LM) is responsible for the preparation, revision, and implementation of this LTSP, which specifies procedures for site inspections, monitoring, conducting maintenance, fulfilling annual and other reporting requirements, and maintaining site records.

1.2 Legal and Regulatory Requirements

The Uranium Mill Tailings Radiation Control Act of 1978 (Title 42 *United States Code* Section 7901 et seq. [42 USC 7901 et seq.]) (UMTRCA) provides for the remediation (or reclamation) and regulation of uranium mill tailings under either Title I or Title II of the act. Title I addresses former uranium mill sites that were unlicensed as of January 1, 1978, and essentially abandoned. Title II addresses uranium mill sites under specific license as of January 1, 1978. In both cases, the licensing agency for uranium production is the U.S. Nuclear Regulatory Commission (NRC) or, in the case of certain Title II disposal sites, an Agreement State. The Lakeview site is regulated under Title I of UMTRCA.

NRC regulations in 10 CFR 40.27 establish a general license for the long-term surveillance and maintenance (LTS&M) of reclaimed UMTRCA Title I disposal sites. NRC regulates the general license, which applies to all UMTRCA Title I disposal sites under long-term management, even those in Agreement States. If the host state decides not to accept responsibility for long-term custody and care of the site, DOE is designated as the licensee under the NRC general license. The general license becomes effective for a particular site when NRC (1) determines that reclamation requirements have been satisfied, (2) accepts a site-specific LTSP, and (3) terminates the specific license. The State of Oregon and NRC both concurred that DOE had met the requirements of the remedial actions, and DOE had concurrence on the LTSP from NRC on September 15, 1995 (DOE 1994).

The requirements for custody and LTS&M as specified in 10 CFR 40.27 and 10 CFR 40 Appendix A Criterion 12, and as implemented in this LTSP, are addressed in the sections identified in Table 1. The plans, procedures, and specifications in this LTSP are based on the *Guidance for Developing and Implementing Long-Term Surveillance Plans for UMTRCA Title I and Title II Disposal Sites* (DOE 2012), hereafter referred to as the LTSP Guidance Document. The current version of the LTSP Guidance Document and this LTSP constitute DOE's operational plan for the custody and LTS&M of the site.

Table 1. LTSP and the Long-Term Custodian (DOE) Requirements for the Lakeview, Oregon, Disposal Site

Requirement		Reference
LTSP		
1.	Description of final site conditions	Section 2.0
2.	Legal description of the site	Appendix A
3.	Description of the long-term surveillance program	Section 3.0
4.	Criteria for follow-up inspections	Section 3.5.1
5.	Criteria for site maintenance and emergency measures	Section 3.6.3
Long-Term Custodian (DOE)		
1.	Notification to NRC of changes to the LTSP	Section 1.3 and 3.1
2.	NRC permanent right-of-entry	Section 3.1
3.	Notification to NRC of significant construction, actions, or repairs at the site	Sections 3.5 and 3.6

1.3 Role of the U.S. Department of Energy

DOE formally established LM in December 2003. The LM mission includes implementing LTS&M at sites transferred to LM to ensure sustainable protection of human health and the environment. LM is responsible for implementing this LTSP after acceptance by NRC.

During long-term stewardship, site conditions may necessitate changes to LTS&M requirements for a particular site. Changes in site conditions or management requirements may include collection of new data or changes in physical site features. In such circumstances, LM will revise the LTSP to describe these changes in site conditions or the site's LTS&M requirements. DOE will notify NRC of any changes to the LTSP; the changes must not conflict with the requirements of the general license (10 CFR 40.27[c][3]).

LM may consider reuse opportunities, such as conservation reuse, maintaining and enhancing wildlife and pollinator habitat, or promoting native biodiversity at the site. LM will evaluate any proposed reuse opportunities to ensure that the reuse will not negatively impact the tailings disposal system or site features, compromise human safety or the environment, or conflict with the requirements of this LTSP or the general license. Such reuse opportunities, if implemented, will not be cause for revising this LTSP; however, consultation with NRC will be sought before any such reuse opportunities are implemented.

LM implements an Environmental Management System (EMS) to incorporate environmental protection practices into LTS&M and emergent activities. LM's EMS process ensures that LM maximizes beneficial use of finite resources, minimizes waste and adverse environmental impacts, and meets or exceeds compliance with applicable environmental, public health, and resource protection laws, regulations, and DOE requirements.

2.0 Final Site Conditions

Reclamation at the Lakeview site began in 1986 and was completed 3 years later in 1989. During this remedial action, 926,000 cubic yards (736,000 dry tons) of contaminated material from the tailings pile, evaporation ponds, buildings, and wind- and water-borne deposits were removed from the mill site and carried by truck to the Lakeview disposal site northwest of Lakeview, Oregon. Removal of windblown materials from the property adjacent to the former mill site was included in this remedial action. Contaminated materials were placed in an engineered disposal cell that was partly constructed below grade.

2.1 General Description of the Disposal Site and Vicinity

The site occupies approximately 40 acres in Lake County, Oregon, approximately 11 miles northwest of the Town of Lakeview (Figure 1).

The site is within the northwestern part of the basin and range province, a large physiographic region characterized by north- and northwest-trending normal faults. The site is on the western edge of the Goose Lake graben, a down-dropped fault block.

The area immediately surrounding the site is privately owned ranch land (previously known as Collins Ranch) at an elevation of 4900 to 5000 feet (ft). Mountains to the north and west are in the Fremont National Forest, where summits reach elevations of more than 8000 ft. Immediately north of the site, Augur Hill rises to an elevation of 5029 ft.

Vegetation at the site is composed of sagebrush, other shrubs, and grasses. The meadow below the site to the west is grassy. At elevations just a few hundred feet above the site, vegetation consists of a ponderosa pine community.

The site is in the eastern Oregon high desert in the rain shadow of the Cascade Mountains. The climate is semiarid with 14.7 inches of annual precipitation, including 54 inches of snow. Most precipitation falls in the 9 months of fall, winter, and spring. Summers are relatively dry.

Based on information from the Lakeview airport, the nearest weather station, mean temperature extremes range from a daily low of 21 °F in January to a daily maximum of 85 °F in July. Average wind speed is 7.5 miles per hour, predominantly out of the south. Topography and elevation are understood to affect the local climate at the site.

The estimated population of Lake County was 8160 according to the 2020 U.S. Census (U.S. Census Bureau 2020). The county economy has historically relied on the lumber, agricultural, and livestock industries. Tourism has increased because of local attractions and outdoor recreation (Lakeview 2025).

2.1.1 Site Ownership and Access

Pursuant to Section 104 of UMTRCA, the State of Oregon acquired the site from a private interest through a civil action suit. This acquisition provided a 40-acre site and perpetual access to the site across a private ranch from Lake County Road 2-16B. The legal description of the site and a brief history of the acquisition are in Appendix A. The site boundary is shown in Figure 2.

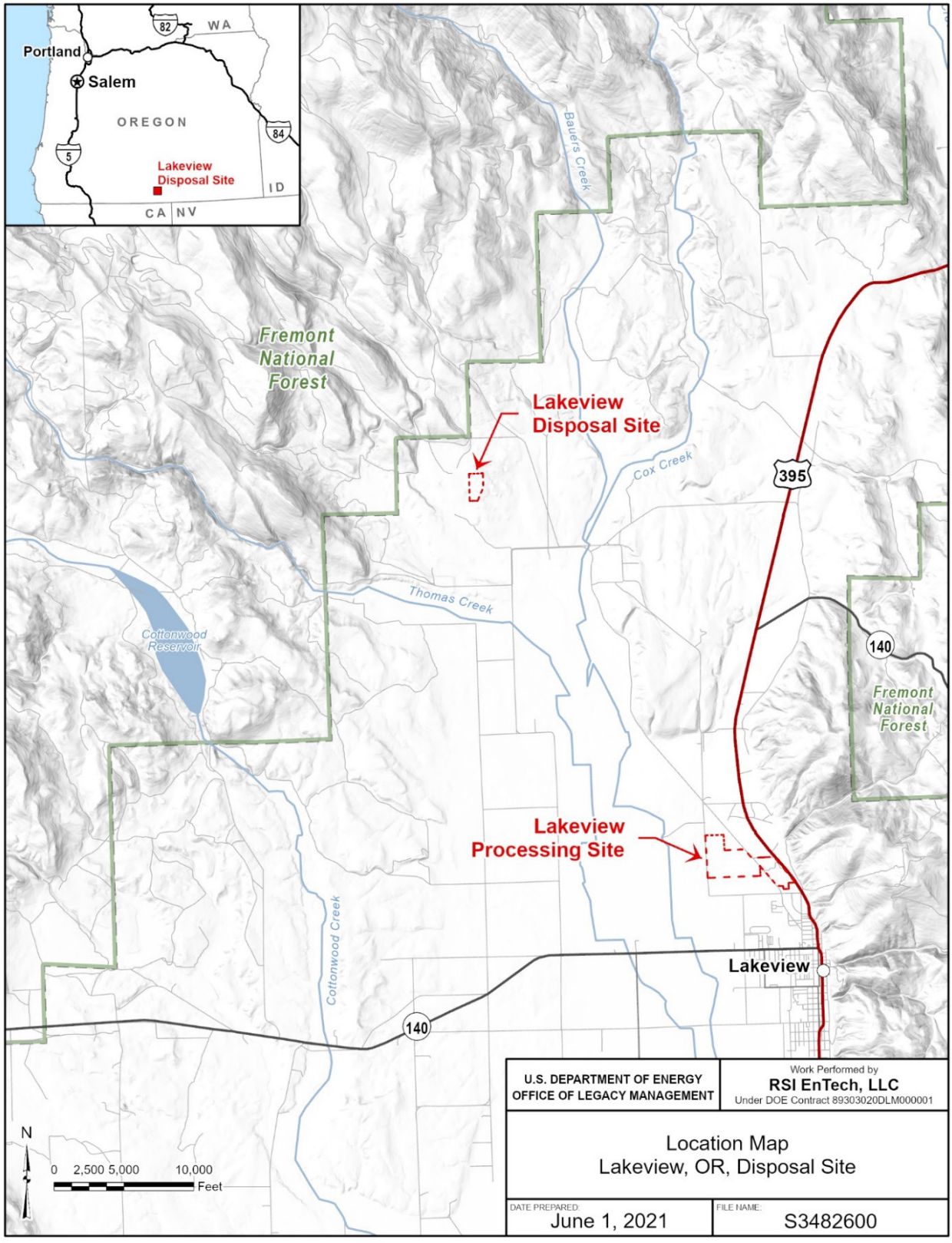
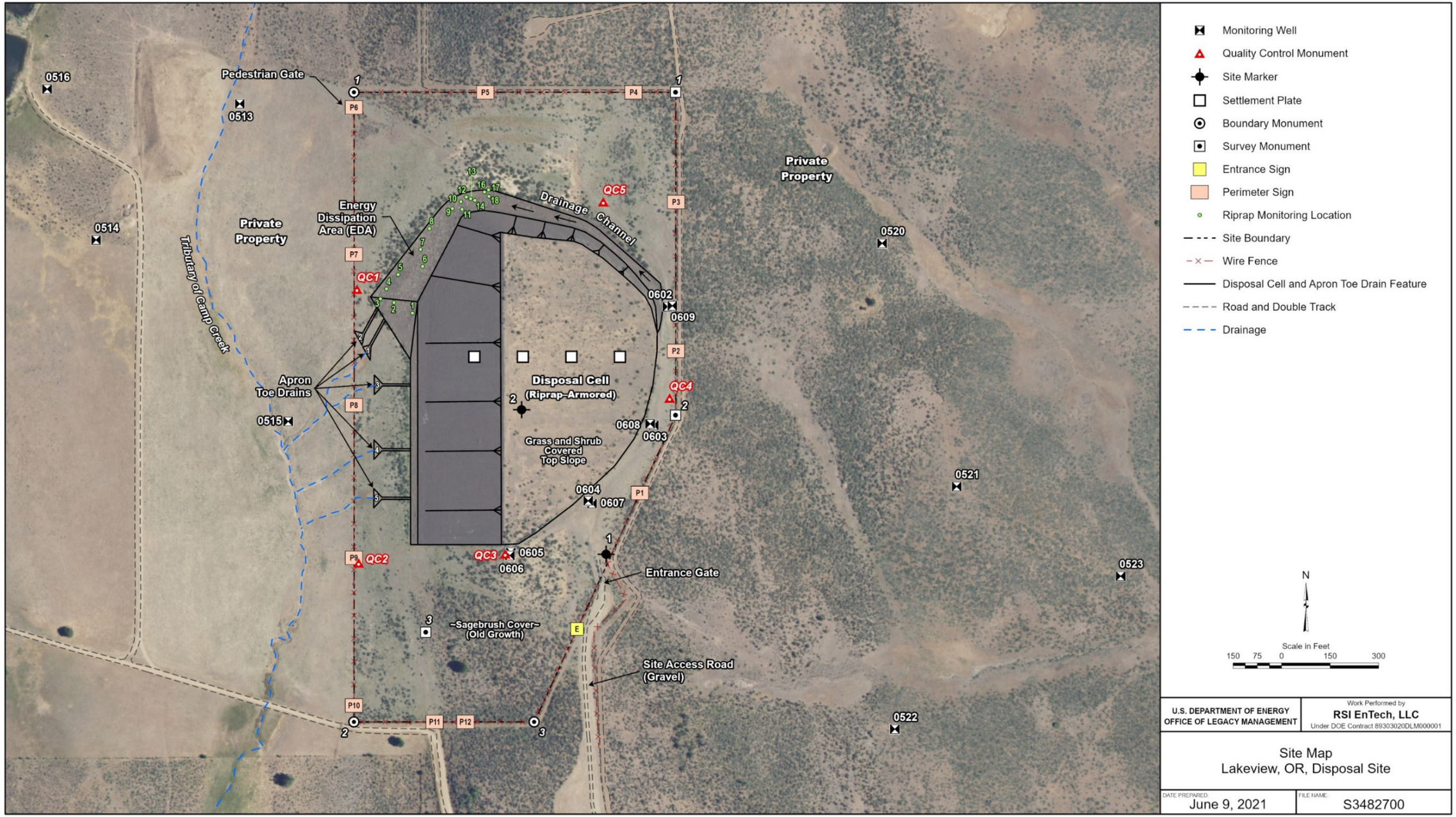


Figure 1. Lakeview, Oregon, Disposal Site Location Map



Abbreviation: QC = quality control

Figure 2. Site Map for Lakeview, Oregon, Disposal Site

2.1.2 Directions to the Disposal Site

Directions to the site are as follows:

Mileage	Route
0.0	Junction of U.S. Highway 395 and State Highway 140 north of the Lakeview commercial district
4.5	Junction with Highway 140 East; continue north
6.3	Turn left (west) on County Road 2-16
7.1	Lake County landfill on the right
9.0	Cross Cox Creek
9.5	Turn right (north) on County Road 2-16B
10.0	Turn left (west) on the site access road
10.2	Cross the cattle guard and open the gate, continue west (private landowner to provide code or open gate)
10.9	Turn right (north)
11.1	Entrance gate in southeast fence line

Although DOE has permanent and unrestricted access to the site (DOE 1994), an access protocol is established with the owner of private land surrounding the site. DOE will advise the landowner or point of contact by telephone before each site visit. The point of contact, address, and telephone number will appear in the inspection checklist (Appendix B). If ownership or contact information changes, it will be noted in the checklist.

2.2 Site History

The Lakeview disposal site is a relocated site in that tailings and other contaminated materials were moved (i.e., relocated) from the former mill site area to a remote disposal site that met remedial action objectives for long-term safety and isolation (DOE 1989b). The former mill site was located approximately 1 mile north of the Town of Lakeview and the disposal site is located approximately 11 miles northwest of Lakeview as shown in Figure 1.

The Lakeview uranium processing mill was built by the Lakeview Mining Company in 1958 and began operating that year. Uranium ore came from the White King and Lucky Lass mines, both approximately 16 miles northwest of Lakeview, Oregon.

The owners of the Lakeview mill also owned the Gunnison Mining Company, which operated the uranium mill at Gunnison, Colorado. Both mills were acquired in 1961 by Kerr-McGee Oil Industries through its subsidiary Kermac Nuclear Fuels Corporation. Between 1960 and 1968, the mill had five owners.

From 1958 to 1961, 130,000 tons of ore were processed at the Lakeview mill. The rated capacity of the mill was 210 tons per day. Uranium ore was processed by a sodium chlorate and sulfuric acid leaching process.

In 1968, the Lakeview mill was acquired by Atlantic Richfield Company. In 1974, Atlantic Richfield began a cleanup operation at the mill under a plan approved by the Oregon State Health Division. The cleanup was completed in 1977 to meet state requirements for control of radiation. Mill buildings and the immediate surroundings were involved in the cleanup and decontamination.

In 1978, Atlantic Richfield sold the property to the Precision Pine Lumber Company, which used the site and buildings as a lumber mill. The property was sold to Goose Lake Lumber Company in 1987, although Precision Pine Lumber continued to own title to the uranium mill tailings onsite. The tailings pile and evaporation ponds were approximately 2000 ft west of the former mill buildings.

The Lakeview mill site was designated for cleanup under UMTRCA in 1978. Remedial action began in 1986 and was completed 3 years later in 1989. After remedial actions were completed in 1989 and the original 1993 LTSP (DOE 1994) was accepted in 1995, the site was transferred to DOE (Appendix C).

Further information on mill site history is in Ford 1977, DOE 1985b, and DOE 1992 and in additional references cited in these documents.

2.3 Site Description

2.3.1 Description of Surface Conditions

The site contains one disposal cell with a rock-soil matrix top cover, drainage channel, apron toe drains, and energy dissipation area (EDA) surrounded by an access-control fence. Perimeter signs, two granite site markers, and boundary monuments delineate the site.

The site comprises 39.6 acres on a hill slope that faces west. The top of the disposal cell is relatively flat but designed to shed runoff to the west at a 2% to 4% grade. The western disposal cell side slope is steeper, with a grade of 20%. The disposal cell surface is also covered with sagebrush, other shrubs, and native grass (DOE 1994). Some of the vegetation is natural (although modified by grazing), and some was planted during the final stages of remedial action.

2.3.2 Permanent Site Surveillance Features

The permanent site surveillance features at the site consist of 12 perimeter signs or no-trespassing signs, an entrance sign, three boundary monuments, three survey monuments, two granite site markers, a perimeter fence, and an entrance gate. These features will be inspected and maintained as part of the institutional controls (ICs) for the site. In 1990, a survey of the four settlement plates determined that settling or swelling was minimal and further surveys were not warranted (DOE 1994). Settlement plates will not be maintained as site surveillance features.

2.4 Disposal System Design

2.4.1 Disposal Cell

The disposal site contains 736,000 dry tons of mill tailings. Radioactivity within the disposal cell is 42 curies of radium-226.

The disposal cell comprises 16.05 acres and is roughly rectangular. It extends 1100 ft from north to south and 800 ft from east to west. The east side of the cell begins at the top of a drainage divide and slopes downward toward Camp Creek Valley to the west. The top of the disposal cell is at an elevation of 4967 ft; the bottom is at an elevation of approximately 4900 ft. The footprint of the disposal cell, as discussed below, is at an elevation of 4880 ft.

As stated above, the disposal cell is partly below grade (Figure 3). During construction, a footprint as much as 40 ft deep was excavated in the side of the hill to increase the capacity of the disposal cell and to reduce the above-grade profile of the cell.

The footprint was lined with a highly compacted layer of natural silt and clay soil obtained from the disposal site excavation (DOE 1992). This liner is 2 ft thick and is referred to as a geochemical and seepage flow barrier. The liner has high neutralization, adsorption, and ion-exchange capacity to restrict and attenuate downward movement of contaminants through the bottom of the disposal cell. The liner was compacted to achieve a hydraulic conductivity value of 1×10^{-7} centimeters per second (cm/s) to prevent seepage into the underlying unsaturated sediments.

Tailings were placed on top of this liner. Another layer of contaminated material from the evaporation ponds and windblown material was placed on top of the tailings and then covered.

The cover consists of two layers: a lower radon-and-infiltration barrier and an upper rock-and-filter layer. The rock-and-filter layer is composed of two sublayers: sand at the bottom and riprap at the top.

The lowest layer in the cover is a highly compacted radon-and-infiltration barrier (radon barrier). It rests directly on the underlying tailings. The radon barrier is approximately 1.5 ft thick and constructed of the same natural silt and clay soils used for the footprint liner.

Like the liner, the radon barrier was compacted to achieve a hydraulic conductivity of less than 1×10^{-7} cm/s. The purpose of this very low permeability is (1) to prevent the release of high levels of radon to the atmosphere (radon flux) and (2) to prevent the infiltration of precipitation through the cover. The tight compaction also helps to keep the radon barrier from drying out. Moisture in the radon barrier further retards the movement of radon through the cover. Within the disposal cell, less contaminated materials from the evaporation ponds and windblown deposits were placed over the more contaminated mill tailings as an additional control on upward movement of radon.

The radon barrier is overlain and protected by a 1.5-foot-thick rock-and-filter layer. At the bottom of the rock-and-filter layer is a sublayer of 0.5-foot-thick sand (filter layer). This highly permeable layer protects the radon barrier from erosion and provides a means of shedding runoff rapidly from the disposal cell with minimal infiltration.

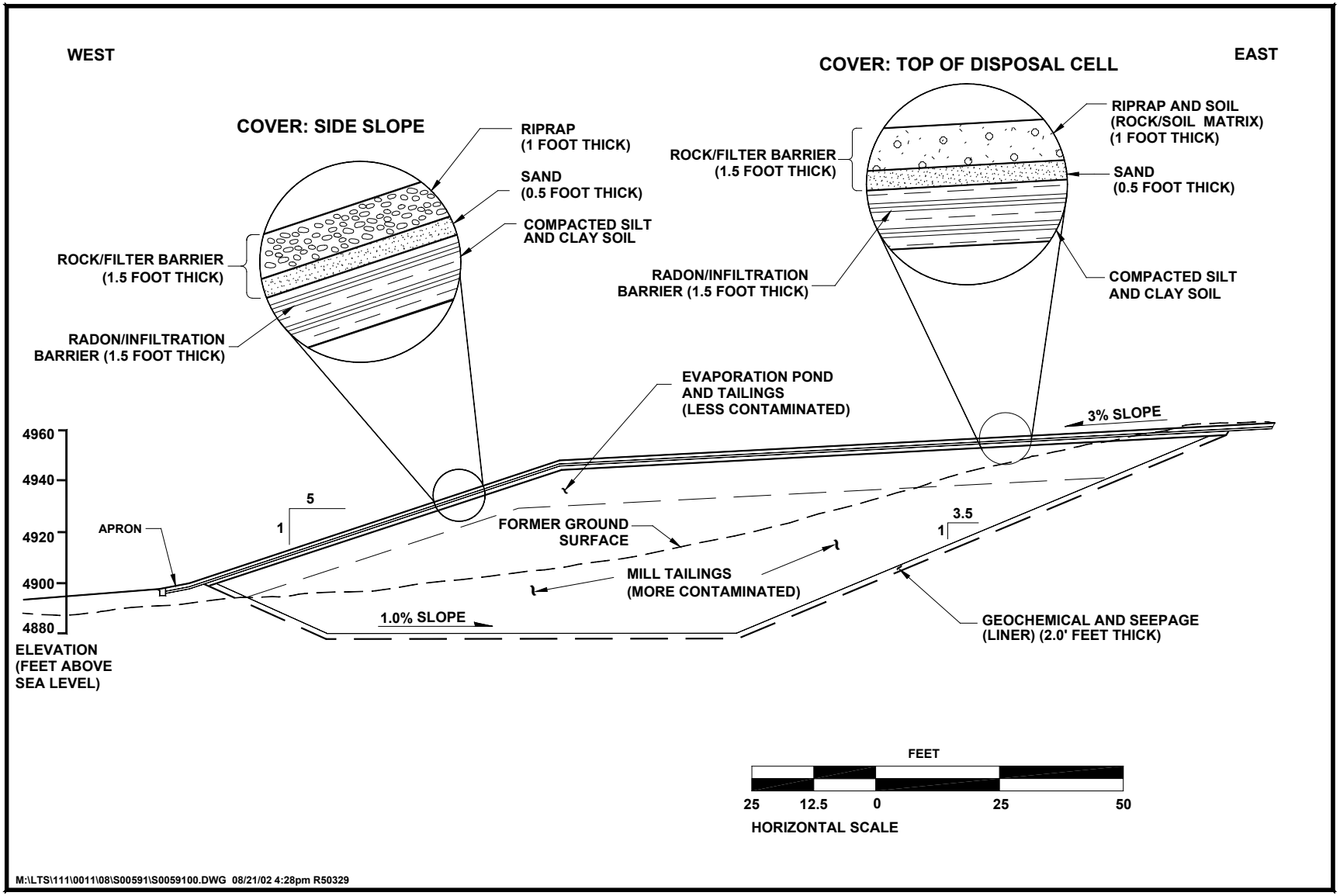


Figure 3. Cross Section of the Lakeview, Oregon, Disposal Cell

Above the sandy filter layer is a 1-foot-thick layer of coarse riprap. The riprap prevents erosion from large or severe storms. The mean diameter (D_{50}) of the riprap, as installed, was 2.7 inches (range: 2.7 to 3.9 inches). D_{50} is a measure such that 50% of the rock by weight is a certain size or larger. Rock of this size was calculated to be sufficient to prevent erosion in the event of a flood from a probable maximum precipitation (PMP) event. PMP is a theoretically "worst possible" storm. As such, the probability of occurrence is extremely small. Since the disposal cell was completed in 1989, surficial weathering has caused some of the riprap to break. For the response to this issue, see Sections 3.3.2 and 3.6.

On the relatively flat top of the disposal cell, the riprap was covered with a thin layer of soil, approximately 4 to 6 inches deep. The cover on top of the disposal cell is therefore referred to in remedial action documents as a rock-soil matrix. Subsequent small excavations in the rock-soil matrix, performed as part of cover performance studies by the Long-Term Performance Project, showed that at some places, the soil has settled into the interstices of the underlying riprap (NRC 2022). In other locations, the soil still partially covers the riprap. The addition of soil on top of the disposal cell was not part of the original design.

The purpose of the rock-soil matrix was twofold: (1) to protect against erosion by reducing runoff and (2) to improve the aesthetics of the site. Reducing runoff to the side slope of the disposal cell would preclude channelized or concentrated runoff at locations along the top of the side slope where there may have been low spots in the cover. This precaution against concentrated runoff allowed smaller diameter riprap to be placed on the side slope of the disposal cell (DOE 1989a). The rock-soil matrix appears to be working in this respect.

The second objective of the rock-soil matrix was to support various range grasses to make the disposal cell appear more natural. After construction of the rock surface, a 15-centimeter topsoil layer was added and seeded with native and cool-season grasses (DOE 1991). The abundance of seeded grasses has remained much lower on the top deck than in surrounding revegetated areas due to inadequate shallow soil water storage needed to establish a resilient stand of grasses. Snowmelt storage deeper in the cover (Waugh et al. 2007) creates a favorable habitat for native shrubs, including rubber rabbitbrush (*Ericameria nauseosa*), antelope bitterbrush (*Purshia tridentata),* and big sagebrush (*Artemisia tridentata*). Some of these species can have deep root structures and should be monitored to ensure continued disposal cell performance (NRC 2022). Current practices facilitate an ecological approach to vegetation management to promote natural succession of native species and control of noxious species.

2.4.2 Drainage Features

Two drainage features are incorporated into the design of the disposal cell. The first is a large drainage channel that wraps around the north and northwest sides of the disposal cell. This channel diverts run-on from Augur Hill and some of the runoff from the northern part of the disposal cell into the natural drainage (Camp Creek) west of the site. At the lower end of this drainage channel, the channel widens and flattens into a basin-like feature lined with very large diameter rock. This portion of the drainage channel is the EDA.

The second drainage feature is a series of five trench drains. Two of these drains are at the mouth of the EDA, and three are along the apron, or base of the western side slope of the disposal cell. The trench drains are essentially rock-filled ditches that collect runoff, divert it away from the disposal cell, and disperse it across the low-lying meadow west of the disposal cell.

2.5 Geology, Hydrology, and Groundwater Remedy

2.5.1 Site Geology and Hydrology

The Lakeview site is underlain by as much as 1000 ft of unconsolidated-to-consolidated Quaternary sediments. The depth to bedrock is unknown but believed to be greater than 1000 ft based on information from the eastern edge of the Goose Lake Basin (DOE 1994).

Stratigraphy beneath the site is described in general terms in the various remedial action documents (DOE 1985a; DOE 1992; DOE 1994). The eastern portion of the site rests on a series of interbedded sands, silts, and fat or highly plastic lacustrine clays that together may be more than 1000 ft thick. Finer-grained materials predominate in the upper 150 ft of this sequence with coarser sediments beneath. The eastern part of the site rests on a pediment surface.

Sand and gravelly deposits underlie the western part of the site. These coarse, gravelly sediments may represent a remnant stream terrace or alluvial fan deposit. The location and nature of the contact between the finer-grained deposits that underlie the site on the east and the gravellier deposits that underlie the site on the west are not defined.

The different sedimentary facies are interpreted to be fluvial and lacustrine in origin. The clays are described as lacustrine. Attempts during site characterization to correlate specific lithologic units between boreholes were unsuccessful due to the complexity of the stratigraphy beneath the site.

2.5.1.1 Surface Water

Camp Creek flows in the small valley about 3000 ft west of the site and at an elevation of about 2950 ft. It is a small stream with a catchment above the site of only about 13 square miles. Because of the difference in elevation and small size of the catchment basin, flooding along this creek is not a credible risk to the site.

2.5.2 Groundwater Remedy

During site characterization, 16 boreholes were drilled to depths of 22 to 125 ft (DOE 1994). Nine of these boreholes were completed as monitoring wells.

Information from these 16 boreholes was used to define groundwater conditions at the site. The series of gravels, sands, silts, and clays, described above, constitutes the uppermost aquifer. This aquifer is referred to in the original LTSP (DOE 1994) as the “lacustrine aquifer,” based on the interpretation that the sediments were deposited in or around a large lake, the remnant of which is the present-day Goose Lake.

During site characterization, the depth to the water table ranged from 10 ft along Camp Creek valley west of the site to as much as 75 ft at the southern edge of the site. Silt, silty sand, and clay-rich sediments beneath the disposal cell were unsaturated to a depth of at least 40 ft. More recent measurements suggest that the depth to the water table may vary from place to place and be as shallow as 20 ft.

Data from the July 2009 sampling event show that groundwater flows from northwest to southeast under unconfined to semiconfined conditions (Figure 4). Groundwater recharge is primarily regional with little or no recharge through soils or unsaturated sediments near the site, although Camp Creek undoubtedly loses some water that may reach the unconfined aquifer. Recharge occurs along silty or sandy layers, on or between clay-rich layers.

Discharge is to surface drainages southeast of the site and ultimately to Goose Lake. Groundwater may be discharged to irrigation wells downgradient from the site.

2.5.2.1 Water Quality

Water quality at the Lakeview disposal site is described in the site characterization report (DOE 1985a) and in the original LTSP (DOE 1994). Results over the 35-year period since closure of the disposal cell (1989–2024) show no apparent differences between upgradient and downgradient wells. All results are below the MCL's.

LTS&M activities include groundwater monitoring every 5 years (Section 3.7.1). Results of monitoring are in annual reports to NRC on the same schedule (Section 3.4). Groundwater monitoring began in 1999, 5 years after the disposal site was licensed. The first report to include results of groundwater monitoring was the 1999 annual report (DOE 2000).

2.6 Institutional Controls

ICs at the Lakeview disposal site, as defined by DOE Policy 454.1 Chg 1 (Admin Chg), *Use of Institutional Controls*, consist of federal ownership of the property, warning and no-trespassing signs (entrance and perimeter signs) along the fully fenced property boundary, and a locked gate at both the entrance to the site and the pedestrian entrance. The disposal site is owned by the federal government and was accepted under the NRC general license (10 CFR 40.27) in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

The site is remote, surrounded by private land, and generally inaccessible to the general public. The site is not visible from public roads.

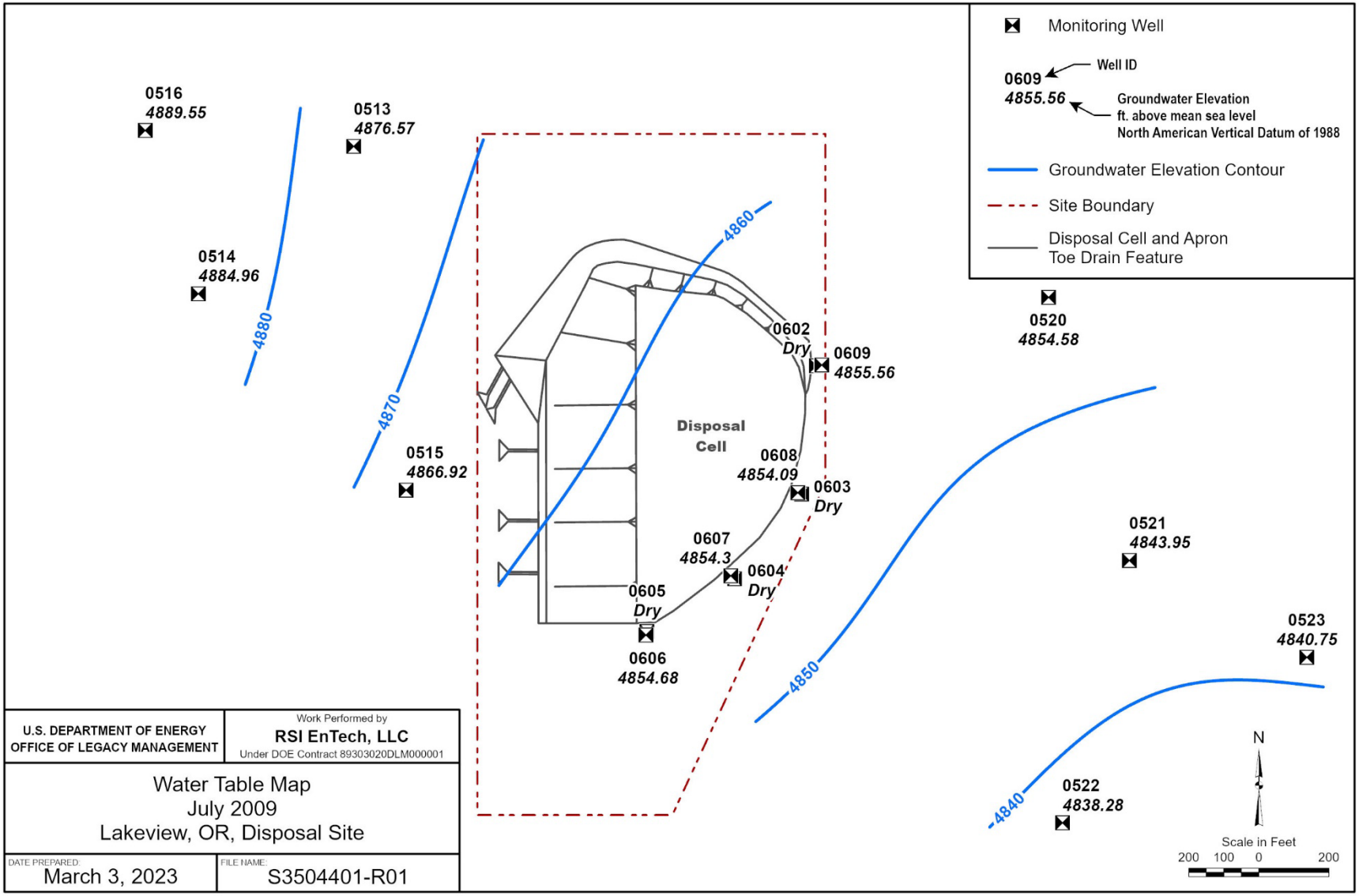


Figure 4. Water Table Map, Lakeview, Oregon, Disposal Site, July 2009

3.0 Long-Term Surveillance and Maintenance Requirements

3.1 General License for Long-Term Custody

With NRC concurrence in the original LTSP (DOE 1994; Appendix D), the site was included under the general license for long-term custody (10 CFR 40.27[b]).

Although sites remediated under UMTRCA are designed and constructed to last "for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years" (40 CFR 192.02[a]), there is no termination of the general license for DOE's long-term custody of these sites (10 CFR 40.27[b]).

When DOE determines that revision of the LTSP is necessary, DOE will notify NRC. Changes to the LTSP may not conflict with the requirements of the general license (Section 3.2).

Representatives of NRC must be granted permanent right-of-entry for the purpose of site inspections. Access to the Lakeview disposal site is described in Section 2.1.2.

3.2 Requirements of the General License

To meet the requirements of the NRC license in 10 CFR 40.27 and 10 CFR 40 Appendix A Criterion 12, the long-term custodian must, at a minimum, fulfil the following requirements:

- Annual site inspection (Section 3.3)
- Annual inspection report (Section 3.4)
- Follow-up inspections and inspection reports (Section 3.5)
- Routine site maintenance (Section 3.6)
- Emergency measures (Section 3.6.2)
- Environmental monitoring (Section 3.7)

3.3 Annual Site Inspection

3.3.1 Frequency of Inspection

At a minimum, sites must be inspected annually to confirm the integrity of visible features at the site and to determine the need, if any, for maintenance, additional inspections, or monitoring (10 CFR 40 Appendix A Criterion 12). To meet this requirement, DOE will inspect the site once each calendar year. The date of the inspection may vary from year to year, but DOE will endeavor to inspect the site once every 12 months unless circumstances warrant variance. Any variance to this inspection frequency will be explained in the inspection report. DOE will notify NRC and the State of Oregon of the inspection at least 30 days in advance of the scheduled inspection date.

3.3.2 Inspection Procedure

For the purpose of the inspection, the site will be divided into four different inspection areas. Inspection areas are inspected by walking or driving a series of unspecified transects across each area so the entire site is inspected (Figure 5). Within each area, inspectors examine specific site surveillance features, such as boundary monuments, signs, site markers, and other features listed on the inspection checklist (Appendix B). Table 2 lists the inspection areas for the site.

Table 2. Inspection Areas for the Lakeview, Oregon, Disposal Site

Inspection Area	Description
Top of disposal cell	Relatively flat area on top of the disposal cell covered by the rock-soil matrix.
Side slope of disposal cell and associated drainage structures	Includes: 1. Riprap-armored side slope of the disposal cell. 2. North drainage channel below the riprap-armored side slope on the north side of the disposal cell down to the EDA. 3. Selected large diameter rocks in the EDA. 4. One to five trench drains along the west side of the disposal cell coming off the riprap-armored side slope.
Area between disposal cell and site boundary, including stock fence	Remainder of the site. Includes: 1. Site boundary, fence, and perimeter signs. 2. Onsite areas disturbed during remedial action and subsequently regraded and vegetated. 3. Onsite areas undisturbed and naturally vegetated.
Outlying area	Surrounding property approximately 0.25 mile beyond the site boundary.

Each inspection area inside the site is visually inspected during a walkover. Within each transect, inspectors examine specific site surveillance features, such as survey and boundary monuments, signs, site markers, and other features listed in Sections 2.3.2 and in the inspection checklist (Appendix B). Inspectors also examine each transect for maintenance requirements; success of previous maintenance; and erosion, settling, slumping, plant or animal encroachment, human intrusion or vandalism, and any other activity or phenomenon that might affect the safety, integrity, long-term performance, or ICs of the site.

Since the completion of the disposal cell, surficial weathering of individual rocks has occurred within the coarse riprap sublayer of the rock-and-filter layer, resulting in individual rocks crumbling into smaller fragments. The tendency of some of the rock in the riprap layer of the side slope to break down was first noted by inspectors during a prelicensing inspection in 1995. The breakage is due to natural weathering processes. This weathering of rock material presents a concern for the long-term performance of the rock-and-filter layer. As such, inspection efforts focusing on rock gradation were conducted. Beginning in 1998 and continuing through 2019, an inspection procedure was performed annually to measure the gradation of the west side slope rock cover. Additionally, beginning in 2009 and continuing through 2019, a durability monitoring procedure was also included in the annual inspection. Collection of these data proved useful in determining and documenting the D50 value of the west side slope rock layer present at the site. However, the two decades of measuring the rock and determining D50 values did not result in a statistically significant trend that could be used for estimating the rate of degradation. While the lack of a trend does not necessarily indicate that the D50 value is stable, it does indicate that the D50 values have not decreased by a statistically significant amount in the period

from 1998 to 2019. Because continued collection of rock gradation and durability data would not significantly enhance the understanding of rock weathering at the site, the annual rock gradation and durability monitoring procedures were discontinued with the approval of NRC after the 2019 inspection (Dayvault 2015; Mandeville 2019; Appendix C).

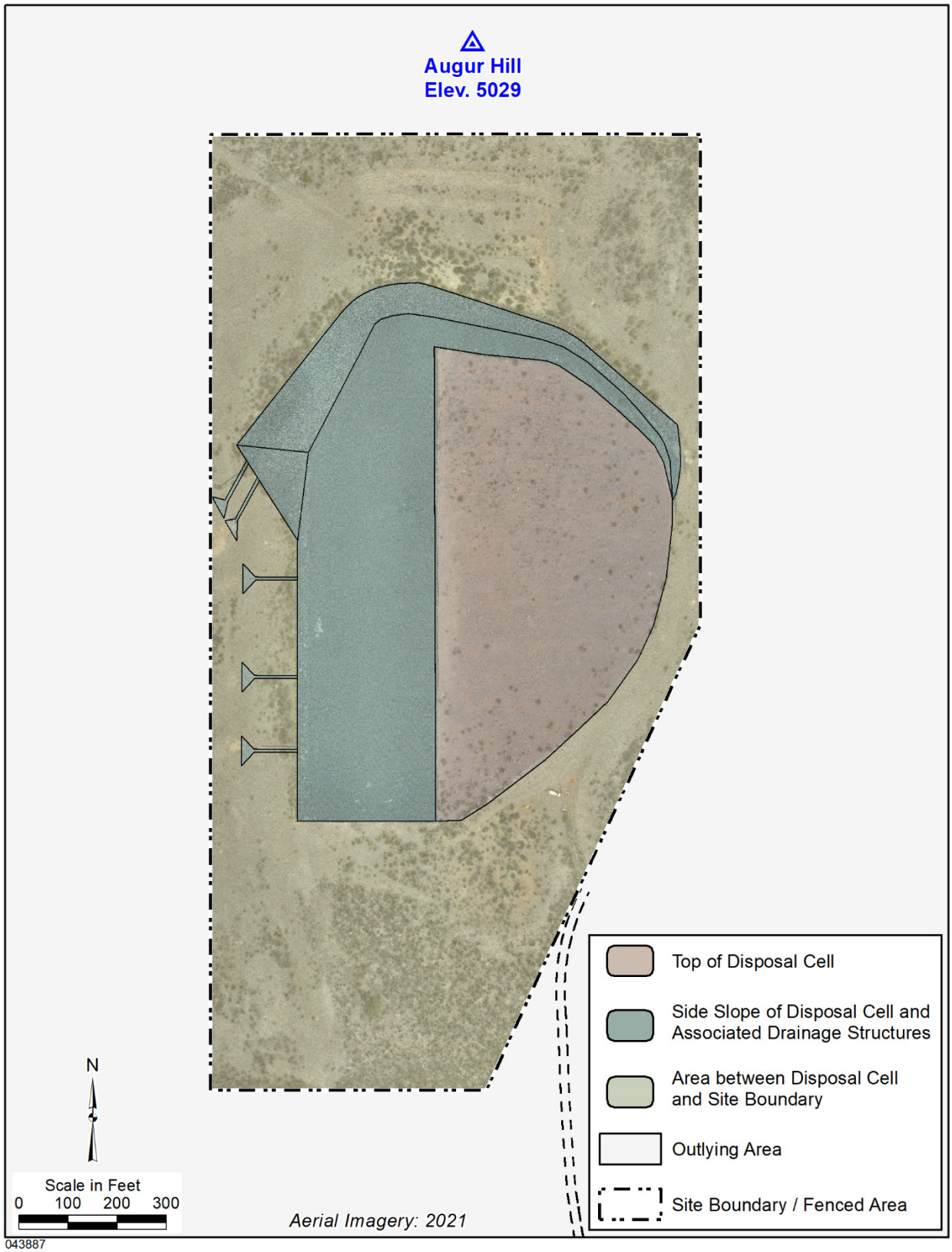
Inspection efforts will continue to closely monitor the performance of the rock-and-filter layer by means of focused visual inspection. The degradation of individual rocks that has occurred has not compromised the performance of the rock-and-filter layer such that it no longer performs the designed objective. Additionally, it is not expected to cause a failure in the performance of the rock-and-filter layer in the near term nor into the foreseeable future. However, due to the long time frame that the cell is designed to perform, it is acknowledged that continued degradation of the rock layer could eventually cause the rock-and-filter layer to no longer perform to its design objectives. For this reason, annual inspections will continue to include focused visual inspections of the west side slope rock cover. If problems with the performance of the rock-and-filter layer were to develop, it would produce evidence that is detectable by visual inspection, such as the following:

- **Crest/Top Slope:** The disposal cell will be observed for evidence of uneven settling and cracking. Cracks, such as gully or rill formation, will be noted.
- **Slopes:** Side slopes will be examined for evidence of erosion or sedimentation, slides, incipient erosion channels, and evidence of piping or material sloughing. Evidence of detrimental changes to the rock-and-filter cover layer are most likely to occur on the lower portions of the slope. Careful examination of the slope toe is of key importance in the inspection.

Minor rock degradation has been observed in the EDA since monitoring began at the original 10 photograph locations established in 1997 and at the 8 additional locations established in 2000. Annual photographic monitoring of the 18 locations for long-term rock monitoring will continue. No significant degradation of the EDA rock has been observed since monitoring began.

Inspectors will note changes within 0.25 mile of the site. Changes that might be significant include new development, changes in land use, and erosion or instability of slopes around the site.

Inspectors will use photographs, as necessary, to support or supplement written observations.



Abbreviation: Elev. = elevation

Figure 5. Inspection Areas Used During Inspection of the Lakeview, Oregon, Disposal Site

3.3.3 Inspection Checklist

The inspection checklist guides the inspection. The site-specific inspection checklist for the site is presented in Appendix B. The checklist is reviewed and revised before each annual inspection. At the end of the annual inspection, inspectors will make notes about revisions to the checklist, if necessary, in anticipation of the next annual inspection. Revisions to the checklist will include items such as discoveries or change in site conditions that must be inspected and evaluated during the next annual inspection.

3.3.4 Personnel

Annual inspections will be performed by at least two inspectors that are trained to perform the inspection. The inspection team should be qualified to inspect site features, such as subsidence and cracking; erosion by surface water and wind; degradation of erosion protection (rock mulch cover or vegetative cover); and the integrity of site markers, fences, and settlement plates as outlined in NUREG-1620 (NRC 2003).

It is preferred that the lead inspector will have participated in previous site inspections at the site. Engineers may need to participate in the inspection if the previous inspection identified potential concerns with the integrity of the disposal cell and diversion channels. Ecologists may need to participate if the previous inspection identified potential concerns with the vegetated cover.

For inspections that follow unusual events, the team should consist of technical personnel (experienced scientists or engineers) of appropriate disciplines (NRC 2003). Scientists will include geologists, hydrologists, biologists, and environmental scientists representing various fields (e.g., ecology, soils, range management). Engineers will typically be trained in civil, geotechnical, or geological engineering. Additional scientists or engineers with specific expertise may be assigned to the inspection to evaluate serious or unusual problems and make recommendations.

3.4 Annual Inspection Report

Results of the annual site inspection are included in an annual compliance report that is submitted to NRC within 90 days of the last UMTRCA Title I disposal site inspection of that calendar year (10 CFR 40 Appendix A Criterion 12). If the annual report cannot be submitted within 90 days, DOE will notify NRC of the circumstances. The annual inspection report includes the annual inspection results for all UMTRCA Title I sites licensed under 10 CFR 40.27.

3.5 Follow-Up Inspections

DOE might conduct a follow-up inspection in response to an unusual observation from routine inspections, reports of unusual damage or disruption, or extreme natural events.

3.5.1 Criteria for Follow-Up Inspections

Criteria for follow-up inspections are in 10 CFR 40.27(b)(4). LM will conduct a follow-up inspection when:

- A condition is identified during the annual inspection (or other site visit) that requires personnel, perhaps with specialized expertise, to return to the site to evaluate the condition.
- DOE is notified by a citizen or outside agency that conditions at the site are substantially changed.
- An extreme natural event occurs, such as a significant seismic event, fire, or flood.

DOE may request the assistance of local agencies to confirm the seriousness of a condition before conducting a follow-up inspection or emergency response. The public may use the 24-hour DOE telephone number posted prominently on the entrance sign to request information or to report a problem at the site (Appendix C).

Once a condition or concern is identified at the site, DOE will evaluate the information and determine whether a follow-up inspection is warranted. Conditions that may require a routine follow-up inspection include changes in erosion; undesirable changes in vegetation; storm damage; trespassing; minor vandalism; or the need to evaluate, design, or perform maintenance projects.

Conditions that threaten the safety or the integrity of the site may require a more immediate (nonroutine) follow-up inspection. Slope failure, a disastrous storm, a major seismic event, fires, and deliberate human disturbance of an engineered structure are among these conditions.

DOE will use a graded approach to follow-up inspections. The urgency of the follow-up inspection will be in proportion to the seriousness of the condition. The timing of the inspection may be governed by seasonal considerations. For example, a follow-up inspection to investigate vegetation may be scheduled for a particular time of year when conditions are conducive to assessing vegetation. A routine follow-up inspection to perform maintenance or to evaluate an erosion problem might be scheduled to avoid seasonal weather.

In the event of "unusual damage or disruption" (10 CFR 40 Appendix A Criterion 12) that threatens or compromises site safety, security, or integrity, DOE will:

- Notify NRC, in accordance with 10 CFR 40 Appendix A Criterion 12, if unusual damage or disruption is discovered during the inspection.
- Notify NRC, in accordance with 10 CFR 40.60, after the discovery of an event that prevents immediate protective actions necessary to avoid exposure to radiation or radioactive materials.
- Begin the DOE environment, safety, and health reporting process in accordance with DOE Order 231.1B Chg 1 (Admin Chg), *Environment, Safety and Health Reporting*, or current guidance.
- Respond with an immediate follow-up inspection or the Emergency Response Team. Implement measures as necessary to contain or prevent the dispersion of radioactive materials (Section 3.6).

3.5.2 Personnel for Follow-Up Inspection for Nonemergencies

Inspectors assigned to follow-up inspections or inspections that follow unusual events will be selected on the same basis as the annual site inspection (see Section 3.3.4).

3.5.3 Follow-Up Inspection Reports for Nonemergencies

The results of routine follow-up inspections will be included in the next annual inspection report (Section 3.4). Separate reports will not be prepared unless DOE determines that it is advisable to notify NRC or another outside agency of a problem at the site.

If a follow-up inspection is required for more serious or emergency reasons, DOE will submit to NRC a preliminary report of the follow-up inspection within the required 60-day period (10 CFR 40 Appendix A Criterion 12).

3.6 Routine Site Maintenance and Emergency Measures

3.6.1 Routine Site Maintenance

UMTRCA disposal sites are designed and constructed so that "ongoing active maintenance is not necessary to preserve isolation" of radioactive material (10 CFR 40 Appendix A Criterion 12). No recurrent active maintenance is required at the Lakeview disposal site, although minor repairs are needed occasionally.

Minor maintenance required in the past and likely to be required in the future includes repair of broken wires in the fence and replacement of perimeter signs. In 2000, small gullies downslope from the trench drains were filled with rock to prevent further erosion.

3.6.2 Emergency Measures

In accordance with 10 CFR 40.27[b][5] and 10 CFR 40.28[b][5], this section defines the criteria for instituting maintenance or emergency measures that DOE will take action on to restore the integrity of the disposal site and to protect the health and safety of the public. In addition to NRC's emergency measures reporting requirements described in Section 3.6.4, DOE may also be required to implement emergency measures in accordance with the *LM/LMS All Hazards Emergency Management Plan* (DOE 2023).

3.6.3 Criteria for Routine Site Maintenance and Emergency Measures

Site intervention measures, from minor routine measures to large-scale reconstruction following potential disasters, lie on a continuum. Although 10 CFR 40.27(b)(5) requires that increasingly serious levels of intervention trigger particular DOE responses, the criteria for those responses are not easily defined because the nature and scale of all potential problems cannot be foreseen. The information in Table 3 presents a guide for appropriate DOE responses and shows that the primary differences between routine maintenance and an emergency response are the urgency of the activity and the degree of threat or risk. DOE's priority level (see Table 3), bears an inverse relationship to DOE's estimate of the probability of occurrence; the highest priority response is believed to be the least likely.

Table 3. DOE Criteria for Maintenance and Emergency Measures

Priority[a]	Description[b]	Example	Response[c]
1 Urgent	Breach of disposal cell with dispersal of radioactive materials.	Seismic event that exceeds design basis and causes massive discontinuity in cover.	Notify NRC. Perform emergency actions to prevent further dispersal, recover radioactive materials, and repair the breach. Conduct follow-up inspections defined in Section 3.5 of this LTSP.
2	Breach of disposal cell without dispersal of radioactive materials or other nonroutine disposal cell repairs.	Partial threatened exposure of radioactive materials.	Notify NRC. Perform emergency actions needed to repair the breach. Conduct follow-up inspections defined in Section 3.5 of this LTSP.
3	Breach of security.	Human intrusion and vandalism.	Restore security; urgency based on assessment of risk.
4	Maintenance of specific site surveillance features.	Deterioration of site marker, signs, or boundary monuments.	Repair at first opportunity and report to NRC in an annual inspection report.
5 Routine	Minor problems or small-scale changes.	Erosion not immediately affecting the disposal cell.	Evaluate, assess impact, respond as appropriate, and report to NRC in an annual inspection report.

Notes:
[a] Priority is highly dependent upon scale and onsite evaluation.
[b] Other changes or conditions will be evaluated and treated similarly on the basis of perceived risk.
[c] DOE emergency response personnel may also have additional requirements in accordance with the *LM/LMS All Hazards Emergency Management Plan*.

3.6.4 Reporting Maintenance and Emergency Measures

Routine maintenance completed during the previous 12 months will be summarized in the annual inspection report (Section 3.4).

In accordance with 10 CFR 40.60, within 4 hours of discovery of any Priority 1 or Priority 2 event, such as those listed in Table 3, DOE will contact the 24-hour NRC Headquarters Operations Center at (301) 816-5100. In addition, DOE will notify the following offices at NRC:

Office of Nuclear Material Safety and Safeguards

Division of Decommissioning, Uranium Recovery, and Waste Programs

Uranium Recovery and Materials Decommissioning Branch (or its successor)

In case of "unusual damage or disruption" (10 CFR 40 Appendix A Criterion 12), DOE will notify the NRC headquarters project manager and provide a preliminary site inspection report within 60 days.

3.6.5 Severe Weather Events

DOE receives notifications of severe weather and will conduct follow-up inspections when weather events occur that can damage engineered disposal systems or other site features.

3.6.6 Seismic Events

As discussed in the LTSP Guidance Document (DOE 2012), DOE subscribes to the U.S. Geological Survey National Earthquake Information Center for notification when an earthquake is of sufficient magnitude to threaten the disposal cell. This service provides data on the magnitude of the event and the location of the epicenter. DOE receives an email notification if a seismic event of magnitude 3.0 or greater occurs within 0.3° latitude or longitude (about 20 miles) [30 kilometers]) of the site (Appendix C). DOE evaluates the effect of these earthquakes by calculating the peak ground acceleration to determine if the event resulted in exceedance of the design basis for the site's disposal cell.

3.7 Environmental Monitoring

3.7.1 Groundwater Monitoring

As a best management practice, DOE will monitor groundwater at the Lakeview disposal site to demonstrate that the performance of the disposal cell meets design requirements.

Monitoring, as established by the initial LTSP (DOE 1994), will be every 5 years at one upgradient and eight downgradient monitoring wells (Table 4; Figure 2). The downgradient wells are approximately 50 ft downgradient from the edge of the disposal cell to provide early detection should the disposal cell no longer perform as an effective containment system. The downgradient wells are in four pairs. In each pair, one well is screened at shallow depth (approximately 100 ft) and one deeper (approximately 150 ft). Upgradient well MW-0515 is screened at approximately 100 ft and is used as a reference and to detect changes in regional (upgradient) groundwater chemistry.

Table 4. Groundwater Sampling Locations at the Lakeview, Oregon, Disposal Site

Well	Location	Screened Depth (ft)
MW-0515	Upgradient	100
MW-0602	Downgradient	100
MW-0609	Downgradient	150
MW-0603	Downgradient	100
MW-0608	Downgradient	150
MW-0604	Downgradient	100
MW-0607	Downgradient	150
MW-0605	Downgradient	100
MW-0606	Downgradient	150

When the wells are sampled, water levels will be measured to detect changes that may occur as a result of long-term weather patterns.

Samples will be analyzed for standard water quality indicators, field parameters, and three specific analytes: arsenic, cadmium, and uranium. After every 5-year monitoring event, results will be evaluated, and the frequency of monitoring may be modified. When LM determines that further monitoring is no longer required, this LTSP will be revised (Section 3.1) and all wells decommissioned in accordance with state groundwater protection requirements.

Groundwater was extensively studied during site characterization. Data from site characterization are summarized in the initial LTSP (DOE 1994). Groundwater in the uppermost aquifer is characterized as calcium-bicarbonate type.

In 1995, the U.S. Environmental Protection Agency established groundwater standards for potential contaminants associated with uranium mill tailings (40 CFR 192). These standards, or maximum concentration limits (MCLs), are included in Table 5.

Results from site characterization showed that background groundwater at the Lakeview disposal site is uncontaminated with respect to contaminants with MCLs, although arsenic and selenium did exceed their respective MCL on at least one occasion (DOE 1994). In all other instances, the concentration of potential contaminants with MCLs is below the MCL value in background groundwater samples.

Pore fluids from the mill tailings were also characterized during remedial action. Pore fluids represent a possible worst-case leachate that might escape from the disposal cell. Of the 13 constituents measured in the pore fluids, each with an MCL, mean values for three constituents exceeded their respective MCLs: arsenic, cadmium, and uranium. These three constituents are therefore target analytes for evaluating the performance of the disposal cell. The results of monitoring for these three constituents since the disposal cell was closed in 1989 are presented in Table 5.

Table 5. Results of Monitoring for Target Analytes, Lakeview, Oregon, Disposal Site, 1989–2024

Well	Location	Arsenic MCL = 0.05[a]	Cadmium MCL = 0.01[a]	Uranium MCL = 0.044[a]
MW-0515	Upgradient	0.0086–0.012	0.00013–0.0010	0.00026–0.0010
MW-0602	Downgradient, shallow	Dry well, no results	Dry well, no results	Dry well, no results
MW-0603	Downgradient, shallow	Dry well, no results	Dry well, no results	Dry well, no results
MW-0604	Downgradient, shallow	Dry well, no results	Dry well, no results	Dry well, no results
MW-0605	Downgradient, shallow	Dry well, no results	Dry well, no results	Dry well, no results
MW-0606	Downgradient, deep	0.0096–0.020	0.000013–0.00012[b]	0.0007–0.0030
MW-0607	Downgradient, deep	0.0066–0.014	0.000013[b]	0.00067–0.0030
MW-0608	Downgradient, deep	0.0042–0.0070	0.000013–0.00074[b]	0.00037–0.0030
MW-0609	Downgradient, deep	0.00052–0.0011	0.000013–0.00030[b]	0.000084–0.0010

Notes:
Results are rounded to two significant figures. Detection limit values for wells with no results are reported in the Geospatial Environmental Mapping System (GEMS) database, as are the results of duplicate analyses.
[a] All results are in mg/L.
[b] The analyte is below the laboratory detection limit.

Results over the 35-year period since closure of the disposal cell (1989–2024) show no apparent differences between upgradient and downgradient wells. All results are below the MCLs.

3.8 Institutional Controls Monitoring

Federal land ownership is the primary IC that serves to ensure long-term site protectiveness. Monitoring of physical ICs will be conducted during the annual inspection when DOE will check the site for unauthorized entry, surrounding land use, and disturbances of site features.

3.9 Records

All DOE records created or inherited by the agency will be managed in accordance with applicable requirements in 44 USC 2901 et seq., 44 USC 3101 et seq., 44 USC 3301 et seq., 36 CFR 1220–1239, and DOE Order 243.1C.

Geospatial and environmental data are collected by DOE during site monitoring, such as results from site inspections. These data are managed in LM's authoritative data systems and are available for use by DOE and the public. All DOE geospatial and environmental data created or inherited by the agency will be managed in accordance with applicable requirements found in 43 USC 2801 et seq. and the Foundations for Evidence-Based Policymaking Act of 2018 and OPEN Government Data Act (Public Law 115-435 [PL 115-435]).

3.10 Quality Assurance

All activities related to the surveillance and maintenance of the site will comply with appropriate DOE orders and other requirements as specified in the LTSP Guidance Document (DOE 2012). Quality assurance requirements are routinely fulfilled by use of a work-planning process, standard operating procedures, trained personnel, documents and records maintenance, and assessment activities. Requirements will be transmitted through procurement documents to subcontractors when appropriate.

3.11 Safety and Health

Safety and health requirements and procedures for DOE activities are consistent with DOE orders, regulations, and applicable codes and standards as specified in the LTSP Guidance Document (DOE 2012). Project-specific safety plans are used to identify specific hazards associated with the anticipated scope of work and provide direction for the control of these hazards. During the pre-inspection briefing, inspectors are required to review safety plans and the LTSP to ensure that they understand the site. Before entering the site, all personnel accessing the site are briefed on the health and safety requirements associated with the site and any work to be performed, such as all-terrain vehicle use, sign replacement, fence repair, and noxious weed control.

4.0 References

10 CFR 40 Appendix A Criterion 12. "Long-Term Site Surveillance," *Code of Federal Regulations.*

10 CFR 40.27. "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations.*

10 CFR 40.28. "General License for Custody and Long-Term Care of Uranium or Thorium Byproduct Materials Disposal Sites," *Code of Federal Regulations.*

10 CFR 40.60. U.S. Nuclear Regulatory Commission, "Reporting Requirements," *Code of Federal Regulations*.

36 CFR 1220–1239. National Archives and Records Administration, "Records Management," *Code of Federal Regulations*.

40 CFR 192. "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations.*

40 CFR 192.02(a). "Standards," *Code of Federal Regulations.*

42 USC 7901 et seq. "Uranium Mill Tailings Radiation Control Act," *United States Code*.

43 USC 2801 et seq. "Geospatial Data Act of 2018," *United States Code.*

44 USC 2901 et seq. "Records Management by the Archivist of the United States and by the Administrator of General Services," *United States Code*.

44 USC 3101 et seq. "Records Management by Federal Agencies," *United States Code*.

44 USC 3301 et seq. "Disposal of Records," *United States Code*.

Dayvault, J., 2015. J. Dayvault, site manager, Office of Legacy Management, U.S. Department of Energy, letter (about Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act [UMTRCA] Title I Disposal Site's West Side Slope Degradation Assessment) to Document Control Desk, U.S. Nuclear Regulatory Commission, March 2.

DOE (U.S. Department of Energy), 1985a. *Disposal Site Characterization Report for the Alternate Uranium Mill Tailings Disposal Site at Collins Ranch Near Lakeview, Oregon,* UMTRA-DOE/AL-050123.0001, Albuquerque Operations Office, Albuquerque, New Mexico, October.

DOE (U.S. Department of Energy), 1985b. *Environmental Assessment of Remedial Action at the Lakeview Uranium Mill Tailings site, Lakeview, Oregon, Volume 1 – Text,* UMTRA-DOE/AL, DOE/EA-0271, Albuquerque Operations Office, Albuquerque, New Mexico, April.

DOE (U.S. Department of Energy), 1989a. *Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Lakeview, Oregon, Appendix B of the Cooperative Agreement No. DE-FC04-84AL20534,* UMTRA-DOE/AL-050510.0000, Albuquerque Operations Office, Albuquerque, New Mexico, February.

DOE (U.S. Department of Energy), 1989b. *Technical Approach Document, Revision II,* UMTRA-DOE/AL-050425.0002, Albuquerque Operations Office, Albuquerque, New Mexico, December.

DOE (U.S. Department of Energy), 1991. *Lakeview, Oregon, Final Completion Report*, Contract No. DE-AC04-83AL18796, Albuquerque Operations Office, Albuquerque, New Mexico, December.

DOE (U.S. Department of Energy), 1992. *Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Lakeview, Oregon, Final, Vol. 1,* UMTRA-DOE/AL-050510.0000, Rev. 1, Albuquerque Operations Office, Albuquerque, New Mexico, July.

DOE (U.S. Department of Energy), 1994. *Long-Term Surveillance Plan for the Collins Ranch Disposal Site, Lakeview, Oregon,* DOE/AL/62350-19F, Rev. 3, Albuquerque Operations Office, Albuquerque, New Mexico, August.

DOE (U.S. Department of Energy), 2000. *1999 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Site*, S00335, Grand Junction Office, Grand Junction, Colorado, January.

DOE (U.S. Department of Energy), 2012. *Guidance for Developing and Implementing Long-Term Surveillance Plans for UMTRCA Title I and Title II Disposal Sites*, LMS/S00336, Office of Legacy Management, November.

DOE (U.S. Department of Energy), 2023. *LM/LMS All Hazards Emergency Management Plan*, LM-Procedure-3-20-17.0-2.0, LMS/POL/S37643-2.0, Office of Legacy Management, September.

DOE Order 231.1B Chg 1 (Admin Chg), *Environment, Safety and Health Reporting,* U.S. Department of Energy, November 28, 2012.

DOE Order 243.1C, *Records Management Program*, U.S. Department of Energy, February 7, 2022.

DOE Policy 454.1 Chg 1 (Admin Chg), *Use of Institutional Controls*, U.S. Department of Energy, December 7, 2015.

Ford (Ford, Bacon & Davis Utah Inc.), 1977. *Phase II – Title I Engineering Assessment of Inactive Uranium Mill Tailings, Lakeview Site, Lakeview, Oregon,* GJT-18, prepared for the U.S. Department of Energy, Grand Junction, Colorado, December.

Lakeview (Town of Lakeview, Oregon), 2025. Lakeview homepage, https://townoflakeview.org/, accessed January 31, 2025.

Mandeville, D.T., 2019. D.T. Mandeville, project manager, Uranium Recovery and Materials Decommissioning Branch, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, letter (about Lakeview Rock Degradation Monitoring Program) to J. Nguyen, Lakeview site manager, Office of Legacy Management, U.S. Department of Energy, October 11.

NRC (U.S. Nuclear Regulatory Commission), 2003. *Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978*, NUREG-1620, Rev. 1, June.

NRC (U.S. Nuclear Regulatory Commission), 2022. *Evaluation of In-Service Radon Barriers over Uranium Mill Tailings Disposal Facilities*, NUREG/CR-7288, March.

PL 115-435. "Foundations for Evidence-Based Policymaking Act of 2018," and "OPEN Government Data Act," Public Law.

U.S. Census Bureau, 2020. "Total Population in Lake County, Oregon Is 8,160," https://data.census.gov/all?q=Lake%20County,%20ORegon, accessed January 31, 2025.

Waugh, W.J., G.M. Smith, B. Danforth, G.W. Gee, V. Kothari, and T. Pauling, 2007. "Performance Evaluation of the Engineered Cover at the Lakeview, Oregon, Uranium Mill Tailings Site," *Proceedings of Waste Management 2007 Symposium*, Waste Management Symposia Inc., Phoenix, Arizona.

Appendix A

Real Estate Documentation
for Disposal Site and Access Corridor

A.1 Real Estate Documentation for Disposal Site and Access Corridor

Acquisition

The Lakeview, Oregon, Disposal Site, near Lakeview, Oregon, was acquired by the State of Oregon through a civil action suit, Lake County Circuit Case No. L-86-060-CV, File No. 330-050-TL001-86, State of Oregon, by and through the *Energy Facility Siting Counsel v. John Collins, et al.* The U.S. Army Corps of Engineers worked with the State of Oregon to transfer the disposal site and access easement to the federal government, thus completing the real estate transactions. Final disposition of the case provided a 40-acre parcel with perpetual access leading west from County Road 2-16B across the Collins Ranch to the disposal site, as well as unlimited access to all offsite groundwater monitoring wells.

Legal Description

Disposal site. The Lakeview disposal site is on a 40-acre parcel of land in Sections 11 and 12, Township 38 South (T38S), Range 19 East (R19E), Willamette Meridian, Lake County, Oregon, and is more particularly described as:

> Beginning at a point on the east line of Section 11, T38S, R19E, said point of beginning bears north 00° 17’25” east 816.36 feet (ft) from the southeast corner of Section 11; thence west 211.02 ft; thence north 1950.00 ft; thence east 220.90 ft to the east line of Section 11, T38S, R19E; thence continuing in Section 12, T38S, R19E, east 779.10 ft; thence south 1000.00 ft; thence south 24° 42’ 18” west 1045.71 ft; thence west 351.93 ft to the point of beginning.

Access road. A strip of land 60 ft wide in Section 12, T38S, R19E, Willamette Meridian, Lake County, Oregon, provides perpetual easement to the site. The centerline of this easement is more particularly described as:

> Beginning at a point on the west right-of-way line of County Road 2-16B, said point of beginning bears north 00°10’19” east 30.00 ft; thence north 89°37’12” west 30.00 ft from the southeast section corner of Section 12; thence north 89°37’34” west 2638.25 ft to a point that bears north 00°22’ 26” east 30.00 ft from the south 1/4 corner of Section 12; thence north 89°3’06” west 1449.65 ft; thence north 86°29’18” west°379.15 ft; thence along a 250.00-foot-radius curve to the right 330.71 ft; thence north 10°41’45” west 359.83 ft; thence north 3°20’24” west 380.92 ft; thence north 00°45’38” east 55.27 ft; thence north 8°40’28” east 40.01 ft; thence north 18°16’10” east 82.69 ft; thence north 11°18’58” east 41.38 ft; thence north 1°03’53” west 24.99 ft to the east boundary of the Lakeview disposal site, said point bears north 23°57’25” east 1356.57 ft from the southwest corner of said Section 12.

The basis of bearings for the foregoing descriptions is the Oregon state plane coordinate system, south zone.

Repository

The deed transferring the Lakeview disposal site to the federal government was recorded on July 12, 1995, in Lake County, Oregon, in File Book 229, page 642 (DOE 1994).

Documentation and correspondence related to property acquisition are on file at the U.S. Department of Energy, Legacy Management Field Support Center, 2597 Legacy Way, Grand Junction, Colorado, 81503.

Appendix B

Inspection Checklist

2024 ANNUAL INSPECTION CHECKLIST
LAKEVIEW, OREGON, UMTRCA TITLE I DISPOSAL SITE

Status of Site Inspections

Date of This Revision: July 10, 2024

Last Annual Inspection: June 13, 2023
Inspectors: Z. Aldous (Lead), T. Santonastaso (Assistant)

Next Annual Inspection (Planned): June 21, 2023
Inspectors: T. Santonastaso (Lead), L Sheader (Assistant)

No.	ITEM	ISSUE	ACTION
1	Access	Gate across the access road on the private ranch, may be locked (with a non-DOE lock, i.e., not a #3359 lock); contact current landowner to open the gate. Notify Oregon Office of Energy and Nuclear Regulatory Commission Site vandalism and unauthorized access.	Byers was contacted on 6/13/23 with a voicemail and a reply that he got the message The regulators were notified 30 days prior to the planned inspection date. Watch for evidence of site vandalism and unauthorized access; notify appropriate authorities if discovered.
2	Safety	Some examples of possible site hazards include: long-distance driving; tripping, falling, or twisting ankles on riprap or vegetation; cuts from sharp edges on fractured rocks; crossing fence lines; weather exposure including heat, stormy conditions and lightening; and biohazards (insects, snakes, etc.).	The Job Safety Analysis (JSA) is now included in the *Conducting UMTRCA Annual Site Inspections* (May 2024) (LMS/PRO/40947-0.2). The *DOE-LM Site Inspections and Minor Maintenance JSA* LMS-011, Expires 06/25/2025 will also be used if needed. Conduct daily safety meeting for all parties before entering site. Check weather and fire conditions prior to inspection. Be aware of changing conditions and discuss emergent work before proceeding. Provide input on hazard or environmental concerns to the inspection lead so that corrective measures can be made as appropriate.

No.	ITEM	ISSUE	ACTION
			In-field JSA modifications and review may be necessary.
3	Specific site surveillance features	See separate list on page 4	Inspect and note conditions of all features, repair or replace as needed. Take at least one photo of each surveillance feature.
4	Biointrusion	Top of disposal cell: A soil-rock matrix was placed on the cell's top slope so grass would grow and blend in with the surroundings. However, the thin soil-rock layer has a low water-storage capacity which supports the growth of deep-rooted species (rabbit brush, sagebrush, and wheat grasses) whose roots do not depend on moisture in the soil-rock matrix. Side Slopes, Energy Dissipation Area (EDA), Drainage Channel, and apron area and area near trench drains: Trees or large bushes may reduce drainage capacity.	Photograph top slope to document plant abundance. Note extensive unvegetated areas or areas with trees or large vegetation; control as needed. Examine cell top for animal burrows. Evaluate area for growth and the presence of grasses, trees or large bushes. Take photos of vegetation that is concerning. Determine the need to remove or treat with herbicide any trees or bushes of concern that could impede drainage flow during the next site visit. Grasses are not a concern because the grass should not affect water flow.
5	Riprap – 1	West Side Slope: Perform focused visual inspections in order to detect further degradation of the rip-rap and/or the appearance of any significant erosional features on the cell. All Side Slopes: Assess areas for evidence of excessive rock degradation.	The NRC letter from October 11, 2019 stated that DOE can cease conducting any further D50 rock gradation monitoring at the Lakeview disposal cell.
6	Riprap – 2	Energy Dissipation Area (EDA): There is a low spot at the bottom of the EDA that does not drain fully into trench drains 1 and 2. The occasional presence of ponded water could potentially hasten the weathering of the EDA boulders. Photo locations were established in the EDA area for annual photographing of the large boulders. To date, changes in the rock have been minor and inconsequential.	Note if ponded water is present at the low end of the EDA and if discernable rock degradation from ponded water has occurred in that area. Examine the rocks in the EDA and channel for weathering. Locate the 18 photo stations and re-photograph the boulders. Use last year's photographs to duplicate the fields of view. Rock #15 was mistakenly labeled to a new rock, ensure you photograph the correct rock. Compare current

No.	ITEM	ISSUE	ACTION
			condition of the 18 rocks to earlier photographs. Repaint numbers if time permits.
7	Cell condition	Examine general conditions of the cell.	Note condition of the cell (top and side slopes) and carefully evaluate for indication or evidence of erosion, settlement, displacement, or slumping. Inspect the top and side slopes margin for signs of rilling or gullying. Look for signs of seepage at the base of the side slopes.
8	Off cell areas (on site)	A shallow depression area is located near monitoring wells 602 and 609. Several small gullies have formed down slope from the trench drains mostly beyond the fence on the Byers' property. Head-cutting onto DOE property was observed for several years. Gravel was placed in the gullies in 2000. Small gullies were beginning to reform down slope of this fill in 2004-2006 and were still reasonably small during the previous inspection. Gullying on north grass slope; any head cutting would occur in the direction opposite of the cell.	Evaluated this area to determination if maintenance actions (placing backfill or trenching) are needed to enhance drainage. Inspect for rills and gullies in this area and note condition. Note if erosion is damaging Byers' property or migrating headward toward the trench drains. Maintenance activities will be performed as needed. Inspect this area for excessive erosion, or for a potential sedimentation source into the drainage channel.
9	Fence	Wires in the fence can break or become loose.	Evaluate fencing to see where new repairs, such as tightening or replacement of wires, are needed. Fence maintenance activities, including the removal of encroaching vegetation, will be performed as needed. Some minor fence repairs will be done during the 2024 inspection.
10	SOARS Station, and solar panels	Vandalism or damage	Check for evidence of vandalism or damage of these items during the inspection. These items will be serviced the week of July 9th.
11	Outlying areas	The site is surrounded by private land.	Note any land use changes that have occurred within 0.25 mile of site since the last inspection.
12	Add additional signs of front gate	Additional signage is required on all DOE sites for Activities that Can't Be Done on DOE Property and 2-flying over the site is prohibited.	2-3 additional signs will be added to the front gate.

Specific Site Surveillance Features
Lakeview, Oregon, Disposal Site

FEATURE	COMMENT
Access road gate	Gate on access road may be closed and locked (gate access code; 1962). Rancher often has it propped open.
Access road	Note condition of spur road and take at least one picture of each feature.
Site entrance gate and pedestrian gate	Gates should be closed and locked and take at least one picture of each feature.
Entrance sign (1)	Note condition and take at least one picture of each feature.
Perimeter signs (12)	Note condition and take at least one picture of each feature.
Site markers (2)	Note condition and take at least one picture of each feature.
Survey monuments (3)	Note condition and take at least one picture of each feature.
Boundary monuments (3)	Note condition and take at least one picture of each feature.
Settlement Plates (4)	Note condition and take at least one picture of each feature.
QC monuments (5)	Note condition and take at least one picture of each feature.
Groundwater monitoring wells (16)	Nine monitoring wells are included in the site groundwater monitoring network: 4 paired wells along the east and south side of disposal cell, and 1 well west of the site. Seven additional off-site wells (non-network wells) also exist: 4 to the west and 4 to the east of site. Inspect and ensure all wells are locked and in good condition, and whether labels remain legible. Take at least one picture of each feature.

Appendix C

Agency Notification Agreements

Department of Energy
Albuquerque Field Office
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

Albert R. Chernoff
UMTRA Project Manager
U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, NM 87185-5400

Dear Mr. Chernoff:

This letter is in response to the U.S. Department of Energy (DOE) request for notification as set forth in the DOE's letter. This office will contact the DOE Grand Junction Projects Office at (303) 248-6070 if flash flood or tornado warnings are issued for Lake County, Oregon.

Sincerely,

[redacted]

Mr. Mike Brooks
National Weather Service Office

MTS./UMT/0094/0023

no USGS letter head
undated, but logged in 6/15/94

Clinton C. Smythe
Engineering and Construction Group Leader
Uranium Mill Tailings Remedial Action
Project Office
2155 Louisiana NE, Suite 4,000
Albuquerque, NM 87110

Dear Mr. Smythe:

This letter is to confirm that the DOE Grand Junction Projects Office (24-hour phone line, (303) 248-6070 has been added to our notification list for the occurrence of earthquakes near the following locations:

Disposal Site	Latitude	Longitude
COLORADO		
Durango (Bodo Canyon)	N37.15	W107.90
Grand Junction	N38.91	W108.32
Gunnison (Landfill)	N38.51	W106.85
Maybell	N40.55	W107.99
Naturita (Dry Flats)	N38.21	W108.60
Rifle (Estes Gulch)	N39.60	W107.82
Slick Rock (Burro Canyon)	N38.05	W108.87
IDAHO		
Lowman	N44.16	W115.61
NEW MEXICO		
Ambrosia Lake	N35.41	W107.80
NORTH DAKOTA		
Bowman	N46.23	W103.55
OREGON		
Lakeview (Collins Ranch)	N42.2	W120.3
PENNSYLVANIA		
Canonsburg	N40.26	W80.25
Burrell VP	N40.62	W79.65
TEXAS		
Falls City	N28.91	W98.13
UTAH		
Mexican Hat	N37.10	W109.85
Salt Lake City (Clive)	N40.69	W113.11

We have entered the following selection criteria into our notification program:

1. Any earthquake of magnitude 3.0 or greater, within 0.3 degrees (about 20 miles) of any site shown above, or

2. Any earthquake of magnitude 5.0 or greater, within 1.0 degrees (about 70 miles) of any site shown above.

Sincerely,

[redacted]

Bruce Presgrave
U.S. Geological Survey
National Earthquake Information Center
P.O. Box 25046
Mail Stop 967
Denver Federal Center
Denver, Colorado 80225

Please address future correspondence to Stuart Koyanagi at the above address. I have moved to a different project.

Thank you + best regards,

[redacted]

Appendix D

Certification and Concurrence Documents

NRC/UMT/0993-0044

UNITED STATES

NUCLEAR REGULATORY COMMISSION

REGION IV

URANIUM RECOVERY FIELD OFFICE
BOX 25325
DENVER, COLORADO 80225

SEP 01 1993

Docket No. WM-64

LTSM000740

LLKV 21.3.5

U.S. Department of Energy
Albuquerque Operations Office
ATTN: Albert R. Chernoff
Project Manager
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Chernoff:

We have completed our review of the certification data for the uranium mill tailings site at Lakeview, Oregon. The data reviewed were the Final Completion Report, the Final Audit Report, and all other associated documentation pertinent to the completed remedial action at Lakeview. The results of our review are documented in the enclosed Final Completion Review Report.

Based on our review of the certification data and on observations and record checks made during periodic site visits, we concur that, with the exception of ground-water restoration, the Department of Energy (DOE) has completed the remedial action in accordance with the approved plans and specifications, and that this action complies with the Environmental Protection Agency's standards in 40 CFR 192, Subparts A-C. I have therefore signed the enclosed signature pages signifying NRC's concurrence in the completion of remedial action at Lakeview, Oregon.

Ground-water cleanup at the processing site will be addressed by DOE as part of a separate ground-water restoration program once the proposed EPA ground-water standards have been finalized. This will require that DOE maintain control of the processing site in a manner consistent with DOE's April 9, 1993, policy letter.

If you have any questions, please contact the NRC Lakeview project manager, Ray Gonzales, at FTS (303) 231-5808.

Sincerely,

[redacted]

for Ramon E. Hall
Director

Enclosures:
As stated

cc:
S. Hamp, DOE
F. Miera, Oregon
D. Stewart-Smith, Oregon

U.S. DEPARTMENT OF ENERGY
CERTIFICATION SUMMARY
for the
Lakeview, Oregon, Disposal Site

The Uranium Mill Tailings Remedial Action Project Manager and the Contracting Officer for the U.S. Department of Energy certify that the Lakeview, Oregon, remedial action is complete. The processing and disposal sites have been remediated and meet all design criteria and technical specifications contained in the approved Remedial Action Plan, as required under Public Law 95-604. This certification applies only to the earth surface remediation. The groundwater restoration activities at the Lakeview mill site will be completed separately. The undersigned request that the U.S. Nuclear Regulatory Commission concur in this certification.

[redacted]

Melanie J. Thomas
Contracting Officer
Programs and R&D Branch
Contracts and Procurement Division

DATE: April 1, 1992

[redacted]

Albert R. Chernoff
Project Manager
Uranium Mill Tailings Remedial
Action Project Office

DATE: 3/19/92

The Director, Uranium Recovery Field Office, Region IV, U.S. Nuclear Regulatory Commission hereby concurs with the U.S. Department of Energy's completion of surface remedial action at the Lakeview, Oregon processing and disposal site.

[redacted]

Mr. Ramon E. Hall, Director
Uranium Recovery Field Office
Region IV, DRSS
U.S. Nuclear Regulatory Commission

DATE: September 1, 1993

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 15, 1995

Mr. Richard F. Sena, Acting Director
Environmental Restoration Division
Uranium Mill Tailings Remedial Action Project
U.S. Department of Energy
2155 Louisiana NE, Suite 4000
Albuquerque, New Mexico 87110

SUBJECT: ACCEPTANCE OF LONG-TERM SURVEILLANCE PLAN (LTSP), LAKEVIEW, OREGON URANIUM MILL TAILINGS REMEDIATION PROJECT

Dear Mr. Sena:

The U.S. Nuclear Regulatory Commission staff hereby accepts the U.S. Department of Energy's (DOE's) final LTSP for the Lakeview, Oregon, Uranium Mill Tailings Remedial Action Project site. This action establishes the Lakeview site under the general license in Title 10 Code of Federal Regulations (10 CFR) Part 40.27.

The acceptance of the Lakeview LTSP is based on the staff's determination that all open issues have been adequately addressed in the page changes to the August 1994 final LTSP, which were submitted by cover letter dated August 15, 1995, and DOE's ability to perform inspections and long-term site surveillance in accordance with Criterion 12 of 10 CFR 40, Appendix A. The LTSP for the Lakeview site satisfies the requirements set forth in the Uranium Mill Tailings Radiation Control Act of 1978, as amended, for the long-term surveillance of a disposal site, and all requirements in 10 CFR 40.27.

As we have previously discussed with Mr. Michael Abrams, the DOE Project Manager, two areas of concern relating to rock durability and seepage from the disposal cell have been identified by NRC staff during the LTSP review. These concerns do not directly impact the acceptance of the Lakeview LTSP and licensing of the site, but may ultimately impact the long-term monitoring strategy and long-term surveillance of the Lakeview site. A brief description of these concerns are presented below.

Rock durability was recognized as a potential concern by DOE during the remedial construction at the site. DOE subsequently proposed to over-design the thickness of the rock cover by 100 percent. NRC was informed of the potential concern and concurred in the proposed remedy. NRC also concurred in the Completion Report for the remedial action on September 1, 1993. Since completion of the disposal cell construction, some of the rock in the cover has deteriorated significantly at a rate that appears more rapid than anticipated.

In an effort to address the rock durability concern, DOE transmitted by cover letter dated July 10, 1995, the results of a petrographic evaluation performed

on the rip-rap covering the disposal cell. Based on this evaluation, DOE recommended that no additional action be taken to improve the rock cover on the side slopes of the cell or modify the inspection approach. However, the NRC staff concludes that the petrographic analysis cannot provide the empirical information needed to evaluate the rip-rap performance through repeated freeze-thaw cycles of a 200-year design life. Consequently, the NRC staff plans to conduct an independent evaluation of the rip-rap durability through freeze-thaw testing. Rock samples have recently been collected from the side-slope and provided to an NRC contractor for testing. The findings from this testing and any recommendations for revising the LTSP, if needed, will be forwarded to DOE.

The seepage concern centers on the documented application of dust-control water in excess of specifications during tailings placement, and the potential for seepage to cause instability of the disposal cell slope. This concern could not be resolved during the site visits conducted for the LTSP review, because of the unusually high rainfall experienced earlier this year. Future conversations with the DOE personnel performing the inspections and a review of post-closure inspection documents may resolve this concern.

Although rock durability and potential seepage are areas-of-concern, the NRC staff concludes that these concerns do not presently require corrective action. In accordance with 10 CFR 40.27(b), this letter accepting the LTSP constitutes the action bringing the Lakeview disposal site under NRC general license. In the event that any future testing, or inspections indicate that any of the disposal cell's components have failed or will likely fail, DOE will be required to implement corrective action measures as described in Chapter 9 of the LTSP, under provisions of the general license.

As described in DOE's guidance document for long-term surveillance, any further interactions between the NRC and the DOE pertaining to the Lakeview site will be conducted with the DOE's Grand Junction Projects Office. If you have any questions regarding this letter, please contact the NRC Project Manager, Michael Layton, at (301) 415-6676.

Sincerely,

[redacted]

Joseph J. Holonich, Chief
High-Level Waste and Uranium
Recovery Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

cc: S. Hamp, DOE Alb
M. Abrams, DOE Alb
D. Bierley, TAC Alb
J. Virgona, DOE GJPO

Appendix E

2019 NRC Response to Rock Monitoring

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 11, 2019

Mr. Jason Nguyen
U.S. Department of Energy
Office of Legacy Management
2597 Legacy Way
Grand Junction, CO 81503

SUBJECT: LAKEVIEW ROCK DEGRADATION MONITORING PROGRAM

Dear Mr. Nguyen:

By letter dated March 2, 2015, the U.S. Department of Energy (DOE) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) staff to discontinue rock degradation monitoring at the Lakeview, Oregon Uranium Mill Tailings Radiation Control Act (UMTRCA), Title I, Disposal Site (Agencywide Document Access and Management System [ADAMS] Accession No. ML15068A252). DOE's 2015 letter also provided responses to a series of comments from the NRC staff dated November 12, 2014 (ADAMS Accession No. ML14303A623).

As discussed in more detail below, the NRC staff has no additional comments or concerns about DOE's decision to cease rock degradation monitoring and modify its long-term surveillance plan (LTSP) to perform more focused visual inspections on the west side slope. This letter also reviews past efforts related to understanding the rock degradation issue at the Lakeview site; further details the NRC staff's position on DOE's request to discontinue rock degradation monitoring; and provides suggestions for DOE to consider moving forward with regard to this issue.

History of Rock Degradation at Lakeview

During construction of the west side slope of the disposal cell in 1988, it was acknowledged that weathering of rock on the side slope of the disposal cell (also referred to as Type B riprap) would likely occur and accelerate degradation of the cover system. This weathering results from the presence of clay minerology within the basalt rock chosen for use in the cover system. Therefore, the LTSP for the Lakeview disposal cell included monitoring the particle size of the riprap (referred to as D_{50} monitoring in the remainder of this letter) to generally quantify the rate of rock degradation over time and to compare the measured D_{50} value to the design specification, which is a D_{50} of 2.7 inches to 3.9 inches. D_{50} monitoring is performed during the annual site inspection and the test results are included in DOE's annual inspection report.

In 2009, DOE initiated a rock durability monitoring procedure as part of the rock degradation monitoring program. DOE and NRC collaboratively developed the rock durability monitoring procedure. The purpose of durability monitoring was to identity the durability class of the rock present on the side slope. The durability classes range from durable, susceptible to near-term degradation, to nondurable (i.e. rocks that have already crumbled). This rock durability monitoring has been implemented at the D_{50} monitoring locations that are randomly selected

prior to each monitoring event. This durability information along with the D_{50} data facilitated the documentation of the condition of the existing rock cover.

The results of the D_{50} monitoring in 2018 showed an average D_{50} of 2.53 inches, which was within the range of D_{50} values (2.26 to 2.88 inches) measured over the last 22 years. However, the average D_{50} of 2.53 inches is lower than the design specification D_{50} of 2.7 to 3.9 inches. In the 2018 annual monitoring report, DOE also performed a statistical analysis of the D_{50} values measured over the last 22 years. While DOE's analysis did not identify a statistically significant trend, the measured D_{50} values typically fall at or below the minimum D_{50} design specification of 2.7 inches. At the NRC staff's suggestion, DOE collected 10 samples of the riprap during the 2010 annual site inspection (ADAMS Accession No. ML110180360). DOE had an off-site laboratory perform a particle size analysis in accordance with ASTM method D5519. The purpose of this effort was to obtain the field D_{50} based on weight and not the number of rocks retained. The results indicated that the mean D_{50} was 2.24 inches. The D_{50} value obtained using ASTM D5519 is based on weight, which is how the D_{50} value is typically specified in an engineering design.

DOE Request to Discontinue Rock D_{50} and Durability Monitoring

In its 2015 letter, DOE summarized its rock degradation monitoring experience and the current condition of the disposal cell at Lakeview. In its correspondence, DOE:

- Recognized the limitations of the rock D_{50} monitoring.
- Discussed the conservatism associated with the design D_{50} range of 2.7 to 3.9 inches.
- Acknowledged that the rock on the west side slope is degrading.
- Stated that the that Lakeview disposal cell continues to meet the requirements of 40 CFR Part 192. DOE's statement was based on observations that the erosion protection was intact and functioning properly during the 2014 annual inspection and the lack of water infiltration identified during the 2010 geoprobe field investigation.

For these reasons, DOE proposed replacing rock degradation monitoring with more focused visual inspections along the west side slope of the disposal cell. Specifically, DOE proposes to revise the inspection checklist in the LTSP to include visual documentation of any erosion rills that form along the west side slope. This would include taking photographs of the rills, mapping their location, inspecting the condition of the erosion protection downslope of a rill, and making repairs as warranted. Because this augmented inspection approach more directly focuses on the potential development of vulnerabilities on the side slope (including those associated with rock degradation), DOE proposes to discontinue the annual rock D_{50} and durability monitoring.

The NRC staff reviewed DOE's letter, the past D_{50} and durability monitoring results, DOE's responses to previous NRC staff comments and the LTSP for the Lakeview disposal cell. For the rock durability monitoring, the NRC staff recognizes that this inspection activity was never incorporated into the LTSP. The NRC staff reviewed the rock durability data and concludes that the results have been helpful in documenting the rock durability class present at the site. Given the sampling methodology, the NRC staff recognizes that collection of additional rock durability data would not significantly enhance the understanding of rock durability at the site. Therefore, the NRC staff has no further comments or concerns with DOE's decision to terminate this activity during the annual site inspection.

For the rock D_{50} monitoring, the NRC staff recognizes the limitations of the current approach. The procedure used to measure the D_{50} is based on a count of the number of rocks retained on each sieve. This is different from the approach used in laboratory testing, such as the ASTM D5519 procedure, where the material retained on each sieve is weighed. The NRC staff performed its own statistical analysis of the data presented in the 2018 monitoring report and agrees that the data do not suggest a statistically significant trend in the D_{50} values. While the lack of a trend does not indicate a stable D_{50} value, it does indicate that the D_{50} values have not decreased by a statistically significant amount in the past two decades. However, the NRC staff notes that the current procedure, measuring the D_{50} value at different locations every year is potentially better suited to documenting the D_{50} values across the side slope than the estimating the rate of degradation.

In its November 12, 2014 letter, the NRC staff suggested that DOE consider mapping the D_{50} results to identify potential areas of the cover that may not be protective. In its March 2, 2015 response, DOE stated that its position that "the original gradation and durability monitoring data were not intended to be used in this way, and such use could result in magnifying the data limitations identified in this letter." Thus, especially given the lack of agreement on how to use the rock D_{50} data, the NRC staff has no further comments or concerns with DOE's proposal to terminate the D_{50} measurements, concurrent with its proposed visual inspections, and the observations below.

The NRC staff believes that a focused visual inspection will allow for the identification of problems with the west-side slope cover. Additionally, the NRC staff understands that the LTSP states that DOE will provide an assessment of the development of any erosion rills or gullies on the cover system within 60 days of their identification, in addition to the obligations associated with DOE's annual inspection program and performing any necessary repairs.

Cover Observation in the Future

While the NRC staff does not have any additional comments on DOE's decision to discontinue rock D_{50} and durability monitoring at Lakeview, the cessation of these activities does not change or mitigate our concerns regarding the presence of poor-quality rock at Lakeview. The NRC staff recognizes that DOE's design procedures and decision to double the rock thickness on the side slope likely resulted in a sufficiently robust cover in the near-term. However, the D_{50} monitoring has shown that the in-place D_{50} on the side slope is frequently smaller than the value specified in the design specification. Thus, it is possible that the existing conditions are not as robust as was envisioned at the time of construction of the cover system.

In its March 2, 2015, letter, DOE states that the Lakeview disposal cell continues to meet the criteria in 40 CFR 192. DOE basis its statement on the observations made during the annual inspections that the erosion protection is intact and functioning properly. The NRC staff recognizes that the past annual inspections have verified adequate performance of the cover system to date. However, these inspections and observations do not reflect the impacts of ongoing degradation and potential future events. The NRC staff's concern going forward remains that the current cover has not been demonstrated to be sufficient over the timeframes identified in 40 CFR Part 192. To provide the NRC staff with continuing assurance that the cover will be effective for the required timeframes, DOE should consider one or more of the following approaches:

- Calculate the minimum D_{50} required on the west side slope to meet the required timeframes in 40 CFR Part 192, based on the current conditions on the top slope of the

disposal cell, while considering newer analytical techniques for calculation of the D_{50} and determination of the appropriate probable maximum precipitation (PMP) event. If DOE decides to perform this calculation, the potential for flow concentrations should be taken into consideration as well. This is discussed further in our December 3, 2009 letter and technical evaluation report (ADAMS Accession Nos. ML093220639 and ML093220669).

- Construct a rock apron at the intersection of the side slope and top slope to reduce flow concentrations.
- Place additional riprap on the side slope of the disposal cell.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

If you have any questions, please contact me at (301) 415-0724, or by e-mail, at douglas.mandeville@nrc.gov.

Sincerely,

[redacted]

Douglas T. Mandeville, Project Manager
Uranium Recovery and Materials
Decommissioning Branch
Division of Decommissioning, Uranium Recovery
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket No.: WM-64