

9.0 Lakeview, Oregon, Disposal Site

9.1 Compliance Summary

The Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on July 10, 2024. No changes were observed on the disposal cell or in the drainage features. Inspectors identified minor maintenance needs but found no cause for a follow-up or contingency inspection.

Disposal cell riprap gradation monitoring has been performed annually since 1997 at random locations on the west side slope due to concerns over premature rock degradation. With the approval of the U.S. Nuclear Regulatory Commission (NRC) in 2019 to discontinue rock gradation monitoring at the site (Mandeville 2019), rock gradation monitoring was discontinued in 2020. Photographs have been collected since 2020 and were collected during the 2024 inspection. No evidence of settling, slumping, erosion, or any other modifying process on the disposal cell side slopes was observed that might affect the integrity of the cell.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater monitoring every 5 years to demonstrate compliance with established groundwater quality protection standards. The most recent sampling event occurred in July 2024. Groundwater monitoring results for the three analytes routinely monitored at the site—arsenic, cadmium, and uranium—were below the corresponding U.S. Environmental Protection Agency (EPA) maximum concentration limits (MCLs) in all monitoring wells.

9.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1994) (LTSP) in accordance with procedures established to comply with the requirements of the NRC general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 9-1 lists these requirements.

Table 9-1. License Requirements for the Lakeview, Oregon, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 9.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 9.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 9.6	(b)(5)
Groundwater Monitoring	Section 5.3	Section 9.7	(b)(2)
Corrective Action	Section 9.0	Section 9.8	—

9.3 Institutional Controls

The 40-acre site, identified by the property boundary shown in Figure 9-1, is owned by the United States and was accepted under the NRC general license in 1995. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site.

Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, perimeter fence and signs, site markers, survey and boundary monuments, and wellhead protectors.

9.4 Inspection Results

The site, approximately 7 miles northwest of Lakeview, Oregon, was inspected on July 10, 2024. The inspection was conducted by T. Santonastaso and L. Sheader of the Legacy Management Support contractor. T. Sicilia and M. Hendrickson (Oregon Department of Energy) and M. Bia and J. Engel (LM) participated in the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

9.4.1 Site Surveillance Features

Figure 9-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 9-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 9.10.

9.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is from a gravel road that heads west from Lake County Road 2-16B. DOE was granted a perpetual easement on the approximately 1.2-mile access road between the county road and the property boundary. A lockable gate across the access road on the adjacent privately owned land limits access to the site. The entrance gate to the site is in the southeast corner of the perimeter fence. The entrance gate was locked and undamaged. The entrance sign is attached to a steel post set in concrete along the access road and was undamaged (PL-1). A pedestrian gate in the northwest corner of the site was locked and undamaged. No maintenance needs were identified.

9.4.1.2 Perimeter Fence and Signs

A sheep fence and four- or five-strand barbed wire enclose the site. Sheep fencing is on the southeastern and southern boundaries of the site. Some juniper trees and other vegetation are growing near, or entangled in, the perimeter fence line (PL-2), but the fence appears stable and remains functional. An empty post was found near the southern fence and will be removed in the future. A small hole in the sheep fence was observed in the southern fence line. The hole appears to be man-made, possibly to help small animals escape through the fence. Evidence of minor erosion from animals digging under the fence was identified near the southeast corner of the fence line and along the northern fence line during the 2022 and 2023 inspections, but these areas are not a concern to site security or the integrity of the fence. New evidence of animal digging was observed along the eastern fence line during the 2024 inspection (PL-3).

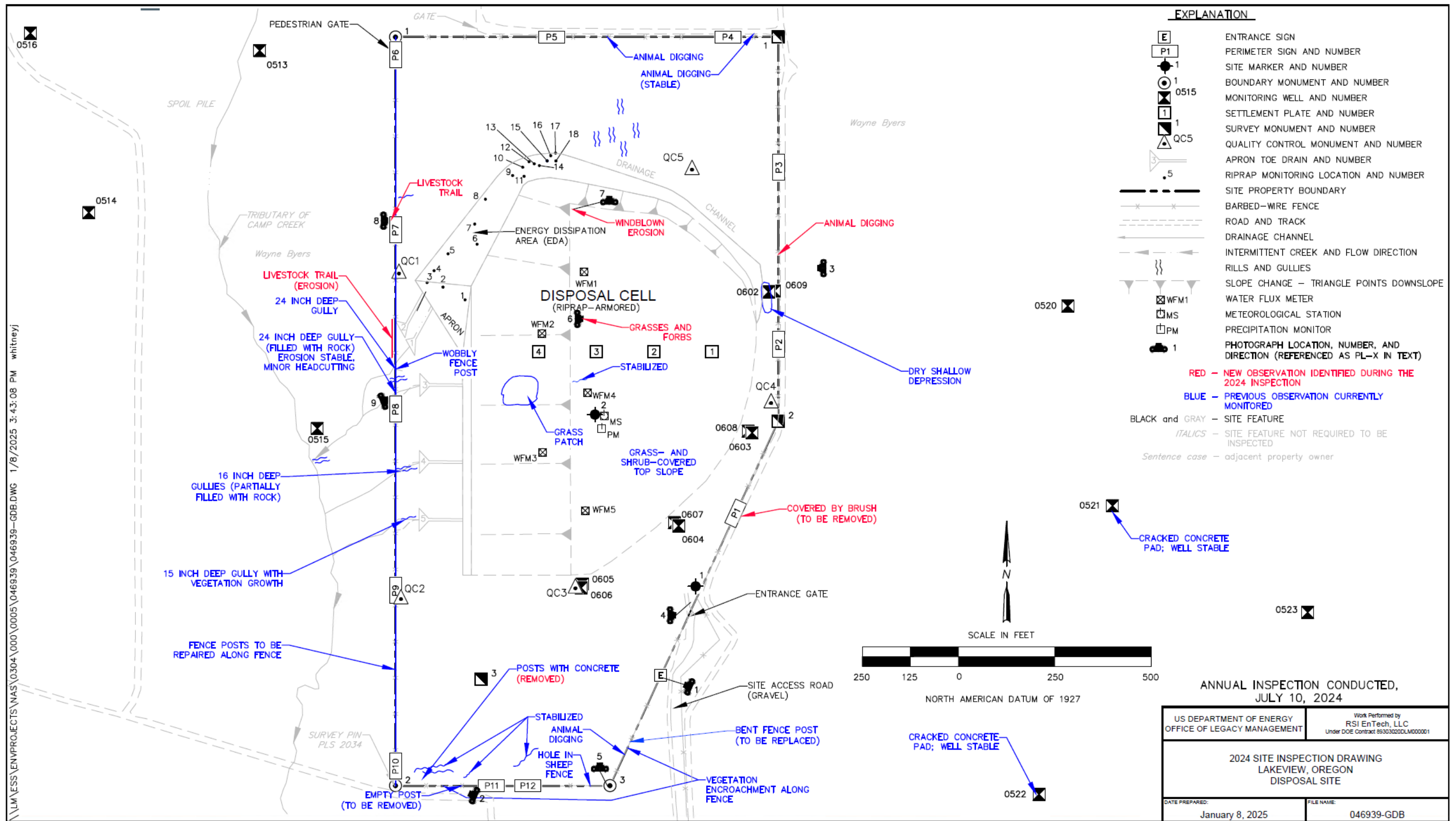


Figure 9-1. 2024 Annual Inspection Drawing for the Lakeview, Oregon, Disposal Site

There are 12 perimeter signs attached to steel posts set in concrete and positioned along the property boundary. Perimeter sign P1 has brush growing around the signpost and the perimeter sign that will need to be removed. No other maintenance needs were identified.

9.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 (PL-4) is just inside the entrance gate, and site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

9.4.1.4 Survey and Boundary Monuments

Three survey monuments and three boundary monuments (PL-5) delineate the property boundary. No maintenance needs were identified.

9.4.1.5 Aerial Survey Quality Control Monuments

There are five permanent aerial survey quality control monuments installed at the site to provide control during aerial surveys of the disposal cell. A baseline aerial survey was performed in October 2021. The quality control monuments were inspected in 2024. No maintenance needs were identified.

9.4.1.6 Monitoring Wells

The LM groundwater monitoring network at the site consists of eight onsite wells directly downgradient of the disposal cell and one upgradient background monitoring well (0515) west of the site boundary (Figure 9-1). Seven additional LM-owned monitoring wells on private property adjacent to the site—upgradient wells 0513, 0514, and 0516 and offsite downgradient wells 0520, 0521, 0522, and 0523—are not required to be sampled as identified in the LTSP.

Offsite downgradient wells 0521 and 0522 have surficial concrete bases around the well casing that are cracked, but the wellhead protectors remain stable. A dry, shallow depression remains near onsite well 0602, as noted in previous inspections. The wellhead protectors were locked and undamaged. No maintenance needs were identified.

9.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the top of the disposal cell; (2) the side slopes of the disposal cell, adjacent drainage channel, and aprons; and (3) the site perimeter and outlying area. The inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

9.4.2.1 Top of Disposal Cell

The disposal cell, completed in 1988, occupies 16 acres. At the time of disposal cell construction, the entire top slope of the disposal cell was covered in 12 inches of type B-sized riprap. In 1989, at the request of the State of Oregon, 4 inches of soil was added over the riprap to allow a

vegetative cover to be established and help minimize the visual impact of the disposal cell. The design for the top of the disposal cell has created conditions that favor the growth of deep-rooted plants. The growth of shrubs on the disposal cell top slope is favored by movement of precipitation through the topsoil, riprap, and bedding layers; the compacted soil (radon barrier) inhibits root growth from reaching the tailings. Grasses and forbs growing on the top slope have gradually increased over the years (PL-6), but some areas, such as near the System Operation and Analysis at Remote Sites (SOARS) station, remain sparsely vegetated. This plant growth pattern is consistent with surrounding offsite areas. Riprap was observed through the soil on the top slope in several small areas during the inspection. These areas are sporadic across the top slope and are likely caused by the soil infilling the spaces without riprap. No structural or disposal cell performance concerns are associated with the riprap becoming visible on the top slope.

Wind erosion of the soil is evident in places on the disposal cell cover. In these areas, the roots of vegetation have been exposed as wind carries the soil away (PL-7). Previously identified erosional features such as small rills were not observed in 2024 and are assumed to have stabilized through natural processes. No structural or disposal cell performance concerns are associated with soil erosion because the riprap rock cover is continuous beneath the top slope soil cover, slope crests, and side slopes. Inspectors will continue to monitor this condition.

The contact boundary between the disposal cell top and side slopes was inspected and generally appears stable and uniform. Windblown erosion was observed during the 2024 inspection at the northwest corner of the crest on the west side slope and the disposal cell top slope; both appear to be stable. Inspectors will continue to monitor the transition zone between the disposal cell top slope and the west side slope for erosion development. There was no evidence of settling, slumping, erosion, or any other modifying process on the top of the disposal cell that might affect the integrity of the disposal cell.

9.4.2.2 Disposal Cell Side Slopes and Adjacent Drainage Channel, Apron, and Toe Drains

Deterioration of the basalt riprap that armors the disposal cell side slopes is a result of physical and chemical weathering processes. In accordance with the LTSP, deterioration monitoring at the site consists of rock gradation monitoring on the west side slope and photographic monitoring in the energy dissipation area (EDA). Addendums to the LTSP commit LM to annually assess the mean diameter value of the riprap on the west side slope through gradation monitoring to ensure that the riprap remains large enough to protect the disposal cell from erosion during a major precipitation event, as designed. The thickness of the riprap on the west side slope was doubled during construction due to concerns over rock quality.

In 2015, LM proposed to replace annual gradation monitoring with rill inspections. The rills may form along the interface between the vegetated soil and rock top slope and the rock-covered west side slope (Dayvault 2015). Focusing on these areas allows LM to assess conditions that may indicate the development of potential failure points along the side slope. In 2019, NRC concurred with the discontinuation of rock gradation monitoring (Mandeville 2019); therefore, it was not performed in 2024. DOE is updating the LTSP to reflect this change. No rills or erosional features were observed along the side slope.

Annual photographic monitoring of the 18 locations for long-term rock monitoring was conducted during the 2024 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. No significant degradation of the EDA rock has been observed since monitoring began.

In the past, water has been observed in a large depression in the EDA at the lower end of the drainage channel. Standing water is a potential concern in this depression because inundation can accelerate the deterioration of large riprap by the freeze-thaw process. No surface water was observed in the EDA depression during the 2024 inspection. The soils were moist in this area in 2024, and the moisture extended south through a swale that has formed at the western edge of the site. The swale appears to seasonally collect water from disposal cell runoff and supports a mixture of hydrophytic and dryland vegetation. There is no rock cover in the swale, except at the very top edge, so moisture is unlikely to affect riprap on the cell.

Small amounts of vegetation (primarily grass) have encroached on the riprap on the side slopes, on the upper (eastern) portion of the stormwater drainage channel (i.e., diversion channel), and on the west side slope's apron. During the 2023 inspection, a patch of grass approximately 2.5 × 2.5 feet (ft) was observed on the west side slope toward the bottom between water flux meters WFM2 and WFM3. During the 2024 inspection, the size of the patch of grass had decreased; continued observations will be made during future site inspections. The relatively sparse plant growth in these features will not affect their performance (i.e., channels were designed to control stormwater runoff from affecting encapsulated materials within the disposal cell). There are a few small shrubs in the upper (eastern) portion of the drainage channel, but they will not obstruct water flow. An area of dense, tall grass near Apron Toe Drains 1 and 3 in the swale area described above suggests that conditions are periodically wetter in this area because stormwater runoff is channeled there by control features. During the 2024 inspection, there was no flowing water in these apron toe drains. No ponded water was observed during the inspection. Minor erosion was observed near the fence line near Apron Toe Drain 3 during past inspections but appears to be stable. Two livestock trails were observed: one near perimeter sign P7 (PL-8) and one between Apron Toe Drains 1 and 2, along the outside of the fence, where erosion is starting. There was no evidence of settling, slumping, erosion, or any other modifying process on the disposal cell side slopes that might affect the integrity of the disposal cell. No maintenance needs were identified.

9.4.2.3 Site Perimeter and Outlying Area

The area beyond the site boundary for a distance of 0.25 mile was observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. This includes the seeded grass area extending from the disposal cell to the site boundary and perimeter fence. No such impacts were observed. Livestock were observed outside the 0.25-mile distance.

In September and October 2021, the Cougar Peak Wildfire burned approximately 91,000 acres to the west of the site, mostly within the Fremont-Winema National Forest. The fire perimeter was within 2 miles of the site, and the burn scar can be clearly seen from the site. No negative effects from the fire have been observed on the site.

Gullies that formed in seeded areas extending west of Apron Toe Drains 1 through 5 were filled with rock in 2000. Although the rock has generally arrested the headcutting that was advancing eastward from the adjacent private property onto DOE property, some minor headcutting is still

evident (PL-9). Several small gullies have been observed on the private property directly west of the site in the heavily grazed areas downslope of the perimeter fence line near monitoring well 0515. Several rills and shallow gullies were also observed onsite on the slope north of the disposal cell where grass reestablishment has been limited, in a drainage area north of perimeter sign P7, north of perimeter sign P8, and in the southwest corner of the site. These rills and gullies were identified during previous annual inspections but appear to have stabilized, as no significant changes were observed in 2024. The gullies do not pose a threat to disposal cell integrity, and inspectors will continue to monitor these areas. In previous years, inspectors have observed a pile of galvanized posts with concrete bases in the southwest corner of the site. These galvanized posts and bases were removed by the adjacent landowner in July 2024. No other maintenance needs were identified.

9.5 Follow-Up or Contingency Inspections

LM will conduct follow-up or contingency inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up or contingency inspection was identified.

9.6 Maintenance and Repairs

In July 2024, the adjacent landowner removed the debris in the southwest corner. Two signs were added to the entrance gate regarding prohibited activities and emergency instructions. No other maintenance was performed in 2024.

Inspectors documented the following minor maintenance during the 2023 inspection to be addressed in the future:

- Replace a bent fence post near the southeast corner of the site
- Repair the fence on the south side
- Raise fence posts along the western fence line that have been pushed into the ground by the snow
- Remove the empty post found on the southern fence line

Inspectors documented the following minor maintenance during the 2024 inspection to be addressed in the future:

- Remove brush covering perimeter sign P1
- Trim back vegetation encroaching along the southern and southeastern fence lines

No other maintenance needs were identified.

9.7 Groundwater Monitoring

In accordance with the LTSP, LM conducts groundwater monitoring every 5 years to demonstrate compliance with established groundwater quality protections standards. The most recent sampling event occurred on July 9, 2024, and the next event will occur in 2029. The groundwater monitoring network consists of nine monitoring wells, including eight downgradient point of compliance (POC) wells installed in four clusters of two wells (one shallow and one deep) and one upgradient background monitoring well (Table 9-2 and Figure 9-2).

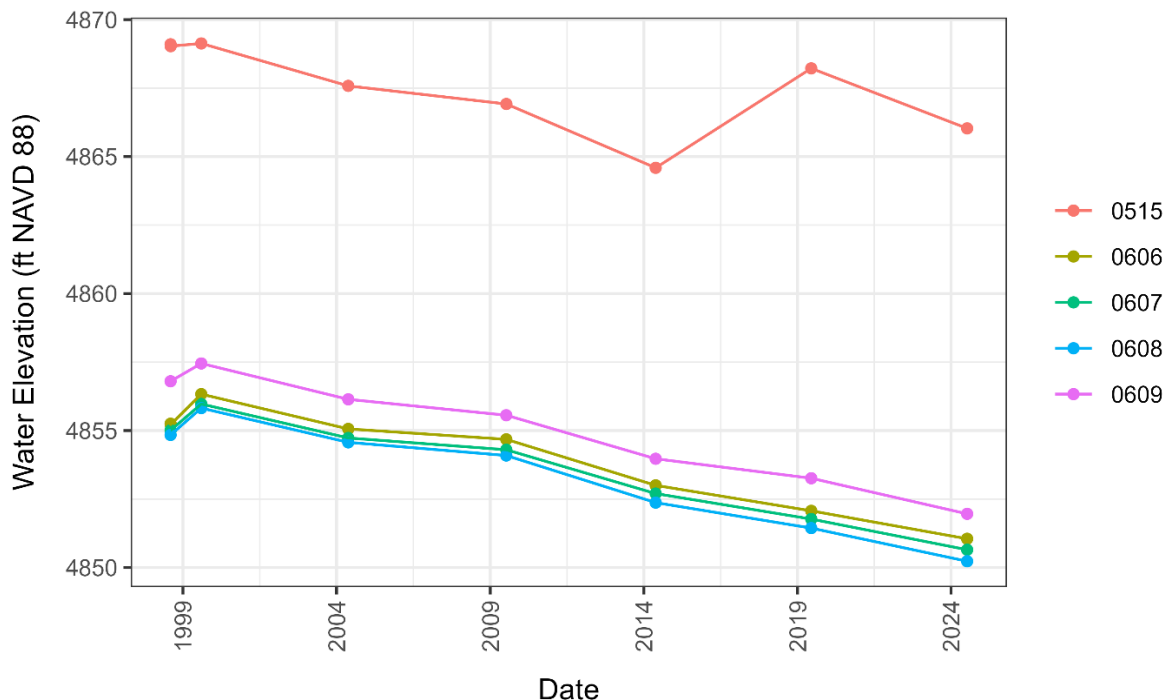
Table 9-2. Groundwater Monitoring Network for the Lakeview, Oregon, Disposal Site

Groundwater Monitoring Purpose	Monitoring Wells
Paired POC wells	0602/0609
Paired POC wells	0603/0608
Paired POC wells	0604/0607
Paired POC wells	0605/0606
Upgradient (background)	0515



Figure 9-2. Groundwater Monitoring Network, Lakeview, Oregon, Disposal Site

At the POC locations, each cluster consists of two wells: a shallow well screened at approximately 100 ft below ground surface (bgs) and a deeper well screened at approximately 150 ft bgs. Historically, the shallow wells (0602, 0603, 0604, and 0605) have been consistently dry or have had insufficient water to sample. This was again the case during the July 2024 sampling event. In accordance with Section 5.2 of the LTSP (requiring routine evaluation of historical groundwater levels), Figure 9-3 plots water elevations over time for 1998–2024, the period since the LTSP was issued. For the reasons stated above, the dataset is limited to background and deeper POC wells. Since 1999, on average, water levels in the deeper POC wells (0606 through 0609) have decreased approximately 5 ft, while those in the shallow upgradient wells have decreased about 3 ft.



Note: Shallow wells 0602, 0603, 0604, and 0605 have been dry and have had insufficient water to sample.
Abbreviation: NAVD 88 = North American Vertical Datum of 1988

Figure 9-3. Hydrographs for Background and Deeper POC Wells at the Lakeview, Oregon, Disposal Site, 1998–2024

The constituents monitored in site groundwater are arsenic, cadmium, and uranium (DOE 1994). EPA established MCLs for these analytes in groundwater in 40 CFR 192 Subpart A Table 1 (Table 9-3).

Table 9-3. Maximum Concentration Limits for Groundwater at the Lakeview, Oregon, Disposal Site

Constituent	MCL ^a (mg/L)
Arsenic	0.05
Cadmium	0.01
Uranium	0.044

Note: ^a MCL (40 CFR 192 Subpart A Table 1).
Abbreviation: mg/L = milligrams per liter

Consistent with historical observations, concentrations of these constituents continue to remain below their respective MCLs in 2024 (Figure 9-4). Arsenic concentrations were ≤ 0.01 milligrams per liter (mg/L) and comparable to or less than the background (well 0515) measurement. As is true for most results since 1998, cadmium results for all wells were below the laboratory detection limit of 0.0003 mg/L. Uranium concentrations remained stable in most wells, with only results for wells 0606 and 0607 slightly exceeding background. The results of Mann-Kendall trend analysis indicate no significant concentration trend except for uranium in southernmost well 0606, with a significant increasing trend (p-value of 0.020).¹ The most recent uranium result for this well, 0.0023 mg/L, is still well below the corresponding 0.044 mg/L MCL.

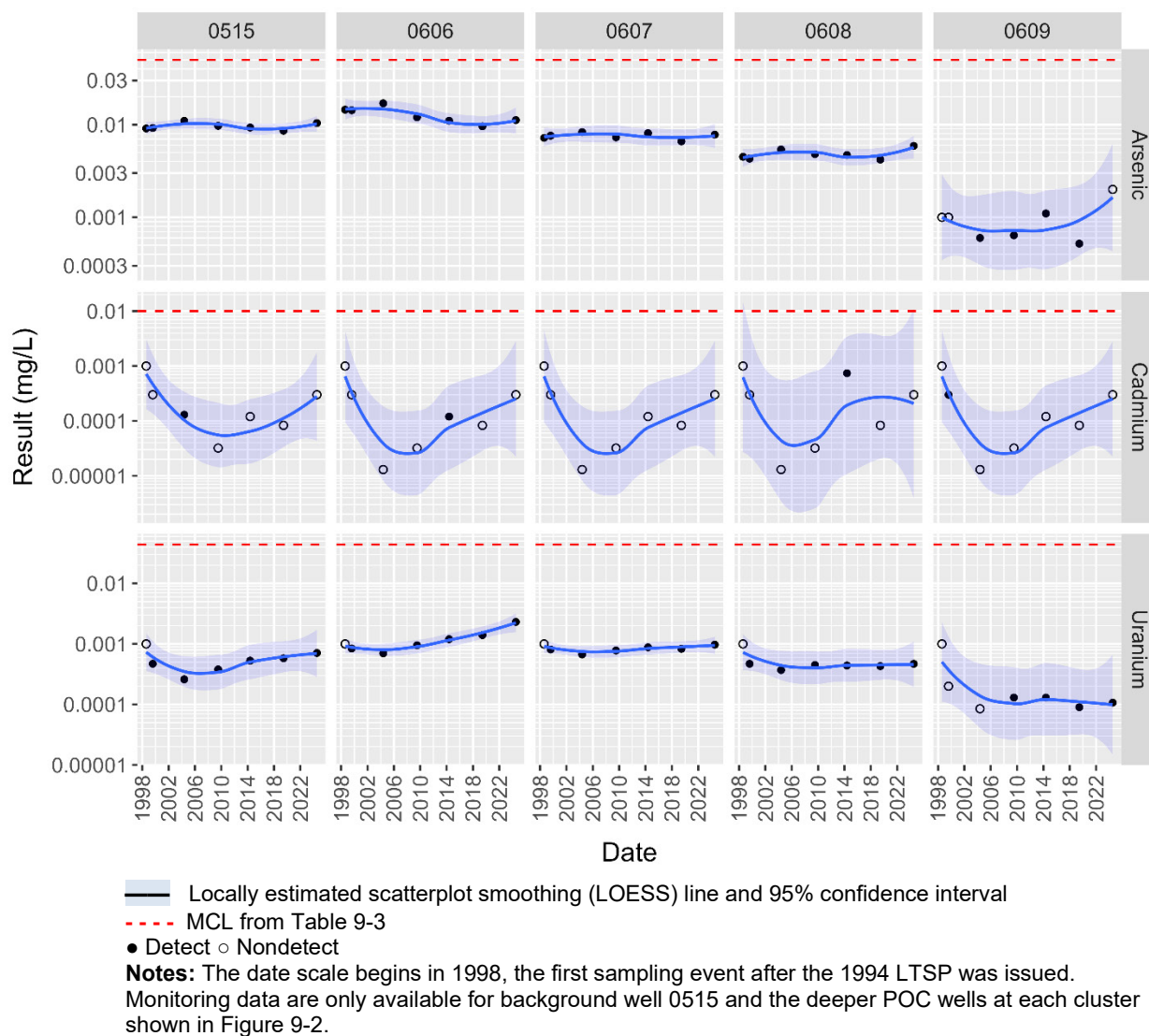


Figure 9-4. Time-Concentration Plots of Arsenic, Cadmium, and Uranium in Monitoring Wells at the Lakeview, Oregon, Disposal Site

¹ Trend analysis was conducted using the “NADA: Nondetects and Data Analysis for Environmental Data” package (Lee 2020) for R, version 4.3.3 (R Core Team 2024). Results are not tabulated here because all but one of the trends were stable (no significant concentration trend).

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (<https://gems.lm.doe.gov>). Based on the monitoring results to date, there is no indication of degradation of groundwater quality near the site. The next disposal cell groundwater monitoring event is scheduled for 2029.

9.8 Corrective Action

In accordance with the LTSP, corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

9.9 References



Site-related documents are available on the LM public webpages at <https://lmpublicsearch.lm.doe.gov/SitePages>.

Note

10 CFR 40.27. U.S. Nuclear Regulatory Commission, “General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites,” *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings,” *Code of Federal Regulations*.

40 CFR 192 Subpart A Table 1. U.S. Environmental Protection Agency, “Maximum Concentration of Constituents for Groundwater Protection,” *Code of Federal Regulations*.

Dayvault, J., 2015. J. Dayvault, UMTRCA 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 Rock Degradation Assessment) to U.S. Nuclear Regulatory Commission, March 2.

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, August.

Lee, L., 2020. “NADA: Nondetects and Data Analysis for Environmental Data,” R package, version 1.6-1.1, <https://CRAN.R-project.org/package=NADA>, accessed November 15, 2024.

Mandeville, D., 2019. D. Mandeville, project manager, U.S. Nuclear Regulatory Commission, letter (about Lakeview Rock Degradation Monitoring Program) to Jason Nguyen, UMTRCA site manager, Office of Legacy Management, U.S. Department of Energy, October 11.

R Core Team, 2024. “R: A Language and Environment for Statistical Computing,” The R Foundation for Statistical Computing, version 4.3.3, <https://www.r-project.org>, accessed November 15, 2024.

9.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	292	Entrance Sign
PL-2	292	Entangled Brush and Juniper Trees in Southern Fence Line
PL-3	270	Animal Digging Under Eastern Fence Line
PL-4	90	Site Marker SMK-1 near the Entrance Gate
PL-5	—	Boundary Monument BM-3
PL-6	90	Grasses and Forbs on Top of the Disposal Cell
PL-7	—	Windblown Erosion on Northwest Corner of the Disposal Cell
PL-8	90	Livestock Trail Outside Site Boundary
PL-9	67	Headcutting at Apron Toe Drain 3

Note:

— = Photograph taken vertically from above.



PL-1. Entrance Sign



PL-2. Entangled Brush and Juniper Trees in Southern Fence Line



PL-3. Animal Digging Under Eastern Fence Line



PL-4. Site Marker SMK-1 near the Entrance Gate



PL-5. Boundary Monument BM-3



PL-6. Grasses and Forbs on Top of the Disposal Cell



PL-7. Windblown Erosion on Northwest Corner of the Disposal Cell



PL-8. Livestock Trail Outside Site Boundary



PL-9. Headcutting at Apron Toe Drain 3