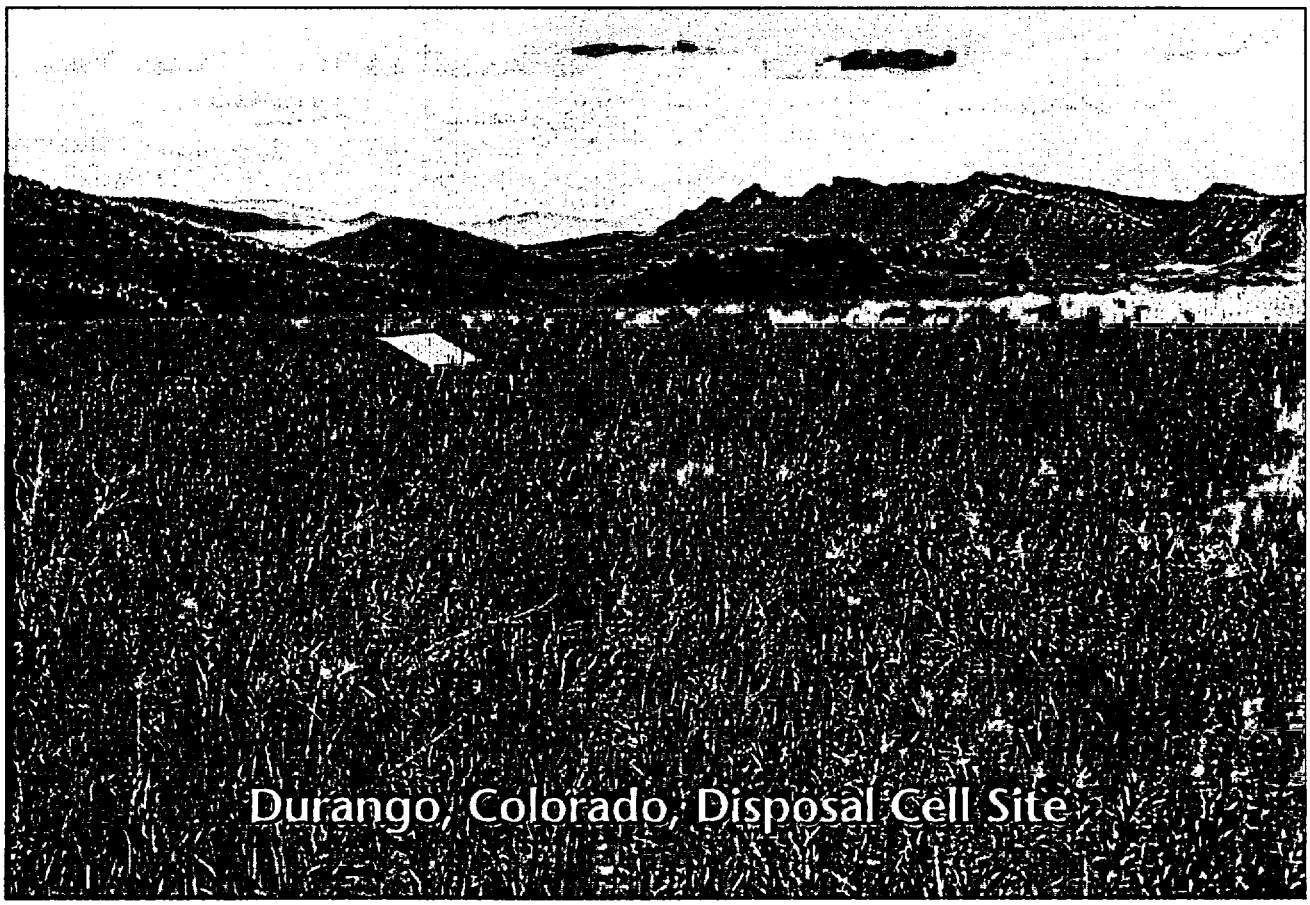
Long-Term Surveillance and Maintenance Program

1999 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

January 2000



Durango, Colorado, Disposal Cell Site

Long-Term Surveillance and Maintenance Program

Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

1999 Annual Report

January 2000

Prepared for
U.S. Department of Energy
Albuquerque Operations Office
Grand Junction, Colorado

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Contents

Acronyms

BM	Boundary Monument
BLM	U.S. Bureau of Land Management
CFR	U.S. Code of Federal Regulations
c.	circa
DM	displacement monument
DOE	U.S. Department of Energy
ECM	Erosion Control Marker
EDA	Energy Dissipation Area
EPA	U.S. Environmental Protection Agency
GJO	Grand Junction Office
GPS	Global Positioning System
FY	fiscal year
L	liter
LTRM	Long-Term Radon Management
LTSM	Long-Term Surveillance and Maintenance
LTSP	Long-Term Surveillance Plan
LTP	Long-Term Performance
NRC	U.S. Nuclear Regulatory Commission
MCL	maximum concentration limit
mg/L	milligrams per liter
MW	monitor well
P	perimeter sign
PCB	polychlorinated biphenyls
pCi/L	picoCuries per liter
POC	point of compliance
RRM	residual radioactive material
SM	survey monument
TDS	total dissolved solids
SMK	site marker
UGW	UMTRA Ground Water
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act

Summary

This report comprises the results of inspections, maintenance, and monitoring by the U.S. Department of Energy (DOE) in 1999 at the 19 uranium mill tailings disposal sites established under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978. Eighteen of these sites were under general license by the U.S. Nuclear Regulatory Commission (NRC) during all or part of 1999. The 19th site, Grand Junction, will not be licensed until an open cell that is still in operation is finally closed, perhaps in 2023.

All sites were inspected, maintained, and monitored, where required, by the Long-Term Surveillance and Maintenance (LTSM) Program established at the DOE Grand Junction Office (GJO), Grand Junction, Colorado, to fulfill DOE's long-term stewardship commitment at these sites.

Site inspections, maintenance, and monitoring are conducted in accordance with site-specific Long-Term Surveillance Plans (LTSP) and procedures established by the DOE to comply with license requirements established by NRC at 10 CFR 40.27. Among these requirements is this annual report to NRC on the status of the sites. Results of ground-water monitoring are included for each site where such monitoring is required.

The purposes of the annual inspection are to confirm the integrity of visible features at the site; to identify changes or new conditions that may affect the long-term performance of the site; and to determine the need, if any for maintenance or follow-up inspections and monitoring. Some sites require routine maintenance, but most maintenance is performed as needed. The LTSM Program monitors ground water if it is required by the LTSP.

Results of the annual site inspections and other site activities performed by the LTSM Program are reported in the site-specific chapter that follow. Table Intro-1 summarizes significant issues, findings, and observations of interest or regulatory concern to NRC.

Table Intro-1. Significant Issue, Finding, or Observation of Regulatory Concern

Site	Chapter	Issue, Finding, or Observation
Ambrosia Lake	1	None
Burrell	2	None
Canonsburg	3	None
Durango	4	None
Falls City	5	None
Grand Junction	6	None
Green River	7	None
Gunnison	8	None
Lakeview	9	None
Lowman	10	None
Maybell	11	None
Mexican Hat	12	None
Naturita	13	None
Rifle	14	None
Salt Lake	15	None
Shiprock	16	None
Slick Rock	17	None
Spook	18	None
Tuba City	19	None

Annual Compliance Report
Ambrosia Lake, New Mexico, Disposal Site

Compliance Summary

The site, inspected on May 10-11, 1999, was in excellent condition and met all compliance requirements. The only concern, a shallow depression around a displacement monument was unchanged and is no longer considered significant. No maintenance is required, and no requirement for a follow-up inspection was identified. Ground-water monitoring is not required at this site.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Ambrosia Lake, New Mexico Uranium Mill Tailings Remedial Control Act (UMTRCA) Title I, disposal site are specified in the *Long-Term Surveillance Plan (LTSP) for the Ambrosia Lake, New Mexico, Disposal Site* (July 1996, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-211, Rev. 1), and in procedures established by the U.S. Department of Energy Grand Junction Office (DOE-GJO) to comply with requirements of Title 10 U.S. *Code of Federal Regulations* (CFR) Part 40.27. These requirements are listed in Table AMB-1.

Table AMB-1. License Requirements for the Ambrosia Lake, New Mexico, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Page 6-1	Section 1.0
Follow-up or Contingency Inspections	Pages 6-1 and 7-1	Section 2.0
Maintenance	Page 8-1	Section 3.0
Ground-Water Monitoring	Pages 5-22 and 5-24	Section 4.0
Corrective Actions	Page 9-1	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The site, north of Grants, New Mexico, was inspected on May 10-11, 1999. The purposes of the inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in the report are shown on Figure AMB-1.

1.1 Specific Site Surveillance Features

The following section details specific site surveillance features investigated during the inspection.

Access Road, Entrance Sign, Perimeter Signs. Access to the site is via a gravel road from New Mexico State Highway 509. The site is approximately 1 mile east of the highway and is visible from the highway.

There is a locked gate across the access road at Highway 509. The gate is locked because the road leads to private mining and grazing interests that lie south and east of the disposal site. The road receives heavy use by these interests. There is a daisy chain of locks on the gate. DOE added its lock to the chain in November 1998.

The entrance sign and all perimeter signs were in excellent condition

Site Markers and Survey and Boundary Monuments. Two granite site markers, five boundary monuments, and three combined survey-and-boundary monuments were all undisturbed and in excellent condition.

Monitor Wells. Twenty-one monitor wells remain at the site. Ground-water monitoring is not required at this site, so the wells were not formally inspected.

Mine Vents. There are two mine-vent shafts inside the site boundary. A third vent is just west of the site but within DOE's restrictive easement on mining adjacent to the site. All three vents are associated with abandoned underground mines now understood to be flooded. All three vents have intact casings and covers.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into four areas called transects: (1) the riprap-covered top of the disposal cell; (2) the riprap-covered side slopes and apron of the cell; (3) the graded and revegetated area between the cell and the site perimeter; and (4) outlying areas. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features, including survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or the long-term performance of the site.

Top of Disposal Cell. For the most part, the top of the disposal cell was in excellent condition. There was no evidence of cracking, slumping, or erosion. There is a shallow depression around the displacement monument, DM-4, at the northeast corner of the disposal cell. This depression was discovered during the 1997 inspection but now appears unchanged. It is believed to be an artifact of final grading before the riprap was laid down. The depression is no longer considered significant, although it will be monitored from year to year.

Annual weeds on top of the disposal cell were withered and dead. The plants are probably Kochia that dried out and died before reaching maturity and producing seeds. The plants appear to grow where the riprap is thin or filled with fine-grained materials, an artifact of installation. The fine-grained material (sand and dirt) apparently retains moisture and provides a rooting medium. The weeds, so far, are not a problem because they die while still immature.

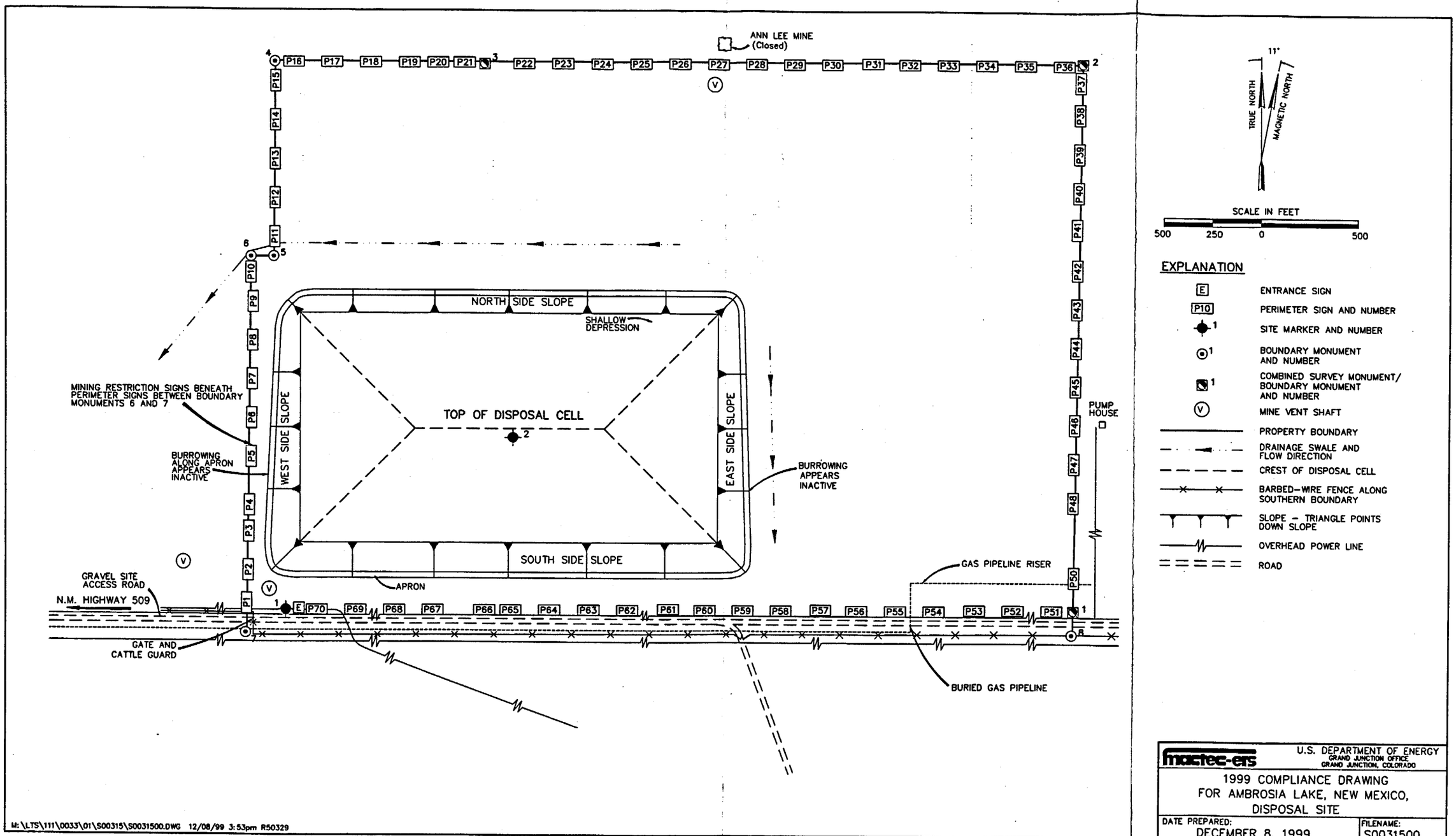


Figure AMB-1. 1999 Compliance Drawings for Ambrosia Lake, New Mexico, Disposal Site

Plant encroachment could increase if site conditions change during the design life of the cell. Study of the effect of deep-rooted plants, such as Kochia, on the long-term performance of rock-covered disposal sites in the western United States is currently under way by the GJO Long-Term Performance Monitoring and Cover Assessment Project.

Side Slopes and Apron. Side slopes and the rock apron around the disposal cell are in excellent condition and show no evidence of cracking, settling, slumping, erosion, or significant plant encroachment. A few dried plants were observed on the east side slope, leeward to prevailing wind.

There are small animal burrows at places along the rock apron on the west and east sides of the disposal cell. None of the burrows is in the riprap that armors the disposal cell. The volume of dirt displaced is very small, and none of it consists of sandy or clay-rich material that could represent tailings or slimes.

Water standing at places in the rock apron along the bottom of the south side slope of the disposal cell is the result of stormwater runoff. Judging from the vegetation near the standing water, the water is ephemeral: It quickly evaporates or dissipates into the soil. It does not flow, and no erosion is associated with it. It is not considered a problem.

Graded and Revegetated Site Area. Vegetation in graded and seeded areas on the site is noticeably better than vegetation off site that is grazed. Vegetation is still sparse in a few places; but overall, the revegetation is successful.

The barbed-wire fence south of the cattle guard near the site entrance is damaged. It may have been damaged by cattle pushing through it. There was evidence of both cattle and elk on site, but the site is not over grazed. Unless overgrazing becomes a problem, repair of the fence is not required. Limited grazing by cattle and elk may benefit the vegetation.

The access road and a power line cross the site along the southern boundary of the site. There is also a riser associated with an underground natural gas line in the southeastern corner of the site. The pipeline is far enough away that excavation along the pipeline will not disturb the disposal cell.

Outlying Areas. The area outward for a distance of 0.25 mile from the site boundary was visually inspected. No erosion or other disturbance, building, construction, or change in land use was seen. One change was noted: The Ann Lee mine opening, immediately north of the site, has been permanently closed and the land reclaimed by the owners.

2.0 Follow-up or Contingency Inspections

No follow-up or contingency inspections were required in 1999.

3.0 Maintenance

No maintenance was required in 1999.

4.0 Ground-Water Monitoring

Ground-water monitoring is not required at this site because the water is in contact with naturally occurring mineralization and the upper aquifer is of limited use due to low yield (less than 150 gallons per day to a pumping well).

5.0 Corrective Actions

Corrective actions in response to natural phenomena or other unpredictable events that could threaten the stability of the disposal cell were not required in 1999.

Annual Compliance Report
Burrell, Pennsylvania, Disposal Site

Compliance Summary

The site, inspected on October 20, 1999, was in excellent condition and met all compliance requirements. Results of ground-water monitoring indicate that the disposal cell continues to perform as designed and constructed, and that annual ground-water monitoring is no longer justified. No requirement for additional maintenance was identified, and there is no cause for a follow-up inspection. Revision of the LTSP is planned for fiscal year (FY) 2000. The revision will propose (1) discontinuance of vegetation control on the disposal cell, and (2) a change in the frequency of ground-water monitoring.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Burrell, Pennsylvania, UMTRCA Title I Vicinity Property Site are specified in the *Burrell, Pennsylvania, Vicinity Property Long-Term Surveillance Plan* (September 1993, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-3F), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table BUR-1.

Table BUR-1. License Requirements for the Burrell, Pennsylvania, Disposal Site

Requirement	LTSP	This Report
Annual (Phase I) Inspection and Report	Pages 3-1 and 7-1	Section 1.0
Follow-up (Phase II) or Contingency Inspections	Pages 3-1 and 6-1	Section 2.0
Maintenance	Page 6-1 and Appendix D	Section 3.0
Ground-Water Monitoring	Pages 4-4 through 4-7	Section 4.0
Corrective Actions	Page 4-7	Section 5.0

Compliance Review

1.0 Annual (Phase I) Inspection and Report

The site, southeast of Blairsville, Pennsylvania, was inspected by the DOE-GJO on October 20, 1999. Inspectors determined that the site is in excellent condition.

The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes or new conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This report describes the results of the inspection. Features mentioned in this report are shown on the drawing, Figure BUR-1.

1.1 Specific Site Surveillance Features

The following section details specific site surveillance features investigated during the inspection.

Site Access. The access road is graveled and hard-packed. The road leads from the access gate at Strangford Road to the entrance gate in the security fence at the site. Ruts in the access road were filled with road base in August 1999. The road is now in excellent condition.

Signs. All were legible, although some had holes.

Fence, Gates, Monuments, and Markers. The security fence, although beginning to rust, is in good condition. The entrance gate and the personnel gate at the west end of the site are both in excellent condition. The new latching mechanism, a drop-rod assembly, on the entrance gate significantly hardens the gate and is a notable improvement.

The site marker SMK-1 is just inside the entrance gate and is in excellent condition. Dense vegetation was cleared from the marker in July, so the marker is now clearly visible. The LTSP makes reference to a second site marker, intended for the crest of the disposal cell. The marker was never installed. Reference in the LTSP to the second site marker will be deleted when the LTSP is revised in 2000.

There are three survey monuments and seven boundary monuments. Because of dense vegetation, some of the monuments have been hard to find. Global Positioning System (GPS) equipment was used during this year's inspection to locate boundary monuments BM-2, BM-3, BM-4, BM-7, and survey monument SM-101. SM-101 had never been found during an annual inspection. It was found this year in what is now a dense thicket. Witness posts, consisting of galvanized pipe and flagging, were installed to make these monuments easier to find.

Four pairs of erosion control markers (ECM-1 and 2, ECM-3 and 4, ECM-5 and 6, and ECM-7 and 8) were inspected and determined to be undisturbed.

Monitor Wells. Five pairs of monitor wells were inspected. All were in good condition. A ground-water sampling team was on the site the week of September 13. Results of monitoring are in Section 4.0 of this report.

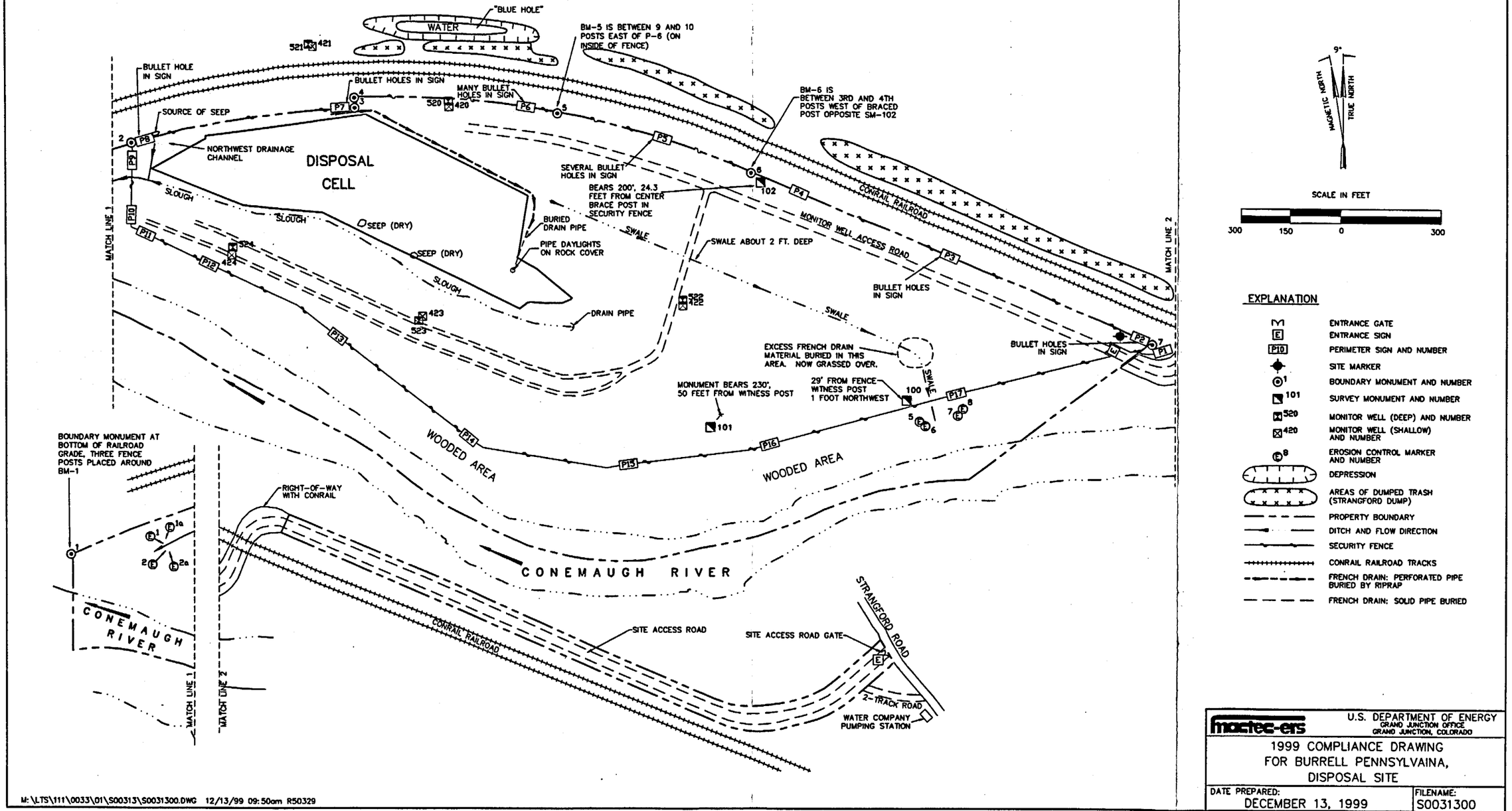
1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into four areas referred to as transects: (1) the disposal cell transect; (2) area adjacent to the disposal cell; (3) the site perimeter; and (4) the outlying area including the access road that leads to the site.

Within each transect, the inspectors examined specific site surveillance features, such as survey-and-boundary monuments, monitor wells, fence, gates, and signs. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or the long-term performance of the site.

Disposal Cell. The disposal cell is covered with riprap. The rock has been in place for 12 years and shows no sign of deterioration.

Trees and shrubs have established aggressively on the disposal cell. With the exception of a 0.5-acre test plot on the south side slope of the disposal cell, DOE has sprayed the vegetation on the disposal cell several times, most recently in July 1998. That spraying resulted in a thorough kill; however, (1) there is abundant dead woody plant material on the disposal cell, and (2) trees



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1999 COMPLIANCE DRAWING FOR BURRELL PENNSYLVAINA, DISPOSAL SITE	
DATE PREPARED: DECEMBER 13, 1999	FILENAME: S0031300

Figure BUR-1. 1999 Compliance Drawings for Burrell, Pennsylvania, Disposal Site

and bushes are beginning to reappear because of a virtually infinite seed supply from wooded areas surrounding the disposal cell.

A study to evaluate the long-term effect of vegetation on the performance of the disposal cell was begun in 1996 and completed in 1999. This study, *Plant Encroachment on the Burrell, Pennsylvania, Disposal Cell: Evaluation of Long-Term Performance and Risk* (GJO-99-96-TAR, June 1999) was published by DOE this year.

The study concludes that plants, including the deep-rooted Japanese knotweed, have increased the hydraulic conductivity of the radon barrier. However, a screening-level risk assessment, part of the vegetation study, determined that (1) the natural forest succession on the disposal cell will not increase risk to human health, safety, or the environment; and (2) the development of forest on the disposal cell will likely improve the long-term performance of the disposal cell, through evapotranspiration that will reduce the risk of stormwater leaching through the disposal cell. These findings will be the basis for a revision to the LTSP that will permit the natural forest succession to proceed without further intervention. The revision is in preparation and will be submitted to the U.S. Nuclear Regulatory Commission (NRC) before the end of 2000. Until the NRC concurs with the revision, DOE will continue to spray the vegetation on the disposal cell every 2 to 3 years.

Seeps along the bottom of the south side slope were inspected. All were dry. Western Pennsylvania has been very dry this summer. Not only were the seeps dry, but the slough at the bottom of the disposal cell was almost dry except near the outflow at the west end of the disposal cell.

Area Adjacent to the Disposal Cell. A French drain was installed along the bottom of the north side slope of the disposal cell in August 1998. The purpose of the drain was to prevent stormwater from ponding along the bottom of the side slope. The drain appears to be working. At the time of this year's site inspection, the area along the drain was mostly dry, and no water was flowing from the drain outlet. Cattails and other wetlands vegetation that were abundant before the drain was constructed are no longer present.

The area surrounding the disposal cell and inside the security fence is covered by thick grass and forest. Access corridors to the four pairs of monitor wells inside the security fence are mowed annually.

Site Perimeter. The security fence, mentioned above, is beginning to rust, but is still in good condition. In 1998, a swath, 5-feet wide, was cleared on both sides of the fence. Dead and entangling vegetation was removed to protect the fence and facilitate inspection and repair. This action was a significant improvement insofar as inspection and maintenance is concerned, and will doubtless increase the life of the fence. Clearing will be repeated every 2 to 3 years, or as necessary, to keep the fence free of vegetation.

Seeps along the security fence, about 60 feet east of perimeter sign P8 (just west of the disposal cell), continue to flow but at a much reduced rate because of the dry summer in the area. Seeps in this area will continue to be monitored against the possibility that the seeps may destabilize the railroad embankment by spring sapping.

Outlying Area. The area beyond the site boundary, outward for a distance of 0.25 mile, was examined for signs of erosion, development, and other changes that might affect the site. Inspectors found two new gas wells on the Burrows' property just inside the access gate near Strangford Road. (DOE's access road is on a right-of-way across the Burrows' property.) These wells are expected to have no impact on the disposal site.

North of the site and along the ConRail tracks, DOE has an access road to the upgradient pair of monitor wells, MW-421 and MW-521. This road also provides access to a long, narrow wooded area along the railroad tracks that has been used as an illegal dump, known locally as the "Strangford dump." Dumping seems to be on the decrease. Inspectors found no new or fresh trash. Although township authorities are aware of the problem, none of the trash has been removed.

The dump is not a threat to the site except for the possibility that contaminants from the dump conceivably could contaminate DOE's monitor wells downgradient from the dump. Inspectors will continue to report conditions at this dump.

The deep depression north of the railroad tracks, referred to as the "blue hole," is usually filled with water. It was, on the occasion of this year's inspection, dry.

2.0 Follow-up (Phase II) or Contingency Inspections

No follow-up or contingency inspections in response to new conditions were required in 1999.

3.0 Maintenance

Maintenance in 1999 consisted of mowing aggressive vegetation along corridors to the monitor wells and along the security fence. Similar maintenance will be performed in 2000.

4.0 Ground-Water Monitoring

DOE monitors ground water at this site as a best management practice to evaluate the effectiveness of the remedial action.

4.1 Monitor Wells

The ground-water monitoring network consists of ten wells in five pairs. These are shown in Table BUR-2.

Table BUR-2. Ground-Water Monitoring Network

Monitor Wells	Location
MW-420 & MW-520	Upgradient, or background wells
MW-421 & MW-521	Upgradient, or background wells
MW-422 & MW-522	Crossgradient wells
MW-423 & MW-523	Downgradient wells
MW-424 & MW-524	Downgradient wells

Each pair of wells consists of a shallow well, completed in unconsolidated fill and alluvium (400-series wells), and a deeper well, completed in the shallow bedrock of the Casselman Formation (500-series wells). In addition, two seeps at the bottom of the south side slope of the disposal cell are also sampled whenever they afford sufficient water. Locations of wells and seeps are shown on Figure BUR-1.

4.2 Frequency of Monitoring.

The wells and seeps are sampled annually in the fall.

4.3 Analytes

Ground-water samples are analyzed for the following analytes. Analytes with maximum concentration limits (MCLs) are underlined.

ammonium	magnesium	selenium
calcium	manganese	sodium
chloride	molybdenum	sulfate
gross alpha	potassium	total dissolved solids
iron	radium-226 + radium-228	uranium
lead	nitrate	vanadium

4.4 Results of Ground-Water Monitoring in 1999

Ground-Water Sample Analytical Results. The 10 wells and 2 seeps were sampled in September 1999.

Of the 18 analytes listed above, 7 with MCLs were detected in the samples. Results from wells completed in the unconsolidated fill and alluvium are presented in Table BUR-3; results from the deeper bedrock wells are presented in Table BUR-4. The MCL for each analyte is also presented in the tables. The MCLs are used as benchmarks for evaluating water quality data at the Burrell site. The seep locations along the southern margin of the cell were dry and could not be sampled in 1999.

Table BUR-3. Summary of Alluvial Ground-Water Sample Results

Analyte	MCL	Alluvial Ground-Water Sample Location				
		MW-420 (upgradient)	MW-421 (upgradient)	MW-422 (crossgradient)	MW-423 (downgradient)	MW-424 (downgradient)
Gross alpha	15[a]	4.52U	11.48U	4.4U	10.38U	8.25U
Lead	0.05	0.00043B	0.0012B	0.00038B	0.00044B	0.00043B
Molybdenum	0.10	0.00082B	0.0008U	0.0008U	0.0157	0.0074B
Nitrate as NO_3	44	0.010U	0.0153B	0.0106B	0.202B	0.124B
Radium-226 Radium-228	5, combined	0.2 0.76U	0.1U 0.76U	0.1U 0.76U	0.6 0.82U	0.14 0.76U
Selenium	0.01	0.0001U	0.0001B	0.0001U	0.0001U	0.0001U
Uranium	0.044	0.0002U	0.0002U	0.0077B	0.0208	0.0023

All results in milligrams per liter (mg/L) except Ra-226, Ra-228, and gross alpha are in picoCuries per liter (pCi/L).
[a]Excludes contributions from uranium and radon-222 decay. Ground water sample results include uranium and radon-222 decay.
U = undetected at respective laboratory reporting limit.
B = less than the required detection limit but greater than or equal to the actual detection limit.

Table BUR-4. Summary of Bedrock Ground-Water Sample Results

Analyte	MCL	Bedrock Ground-Water Sample Location				
		MW-520 (upgradient)	MW-521 (upgradient)	MW-522 (crossgradient)	MW-523 (downgradient)	MW-524 (downgradient)
Gross alpha	15[a]	3.26U	5.26U	3.95U	5.04U	5.48U
Lead	0.05	0.00037B	0.00072B	0.00037B	0.0004B	0.00036B
Molybdenum	0.10	0.0012B	0.0139	0.0008U	0.0014B	0.0012B
Nitrate as NO_3	44	0.0268B	0.0676B	0.0762B	0.158B	0.208B
Radium-226 Radium-228	5, combined	0.11U 0.81U	0.12U 0.88U	0.11U 0.78U	0.13U 0.95U	0.11U 0.78U
Selenium	0.01	0.0001U	0.0001U	0.0001U	0.0001U	0.0001U
Uranium	0.044	0.0002 U	0.0002 U	0.0002 U	0.0006B	0.0002U

All results in mg/L except Ra-226, Ra-228, and gross alpha are in pCi/L.
[a]Excludes contributions from uranium and radon-222 decay. Ground-water sample results include uranium and radon-222 decay.
U = undetected at respective laboratory reporting limit.
B = less than the required detection limit but greater than or equal to the actual detection limit.

Gross alpha, lead, and selenium. Gross alpha, lead, and selenium concentrations remain below laboratory detection limits at all wells. Since September 1987, the first year the wells and seeps were sampled by the Long-Term Surveillance and Maintenance (LTSM) Program, these analytes have been at or below the laboratory detection limit at all locations. Anomalously high concentrations of lead, ranging from 0.02 to 0.15 mg/L, were detected in samples collected in June 1987 (more than 12 years ago), when the wells were first sampled. This condition no longer remains.

Nitrate. The concentration of nitrate continues to be very low, barely above detection level, in most of the wells. All results for nitrate are at least two orders of magnitude below the MCL. This condition has persisted since monitoring began in June 1987.

Radium. One or the other of the two radium isotopes occurred above laboratory detection limit in four wells in 1998. In 1999, radium-226 was above detection limit in three of the wells. No trend is apparent in the data, but radium values are all significantly lower than their respective MCLs. This condition has persisted since monitoring began in June 1987.

Molybdenum. Molybdenum has occurred consistently both years (1998 and 1999) in two wells, in upgradient bedrock well, MW-521, and in downgradient alluvial well, MW-423. Values at both wells have been consistent from one year to the next. Molybdenum at all wells is at least one order of magnitude below the MCL, and has decreased by more than one half to present values since maximum concentrations of approximately 0.06 mg/L to 0.08 mg/L were detected in 1987 and 1988.

Uranium. Uranium is above the detection limit at the two downgradient alluvial wells, MW-423 and MW-424 and the crossgradient well, MW-422. At MW-423, uranium increased from 0.0016 milligrams per liter (mg/L) in December 1996 to 0.022 mg/L in October 1998 and 0.0208 mg/L in September 1999. A similar fluctuation occurred at MW-423 in 1991 and 1992. In the 1991-1992 interval, uranium increased from less than 0.0003 mg/L to 0.019 mg/L, then decreased again to 0.003 mg/L. Samples in the intervening years ranged between approximately 0.001 mg/L to 0.008 mg/L. There is no overall trend in the uranium results for MW-423 since monitoring began in 1987.

At downgradient well MW-424, uranium only marginally exceeded the detection limit of 0.001 mg/L in 1998 and 1999. Uranium concentrations at MW-424 have historically been either near or below the detection limit, consistent with upgradient sample results.

At crossgradient well MW-422, uranium values have fluctuated between below detection in 1997 and 1998, to the present value of 0.0008 mg/L. Uranium concentration in ground water at all sampling locations continues well below the MCL.

Summary. Information from monitoring of ground water indicates:

- The limited amount of preremediation site characterization data on water quality, c. 1982, indicates that uranium concentrations then were comparable to the maximum values for uranium observed during the 1987 to 1999 postremediation period. The concentration of uranium in ground water has not increased since the disposal cell was constructed.

- The concentrations of two important hazardous constituents, uranium and molybdenum, have decreased slightly (molybdenum) or remained essentially unchanged (uranium) since the disposal cell was completed. All contaminant concentrations have remained well if not far below their respective MCLs.

- There are no trends in the analytical or water level data to indicate that seepage from the disposal cell degrades ground-water quality relative to contaminant levels that existed in ground water prior to cell construction.

On the basis of everything the data show, continued ground-water monitoring on an annual basis is a questionable practice. Monitoring on an annual basis provides no added protection for public health, safety, or the environment. Options to terminate monitoring (or to decrease the frequency of monitoring to once every 5 years) should be considered.

5.0 Corrective Actions

Corrective action may be required if results of ground-water monitoring suggest that the performance of the disposal is not protective of human health and the environment. Corrective action was not required in 1999.

End of current text

Annual Compliance Report
Canonsburg, Pennsylvania, Disposal Site

Compliance Summary

The site, inspected on October 19, 1999, was in excellent condition and met all compliance requirements. The grass, mowed annually, was healthy despite a dry year. Trees and shrubs continue to be cleared from the fence line, diversion channels, and perimeter ditches, as necessary. The most recent clearing was this year, 1999. The bank along Chartiers Creek at Area C continues to be lost to erosion along the creek. DOE plans to stabilize the bank in 2000. No additional maintenance is required and there is no cause for a follow-up inspection. Ground-water monitoring continued at six wells along with surface water in Chartiers Creek. Uranium was detected above the MCL at two downgradient wells, as in the past, but dropped below the MCL at the crossgradient well.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Canonsburg, Pennsylvania, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Canonsburg, Pennsylvania, Disposal Site* (October 1995, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-203, Rev. 0), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table CAN-1.

Table CAN-1. License Requirements for the Canonsburg, Pennsylvania, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 3.1 and Section 7.0	Section 1.0
Follow-up or Contingency Inspections	Section 3.2, Section 6.2, and Appendix E.4	Section 2.0
Maintenance	Section 6.1	Section 3.0
Ground-Water Monitoring	Page 4.0	Section 4.0
Corrective Actions	Section 4.4	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The site at Canonsburg, Pennsylvania, was inspected by DOE-GJO on October 19, 1999. Inspectors determined that the site was in excellent condition.

The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes or new conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. Inspection results are presented in this section. Features mentioned in the report are shown on the attached drawing, Figure CAN-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

Gates and Signs. The entrance gate, entrance sign, and the auxiliary gate on the north side of the site are in good condition. Padlocks on the gates are corroded or rusting and will have to be replaced from time to time. Perimeter signs on the fence around the site are also in good condition.

Markers and Monuments. The two site markers, three survey monuments, and four boundary monuments were in excellent condition. Inspectors used GPS equipment to locate and verify the location of all site surveillance features.

All four pairs of ECMs were undisturbed with one exception: ECM-4A, near the edge of the bank along Chartiers Creek, was lost to erosion along the bank in 1996. This ECM does not need to be replaced because the other marker in the pair, ECM-4, can be used for reference. No new evidence of erosion was noted along the bank during this year's site inspection, except for Area C.

Monitor Wells. Six monitor wells (MW-406, MW-410, MW-412, MW-413, MW-414, and MW-424) are in the LTSM monitoring network at this site. Personnel were on site the week of September 22 to sample the wells. All wells were in satisfactory condition. Each well is secured with a cap-and-pin locking system and a standard padlock. Padlocks are corroding and will have to be replaced from time to time.

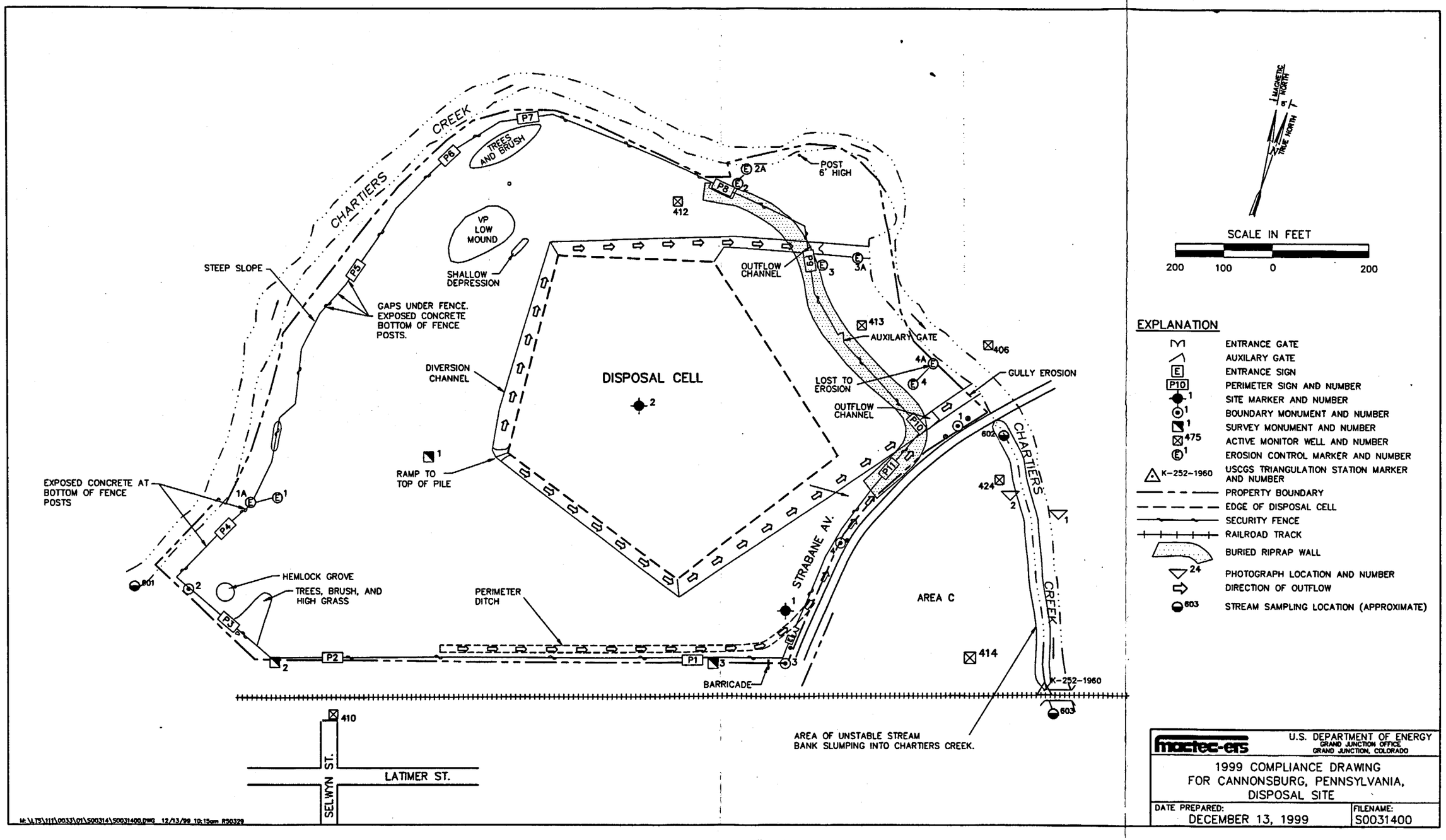
1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into five areas referred to as transects: (1) the disposal cell; (2) the grassed area surrounding the disposal cell; (3) the diversion channels and perimeter ditches; (4) the site perimeter and security fence; and (5) outlying areas. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features, such as monitor wells, survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or the long-term performance of the site.

Disposal Cell. The disposal cell is grass-covered and in excellent condition. The grass is mowed and mulched annually, most recently in August 1999. There was no animal activity or evidence of erosion, settlement, slumping, or other indication of instability.

Grassed Area Surrounding the Disposal Cell. The thick grass that covers the disposal cell also covers the area surrounding the disposal cell and extends beyond the security fence to the creek, from ECM-2 eastward to the Strabane Avenue bridge. The grass, mowed and mulched annually, is in excellent condition.



mactec-ers	U.S. DEPARTMENT OF ENERGY GRAND JUNCTION OFFICE GRAND JUNCTION, COLORADO
1999 COMPLIANCE DRAWING FOR CANNONSBURG, PENNSYLVANIA, DISPOSAL SITE	
DATE PREPARED: DECEMBER 13, 1999	FILENAME: S0031400

Figure CAN-1. 1999 Compliance Drawings for Canonsburg, Pennsylvania, Disposal Site

There are several groves of large trees and bushes in this transect. Beginning in 1994, dead trees and branches have been removed periodically from these groves. The entire area inside the fence is now park-like and well kept. Trees and branches in these groves and from along the fence line (see below) will continue to be removed as necessary.

Diversion Channels and Perimeter Ditches. Channels and ditches are armored with riprap. The rock is in excellent condition.

Vegetation is cleared from these channels every two years, or as necessary. In 1998, vegetation was treated with herbicide. In 1999, dead plant material was removed from the channels. The channels are now free of vegetation and in excellent condition. Regular spraying and clearing will be necessary to maintain these channels in their as-built condition.

At the northeast corner of the site, the northeast outflow channel and the eastern perimeter ditch, both armored with riprap, converge to form one spillway. This spillway was reconstructed in April 1998 to mitigate headward erosion and a public safety problem. The new, armored spillway is functioning as designed and headward erosion is eliminated.

Site Perimeter and Security Fence. The security fence is generally in excellent condition although it is beginning to rust. From the far western corner of the site, north along the top of the bank above Chartiers Creek, to near perimeter sign P5, the concrete "boot" at the bottom of several fence posts is exposed. Inspectors have been watching these posts since the site was first inspected in 1990. So far, there is no sign of erosion, slumping, or movement of soil away from the posts; all posts are firmly in place.

In August 1999, trees, grass, and heavy brush growing on both sides of the fence were mowed by tractor and bushhog. Vegetation also was treated with herbicide where necessary. This action was taken to prevent plants from interfering with the fence and to improve the appearance of the site. In addition, a path was cleared by hand along the outside of the fence above the creek so inspections can be performed along the outside of the fence all around the site.

Outlying Areas. The site is in an urban area and is surrounded by residential and commercial property. The area outward for a distance of approximately 0.25 mile was visually inspected for development or change in land use that might affect the safety or security of the site. None was seen; the neighborhood is unchanged.

Area C is a triangular, grass-covered property across Strabane Avenue east of the site. Area C was involved in remedial action and is now owned by the state. DOE understands that the state will eventually give Area C to a local government. The state understands that the deed for Area C, when transferred to the community, will carry a restriction on excavation and residential use of the property.

DOE continues to cut the grass at Area C, as a courtesy to the state.

Inspectors noted that erosion continues along the western bank of Chartiers Creek as it flows past Area C (CAN PL-1 and CAN PL-2). To address this problem, DOE is preparing an engineered design to stabilize the bank from the Strabane Avenue bridge to the railroad bridge abutment to

the south, a distance of approximately 600 feet. It is anticipated that bank stabilization activities will begin in late summer of 2000.

2.0 Follow-up or Contingency Inspections

No follow-up or contingency inspections, in response to a potential problem or a new or changed condition, were required in 1999.

3.0 Maintenance

Grass was cut in the summer of 1999, and vegetation was cleared from diversion channels and drainage ditches, as required by the LTSP, Section 6.1. Vegetation also was cleared along the security fence. No additional maintenance needs were identified.

4.0 Ground-Water Monitoring

DOE monitors ground water at this site as a best management practice to evaluate contaminant trends in the shallow, unconfined aquifer that lies beneath the disposal cell.

Monitor Wells. There are six wells in the LTSM ground-water monitoring network. Samples are also collected at three locations in Chartiers Creek at the same time that the wells are sampled.

The six wells are all completed in shallow unconsolidated materials (unconfined aquifer):

MW-410	Upgradient well
MW-406	Downgradient well
MW-412	Downgradient well
MW-413	Downgradient well
MW-424	Downgradient well
MW-414	Crossgradient well

4.1 Frequency of Monitoring

The LTSP requires sampling of the six monitor wells and three surface sample locations for 2 years following licensing of the site by NRC. The site was licensed in January 1996. It was sampled in December 1996, and again in November 1997. The 2-year requirement was fulfilled after monitoring in 1997. However, because the concentration of uranium in some of the wells continues to be above the EPA MCL, and because the Uranium Mill Tailings Remedial Action (UMTRA) Ground Water (UGW) Project has an alternate concentration limit (ACL) application pending with NRC, DOE continues to monitor the wells on a year-to-year basis.

4.2 Analytes

The LTSP specifies two hazardous constituents for monitoring at this site: molybdenum and uranium. All samples are analyzed for these two constituents as well as standard water quality indicators and field parameters.

4.3 Results of Ground-Water and Surface-Water Monitoring in 1999

Analytical results for molybdenum and uranium in ground- and surface-water samples collected in October 1998 and September 1999 are shown in Tables CAN-2 and CAN-3. The MCLs for molybdenum and uranium are included in the tables. The MCLs are benchmarks for evaluating water quality data at the site.

Table CAN-2. Summary of Ground-Water Sample Results

Analyte	MCL	Year	Ground-Water Sample Location					
			MW-410 (up-gradient)	MW-406 (east of creek)	MW-412 (down-gradient)	MW-413 (down-gradient)	MW-414 (cross-gradient)	MW-424 (down-gradient)
Molybdenum	0.10	1998 1999	0.001U 0.0008U	0.0039B 0.0035B	0.0011B 0.001U	0.0034B 0.0025B	0.019 0.0108	0.001B 0.0014B
Uranium	0.044	1998 1999	0.001U 0.0002U	0.0034 0.010	0.113 0.0544	0.140 0.164	0.0441 0.0187	0.001U 0.0002U

All results in mg/L.
U = undetected at respective laboratory reporting limit.
B = less than the required detection limit but greater than or equal to the actual detection limit.

Table CAN-3. Summary of Surface-Water Sample Results

Analyte	MCL	Year	Surface Water Sample Location		
			601 (upgradient)	602 (downgradient)	603 (downgradient)
Molybdenum	0.10	1998 1999	0.119 0.0961	0.112 0.0987	0.108 0.0898
Uranium	0.044	1998 1999	0.001U 0.0002U	0.001U 0.0002U	0.001U 0.0002U

All results in mg/L.
U = undetected at respective laboratory reporting limit.

Molybdenum. Among the September 1999 well samples, molybdenum was above the laboratory detection limit in only the crossgradient well, MW-414, where it continued little changed from 1998. The value for both years was an order of magnitude below the MCL.

At the crossgradient well, MW-414, the result for molybdenum, 0.0108 mg/L, was 3 to 10 times higher than at the other wells. The molybdenum result for this well is consistent with historic data for the well that go back to approximately 1987. This well is in Area C, where liquid wastes were impounded when the mill was in operation. The well is hydraulically across the gradient (crossgradient) from the disposal cell. The disposal cell is, therefore, not a credible source of the molybdenum.

Molybdenum in the unconfined aquifer has generally decreased since about 1991. Prior to that time, molybdenum concentrations commonly ranged between 0.02 and 0.03 mg/L, except at the upgradient well, where molybdenum was typically below detection limits.

Prior to construction of the disposal cell, molybdenum concentrations in the ground water were as high as 0.15 mg/L. Molybdenum, currently detected, is probably a residual of the higher levels present when the mill was actively contaminating the aquifer. Ambient molybdenum may also derive, in part, from unencapsulated source materials that were not remediated and placed inside the disposal cell.

The concentration of molybdenum in the creek samples is higher than at all ground water sampling locations, including MW-414, indicating a source other than the disposal cell. The concentration of molybdenum in all three surface-water (creek) samples was near the MCL in 1999. In 1998, molybdenum in the creek samples was just above the MCL.

Uranium. Uranium concentrations in 1999 were approximately 1.2 to 4 times greater than the MCL at two downgradient locations, MW-412 and MW-413 (Table CAN-2).

At well MW-412, uranium was below the MCL prior to mid-1990 and has since risen and remained above the MCL, although it dropped significantly to near the MCL in the September 1999 sampling. Uranium has exceeded the MCL at well MW-413 in all but one sample since 1986. It continued above the MCL in 1999. Uranium in crossgradient well MW-414 was consistently below the MCL until early 1994, after which the concentration of uranium has fluctuated above and below the standard. In 1999, uranium at MW-414 again dropped below the MCL.

Uranium remained below the detection limit in upgradient well MW-410 and in downgradient well MW-424, a result consistent with historical results for these wells. Uranium concentration at well MW-406, on the opposite side of the creek from the site, was above the detection limit but below the MCL.

The elevated concentration of uranium at some wells, and the fluctuations in uranium at these wells, are probably unrelated to cell performance for the following reasons: (1) contaminant source material is known to lie outside the disposal cell; (2) the geochemistry of ground water and unconsolidated materials beneath and downgradient from the site may be favorable to the mobilization of uranium; and (3) high levels of uranium contamination existed in ground water prior to construction of the disposal cell. As discussed below, these factors may account for the levels of uranium in ground water and probably make definitive evaluation of the disposal cell performance impossible.

The DOE completion report for this site states that a layer of deeply buried contaminated material was left in place east of the disposal cell. Radiological characterization of this material, obtained before the site was remediated, indicates that this material is widespread throughout this area. It was not remediated because it averages less than 150 picocuries per gram (pCi/g) of radium-226. The layer was reported to be from 2- to 6-feet thick and overlain by 4- to 8-feet of clean fill. Later, during site remediation, contaminant levels in this layer were found to be greater than previously estimated.

Waste material in Area B consisted of heterogeneous mixtures of unprocessed ore and concentrated milling residues interspersed with fill and soil. Analysis of soil samples collected in Area B prior to remediation showed both moderate levels of radium-226 and elevated concentrations of uranium-238. For example, two samples contained 18 pCi/g and 160 pCi/g radium-226, and 85 pCi/g and 290 pCi/g uranium-238, respectively. This is equivalent to approximately 255 milligrams per kilogram (mg/kg) radium-226 and 870 mg/kg uranium-238. These data indicate that high uranium concentrations were neither isolated nor anomalous occurrences in Area B. The background concentration of uranium-238 in soils at the Canonsburg site is about 3 to 5 mg/kg.

If the above soil sample results are representative of materials comprising the layer of contaminated material left in place, then this layer is the likely source of ground-water contamination. Ground-water elevations are typically about 5 feet below the surface of the ground in Area B and have not declined since the disposal cell was constructed. Therefore, the contaminated layer may frequently be in contact with ground water.

Furthermore, geochemical conditions at the site may tend to favor mobilization of uranium, in that the ground water is acidic (pH ranges between about 5.5 and 6.5), moderately high in alkalinity (300 to 400 mg/L), and possibly oxidizing, at least from time to time.

The continued elevated levels of uranium in ground water may also be the result of incomplete flushing of dissolved and sorbed uranium since the aquifer was initially contaminated by mill operations. Historic records document that in 1982 and 1983, ground water east or upgradient from MW-414 contained 3,950 pCi/L uranium-238. This is equivalent to approximately 12 mg/L uranium-234 + uranium-238. In the former mill area, which was located primarily upgradient from the present disposal cell, a concentration of 1,100 pCi/L uranium-238 was reported. This is approximately equivalent to 3.3 mg/L uranium-234 + uranium-238. At many other sampling locations, uranium concentrations were well above the MCL. For example, in the area near downgradient wells MW-412 and MW-413, uranium concentrations were on the order of 0.2 to 0.4 mg/L.

There are several hydrologic factors that could potentially account for the observed fluctuations and apparent trends in uranium concentrations over time. For example, water-level measurements taken before the start of remedial action show that the potentiometric surface and ground-water flow directions varied significantly. Potentiometric surface maps, based on 1979, 1982, and 1983 water level data, show directional variations of as much as 45 to 90 degrees within Areas B and C. Prior to remediation, a prominent ground-water mound existed beneath the mill area. The data also indicate that the hydraulic gradient between Chartiers Creek and the aquifer experienced periodic reversals in eastern portions of the site.

Recent ground-water level measurements indicate that the elevation of the water table upgradient or southwest of the disposal cell has not changed significantly from preremediation levels. This information indicates that the amount of underflow to the site has not changed.

Water level measurements also indicate that water table elevations over most of the site are not significantly different from preremediation conditions, although water levels appear to have decreased by several feet in Area C since construction of the disposal cell. Significant

fluctuations of up to 5 to 6 feet or more at a given well are indicated in water level data collected prior to and after construction of the disposal cell.

There do not appear to be dramatic differences in water table conditions prior to and after site remediation. The observed fluctuations and apparent trends in uranium concentrations could therefore be the result of variations in ground water flow directions over time, particularly because source material is likely within the areas of concern. However, the current monitoring network does not provide sufficient detail to determine if ground-water flow directions have changed as a result of site remediation, or if flow directions vary since the disposal cell was constructed. The current data indicate that the general direction of flow is to the northeast. There is insufficient data to determine if the former ground water mound in the area of the former mill has dissipated.

Although Chartiers Creek is an aquifer discharge boundary, the amount of discharge relative to the volume and rate of water flow in the creek (dilution) maintains uranium concentrations below detectable levels in the creek (Table CAN-3). Similarly, there is no increase in molybdenum as a result of discharge from the site. Sources upgradient of the site apparently account for the relatively high levels of molybdenum in Chartiers Creek in the site area.

Summary. Performance of the Canonsburg disposal cell cannot be evaluated unambiguously on the basis of the available ground-water data for the following reasons: (1) elevated concentrations of uranium and molybdenum were present in ground water prior to construction of the disposal cell, and residual levels may mask any possible contribution from the cell; (2) contaminated materials remain in unremediated areas of the site and may continue for a long-time to release uranium to ground water; and (3) ground-water travel paths may vary significantly over time and, with continued release from on site source material, concentrations at a given location would be expected to vary..

DOE considers the risk associated with the uranium in ground water to be negligible and insignificant in that the ground water (1) is institutionally controlled, and (2) has no detectable effect on the chemistry of water in the creek. The UGW Project is using similar arguments in its effort to comply with EPA standards for ground water beneath the site. Thus, public health, safety and the environment are adequately protected.

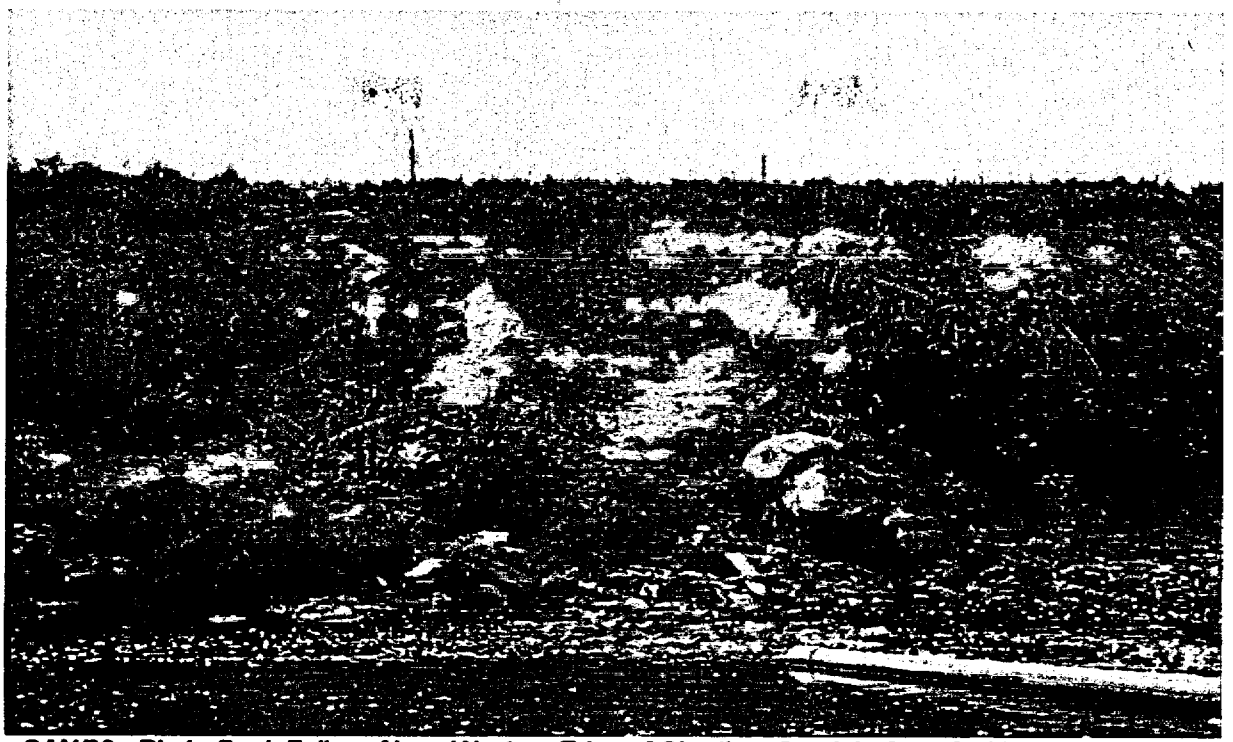
5.0 Corrective Actions

Corrective action in response to trends or anomalies in results of ground-water monitoring was not required in 1999.

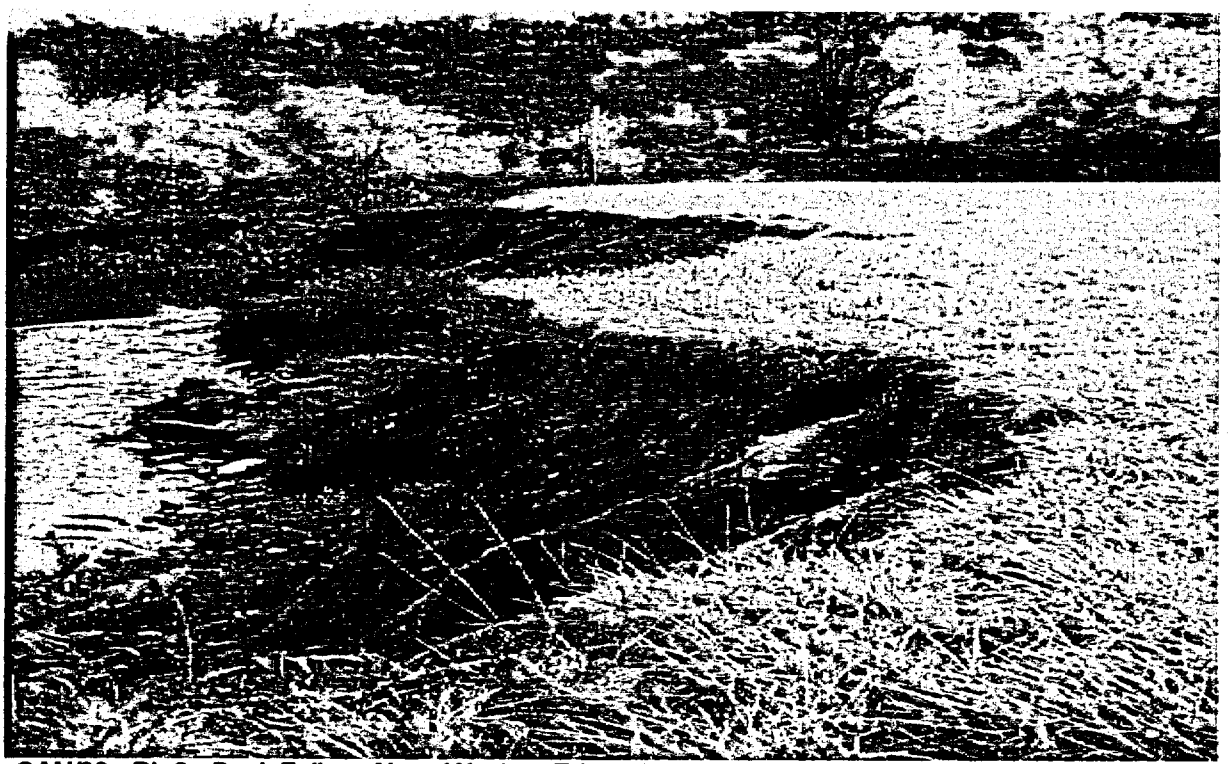
6.0 Photographs

Table CAN-4. Photographs Taken at Canonsburg, Pennsylvania, Disposal Site, 1999

Photograph Location Number	Description
CAN PL-1	Bank failure along western edge of Chartiers Creek in Area C. View to the west.
CAN PL-2	Bank failure along western edge of Chartiers Creek in Area C. View to the south.



CAN/99. PL-1. Bank Failure Along Western Edge of Chartiers Creek in Area C. View to the West.



CAN/99. PL-2. Bank Failure Along Western Edge of Chartiers Creek in Area C. View to the South.

Annual Compliance Report
Durango, Colorado, Disposal Site

Compliance Summary

The site, inspected on June 15, 1999, was in excellent condition and met all compliance requirements. Vegetation on top of the disposal cell, stunted by dryness in 1998, was fully restored by spring rains in 1999. Scattered bushes and trees continue to encroach on the side slope of the disposal cell. Evaluation of the effect of these plants on the long-term performance of the disposal cell is warranted. Erosion on over-steepened slopes above the drainage channels, and consequent deposition of colluvium in the channels, appears to be abating. Vegetation is establishing on these slopes and the supply of detritus is decreasing. Erosion at the mouth of drainage Ditch No. 1, at the northeast corner of the disposal cell, continues but at a very slow pace. The mouth is self-armoring with riprap as the erosion progresses. Maintenance to repair vandalized perimeter signs, sign posts, and the entrance gate was completed. Because vandalism is recurrent, evaluation of options, including the installation of a guard rail or other barrier, to restrict casual public access is warranted. Ground-water monitoring continued. Target analytes continue below the MCL, and this indicates that the disposal cell is performing as designed. No requirement for follow-up or contingency inspections was identified.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Durango, Colorado, UMTRCA Title I Disposal Site are in the *Long-Term Surveillance Plan for the Bodo Canyon Disposal Site, Durango, Colorado* (September 1996, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-77, Rev. 2), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table DUR-1.

Table DUR-1. License Requirements for the Durango, Colorado, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Pages 6-1 through 6-7	Section 1.0
Follow-up or Contingency Inspections	Pages 7-1 through 7-2	Section 2.0
Maintenance	Pages 8-1 through 8-2	Section 3.0
Ground-Water Monitoring	Pages 5-14 through 5-21	Section 4.0
Corrective Actions	Pages 5-21	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The site, southwest of Durango, Colorado, was inspected by DOE-GJO on June 15, 1999. The purposes of the inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in the report are shown on Figure DUR-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

Entrance Gate, Entrance Signs, and Perimeter Signs. The entrance gate, damaged by vandals in 1998, was repaired in March 1999. The repair included enclosure of the lock behind iron plate so vandals with guns cannot shoot at the lock. The gate was attacked again in the summer of 1999 by vandals with a large or heavy vehicle. Again, the gate was repaired.

DOE was advised just prior to the inspection that firefighters had to break the lock at the gate to enter the site to put out a lightning fire. Inspectors found the lock broken, but saw no evidence of a fire anywhere on site or beyond the site boundary.

Stolen perimeter signs and damaged sign posts, reported in 1998, were repaired in March 1999. The perimeter sign post nearest the entrance was snapped off in October 1999. Vandalism is a routine problem at this site and is expected to recur. (See below under "Outlying Area.")

Site Markers, Survey and Boundary Monuments. Site markers, survey monuments, and boundary monuments are all in excellent condition with certain exceptions. The site marker near the entrance gate (SMK-1) is pocked from gunshot. The marker remains readable.

The concrete base at boundary monument BM-3 and two of the reference monuments for BM-3 are threatened by erosion and may eventually be dislodged. BM-3 and the two reference monuments are in the middle of a small gully at the southeast corner of the site. Inspectors have placed rocks around the monument to slow the progress of erosion.

Monitor Wells. The six wells in the monitoring network are locked and in excellent condition.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into five areas called transects: (1) the top of the disposal cell, (2) the side slopes of the disposal cell, (3) the drainage ditches, (4) the site boundary, and (5) outlying areas.

Within each transect, the inspectors examined specific site surveillance features, such as site markers, survey and boundary monuments, perimeter signs, monitor wells, drainage structures, as well as vegetation, and other features.

Top of Disposal Cell. The top of the disposal cell is in excellent condition. No evidence of settling, slumping, or erosion was observed.

In 1998, inspectors reported that vegetation on the top of the disposal cell had changed significantly. Yellow sweetclover dominated the plant community; and perennial grasses, once well-established, appeared stressed or dead. Inspectors suggested that this might be a response to changes in the soil water and nutrient status. This year, however, after spring rains, inspectors found perennial grasses healthy and restored (DUR PL-1). Very little sweetclover was present on top of the disposal cell. The vigor of the perennial grasses appears to be moisture dependent.

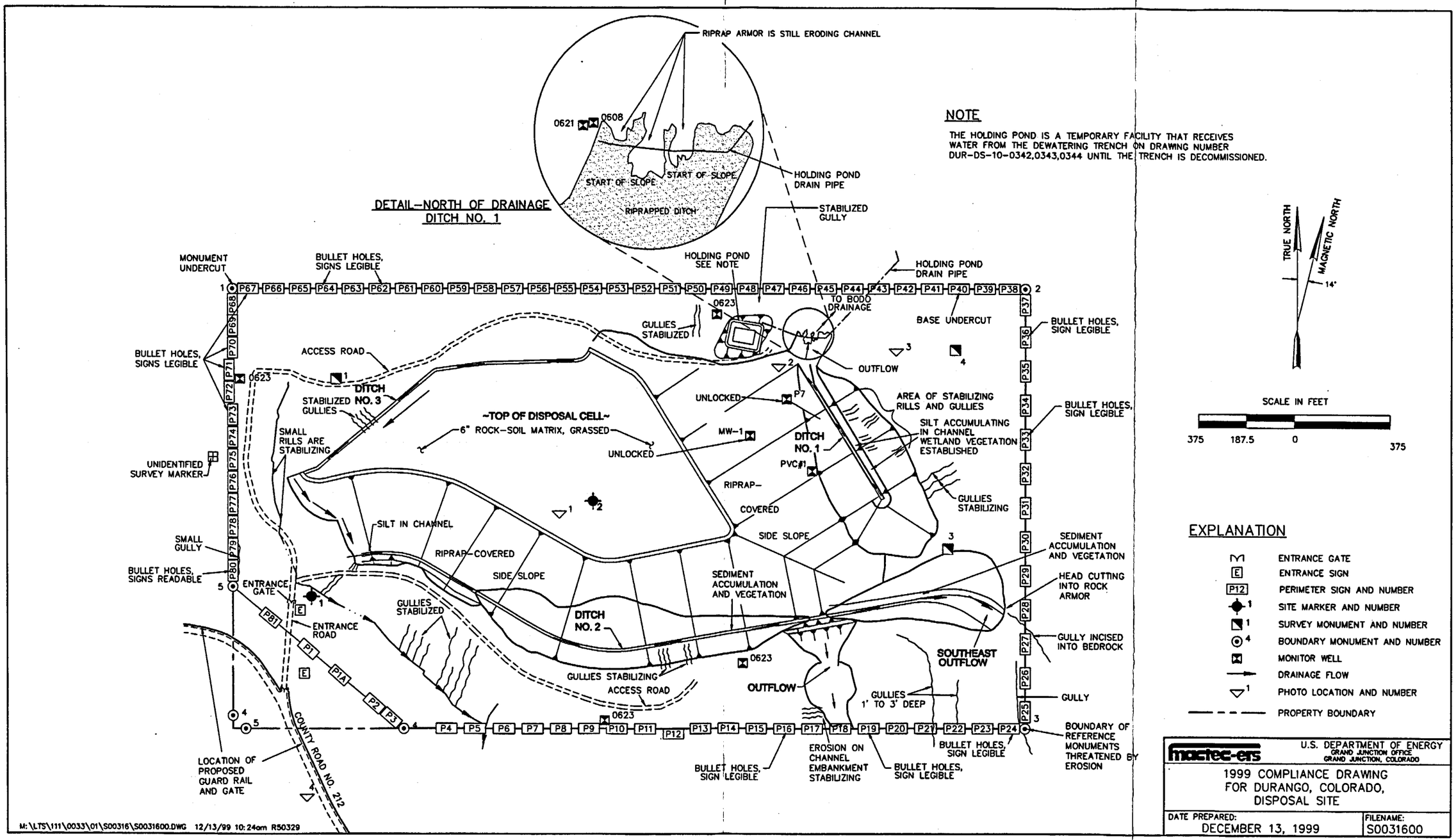


Figure DUR-1. 1999 Compliance Drawings for Durango, Colorado, Disposal Site

Rabbitbrush and four-wing saltbush, both deep-rooted shrubs, grow near the east end of the top slope. Occasional rabbitbrush and willow grow along the edge of the top slope. Because they are few, deep-rooted plants do not currently threaten the performance of the cover. However, given that the number of shrubs and trees is likely to increase, the effects of these deep-rooted plants on the long-term performance of the cover warrants evaluation. This evaluation is currently underway by the DOE's Long-Term Performance Monitoring and Cover Assessment Project.

Small animal burrows were observed at several places on top of the disposal cell. The burrows are all quite small and localized; most appeared inactive. There was no significant displacement of soil at any of the burrows. Given the 7-foot thickness of cover materials on top of the disposal cell, and the negligible displacement of material by the burrowing, there is little danger that burrowing will expose tailings. The burrows may, however, cause the soil to dry out. The harbinger, in this case, might be grass dying from lack of soil moisture in the area around the burrows. This was not observed.

Side Slopes of Disposal Cell. Rock-covered side slopes of the disposal cell are in excellent condition. Disturbances, such as subsidence, rock deterioration, or slope failure, were not observed.

Occasional plants, including boxelder, thistle, mullein, smooth brome, yarrow, and one pine tree, are growing on the south side slope, particularly on the east and southeast sides (DUR PL-2). As with the top of the disposal cell, the long-term effect of deep-rooted plants on the side slope warrants evaluation.

Drainage Ditches. Drainage ditches lie at the bottom of the side slopes on the northwest, south and east sides of the disposal cell. These ditches direct runoff away from the disposal cell and into natural drainages that carry stormwater away from the disposal site.

Erosion and mass wasting occur at several places along these channels where the slopes above the ditches were over steepened during site construction. The sandstone and shale that underlie these slopes weather to small rubble. At places, this material has accumulated along the sides of the ditches as small colluvial fans and aprons that extend out over the top of the riprap in the bottom of the ditches. At places in Ditch No. 1, moist sediment in the colluvial deposits supports small patches of wetlands vegetation. Over the years, with the progressive establishment of natural vegetation on the slopes above the ditches, the supply of detritus has noticeably decreased. Inspectors adjudge that nowhere do these deposits threaten the performance of the ditches in the event of a large storm.

However, should colluvial deposits ever dam one of the drainage ditches so as to impound water, the dam would have to be cut out or removed. The bottoms of the ditches, at their highest point, are at elevations of about 7,035 to 7,040 feet. This is approximately the same elevation as the tailings in the bottom of the disposal cell. Water impounded in one of the diversion channels for a long period of time could migrate laterally to saturate the tailings in the lower part of the disposal cell. The bedrock dips to the southeast, away from the disposal cell. Some, perhaps most, of the impounded water would probably drain away from the disposal cell along bedding planes and permeable zones in the bed rock. Nevertheless, impounded water would be undesirable and maintenance of the ditches to improve drainage would be required.

Significant erosion is occurring in a drainage channel at only one place: the mouth of drainage Ditch No. 1 (DUR PL-3). Erosion at this location was foreseen in the design and began immediately after the disposal cell was constructed. In the design, it was anticipated that as the soil underneath the rock armor eroded, the large diameter rock in the bottom of the drainage channel would progressively drop down to armor the new, less steep gradient. This effect was observed.

DOE began measurements and rephotography of the progress of erosion at this location in 1996. During this year's inspection, GPS equipment was used to map the current configuration of the mouth of the drainage channel. A comparison with the configuration presented in previous annual reports shows that erosion is slowing. There is nothing to suggest that erosion at this location is or will become a problem. Because the rate of change is so slow and rephotography shows little change, DOE will repeat mapping with GPS equipment on an every-2-year basis until such time as DOE may determine that additional surveys are no longer warranted.

Site Boundary. The site is not fenced. The boundary is delineated by 5 boundary monuments and 83 warning signs. With the exception of repeated vandalism of signs and sign posts, no disturbance along the site boundary has occurred. As mention above, one boundary monument, BM-3, at the southeast corner of the site may eventually be displaced by erosion.

Rill and gully erosion on the south-facing slope along the southern boundary of the site appears to have stabilized. Establishment of vegetation in these areas and exposure of resistant bedrock in the deeper gullies are effectively preventing further erosion.

Migration of riprap down the steep hill below the outflow of drainage Ditch No. 2 has subsided. Inspectors discovered no areas of new erosion on or around the site.

Outlying Areas. The area beyond the site boundary for a distance of 0.25 mile was visually inspected for signs of erosion, development, or other disturbance. The primary land use in the area around the site is wildlife habitat. Inspectors observed no activity or development that might affect the site. Vandalism, however, and use of the site by hunters, and possibly poachers, continues.

The proximity of county roads, coupled with the fact that this site is not surrounded by a security fence, makes unlawful access to the site easy. Repeated damage to the gate, theft of perimeter and entrance signs, and littering are a consequence of the site's isolation and easy access along a county road. Vandalism shows no sign of abating. The county road along the southern boundary of the site is also the scene of casual dumping of landscaping debris (tree branches and weeds no longer accepted by the county landfill) and big game remains (bones, skulls, entrails) left by hunters.

A contributing, if not causal, factor is the convenient sanctuary the entrance road affords to vandals. The photograph, DUR PL-4, shows the entrance road branching off County Road 212. The county road continues on to the left in the picture. Clearly, the entrance road to DOE's site is heavily used, and this use is not due to the three or four visits DOE normally pays to the site each year for inspections and ground-water monitoring.

The county road to the site is public, yet secluded. This invites mischief. Options, including the installation of a guard rail or other barrier, to restrict casual public access to the site should be evaluated. If vandals and persons with idle time find it inconvenient to pull off the county road at DOE's entrance, most would go elsewhere.

2.0 Follow-up or Contingency Inspections

No follow-up or contingency inspections were required in 1999.

3.0 Maintenance

Maintenance consisted of repair to vandalized signs, sign posts, and the entrance gate. The need to repair damage due to vandalism is likely to continue until a means to restrict causal public access is found.

4.0 Ground-Water Monitoring

DOE monitors ground water at this site to verify the initial performance of the disposal cell. The design and location of the disposal cell are believed sufficient to minimize the migration of hazardous constituents from the disposal cell into local ground water.

4.1 Monitoring Network and Frequency of Monitoring

The array of wells in the monitoring network includes two upgradient wells and four downgradient, point-of-compliance wells:

MW-605	Upgradient, northwest
MW-623	Upgradient, alluvial, north
MW-607	Downgradient, south
MW-608	Downgradient, alluvial, northeast
MW-612	Downgradient, south
MW-621	Downgradient, northeast

Location of wells in the monitoring network is shown on Figure DUR-1.

4.2 Frequency of Monitoring

Wells are sampled annually.

4.3 Analytes

Samples are analyzed for standard water quality indicators, field parameters, and three specific analytes: molybdenum, selenium, and uranium. The performance standards for these three analytes are the proposed concentration limits (PCLs) identified in Section 5.2 of the LTSP.

The PCLs for molybdenum, selenium, and uranium are slightly higher than the MCLs established by EPA at 40 CFR 192 because the PCLs take into account the elevated concentrations of these three constituents that occur naturally in the ground water.

4.4 Results of Ground-Water Monitoring

Analytical results for the three target analytes (molybdenum, selenium, and uranium) in ground-water samples collected by the LTSM Program in 1997, 1998, and 1999 are shown in Table DUR-2. The PCLs for molybdenum, selenium, and uranium are included in the table heading.

No results were above detection limits during the 1997 through 1999 time period at three wells, MW-605, MW-607, or MW-621; so these wells are not included in the table. (Detection limits, contract or instrument, are usually about ≤ 0.001 mg/L.)

DUR-2. Summary of Ground-Water Sample Results, June 1997, 1998, and 1999

Ground-Water Sample Locations	Year Sampled	Analyte		
		Molybdenum PCL 0.22 mg/L[a]	Selenium PCL 0.042 mg/L	Uranium PCL 0.077 mg/L
MW-623 (upgradient alluvial)	6/97	0.0011B	0.001U	0.0027
	6/98	0.0017B	0.001U	0.0013
	6/99	0.0024B	0.001U	0.0015
MW-608 (downgradient alluvial)	6/97	0.001U	0.0047B	0.0029
	6/98	0.001U	0.010	0.0075
	6/99	0.0016B	0.0085	0.0090
MW-612 (downgradient bedrock)	6/97	0.001U	0.001U	0.001U
	6/98	0.001U	0.001U	0.001U
	6/99	0.0214	0.001U	0.0092

[a]PCL = Proposed concentration limit.
B = Result is less than the required detection limit but greater than or equal to the actual detection limit.
U = Result is below the instrument detection limit.

Molybdenum. Molybdenum remained below detection limits at all wells except downgradient well MW-612, where molybdenum was detected for the first time in any of the monitor wells over the last 3 years. Although detected at MW-612, the concentration was an order of magnitude below the PCL. Further monitoring is necessary before a trend can be established.

Selenium. Selenium was above detection limits in only one well, downgradient well MW-608, where it was also detected in 1998. The concentration of selenium was below the PCL in 1998 and in 1999.

Uranium. Uranium continued above the detection limits in two wells and appeared for the first time at a third well. Uranium has been detected each year at upgradient well MW-623 and in downgradient well MW-608. If 3 years' data are sufficient to indicate a trend, the trend may be downward at MW-623 but upward at MW-608. Both wells are screened in the alluvium. Uranium was detected for the first time in downgradient well MW-612, a well screened in bedrock. All results for uranium are an order of magnitude below the PCL.

Summary. Molybdenum and selenium continue below detection at most wells. Uranium was detected in one upgradient and two downgradient wells in 1999. All detections were approximately an order of magnitude below the PCL. Ground-water data indicate that the disposal cell is performing as designed and constructed.

5.0 Corrective Actions

Corrective actions in response to verification of an established concentration limit exceedence (in ground water) were not required in 1999.

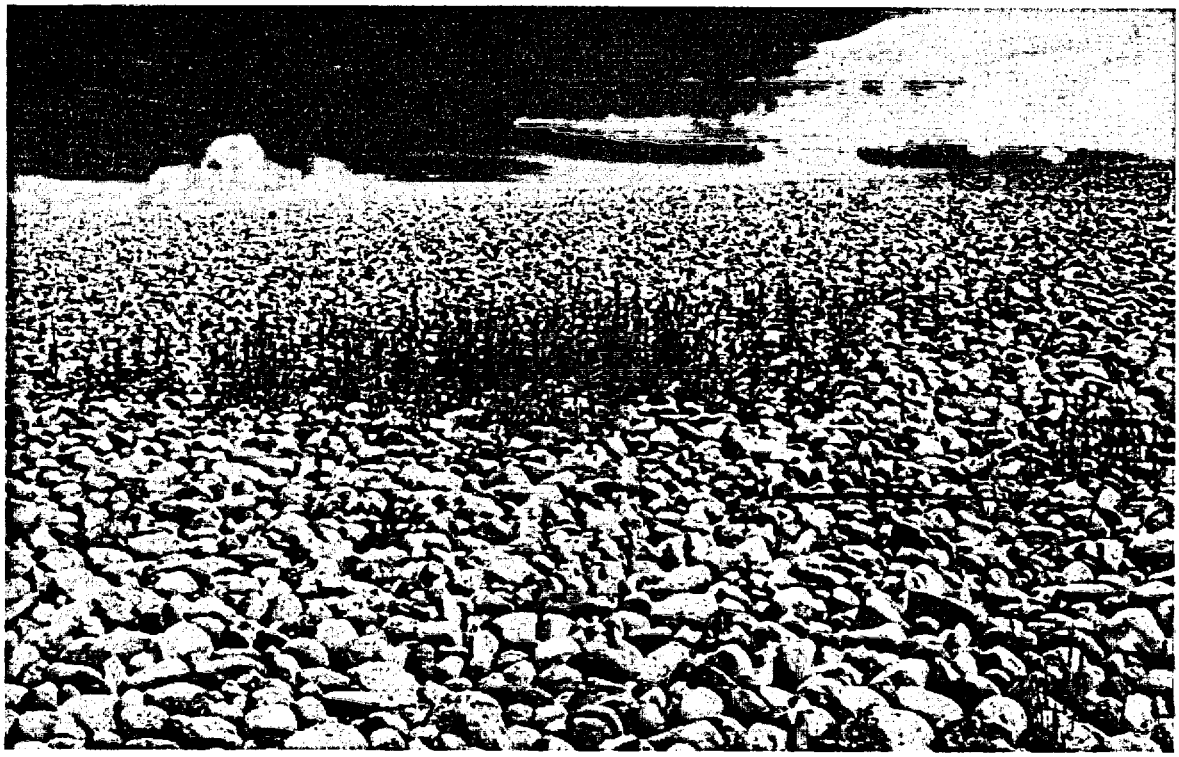
6.0 Photograph Log

Table DUR-3. Photographs Taken at Durango, Colorado, Disposal Site, 1999

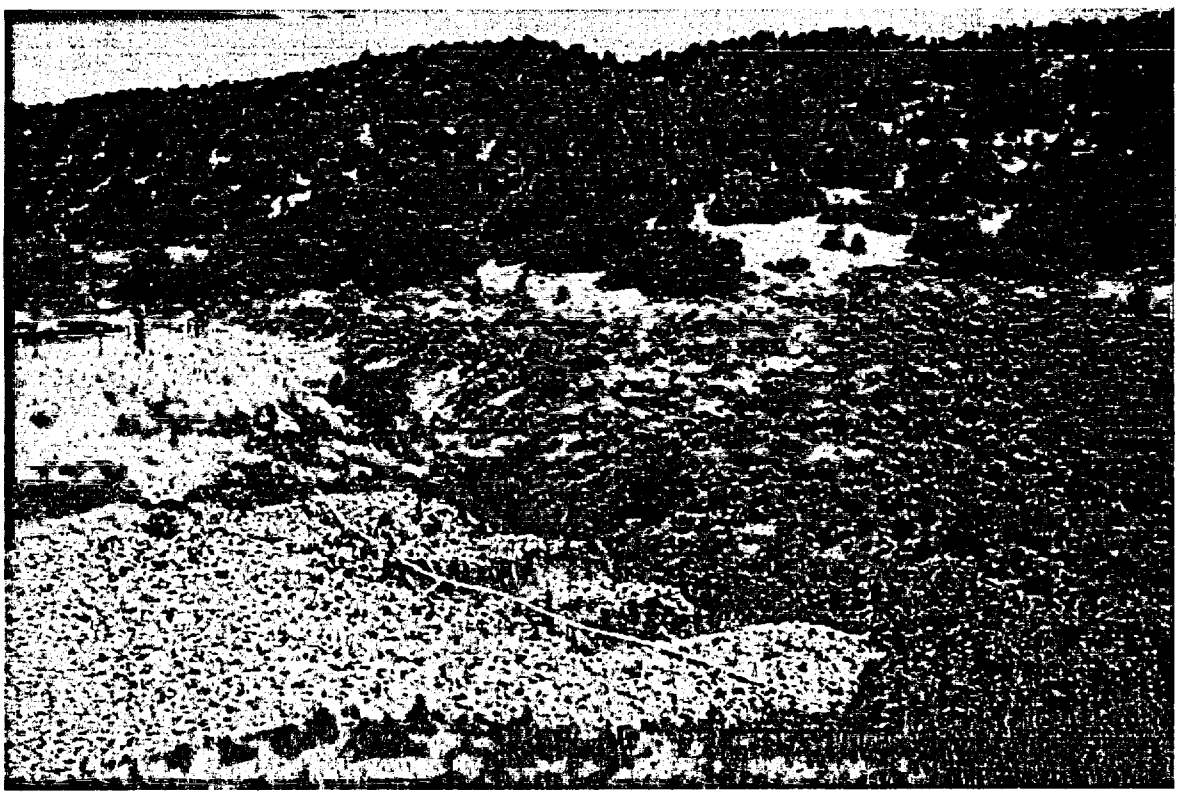
Photograph Location Number	Description
DUR PL-1	Vegetation on top of the disposal cell, June 1999
DUR PL-2	Thistle colony on east side slope of the disposal cell, June 1999
DUR PL-3	Erosion at mouth of drainage ditch no. 3
DUR PL-4	Road damage as evidence of casual visits to the site by the public

End of current text

DUR 6/99. PL-1. Vegetation on Top of the Disposal Cell



DUR 5/99. PL-2. Thistle Colony on East Side Slope of Disposal Cell



DUR 6/99. PL-3. Erosion at Mouth of Drainage Ditch No. 3

DUR 6/99. PL-4. Road Damage as Evidence of Casual Visits to the Site by the Public

Annual Compliance Report
Falls City, Texas, Disposal Site

Compliance Summary

The site, inspected on January 12-13, 1999, was in excellent condition and met all compliance requirements. Scattered small trees and bushes beginning to grow on the side slopes of the disposal cell were sprayed with herbicide by the inspectors. A small percentage of the riprap on the side slopes is fracturing for undetermined reasons. Maintenance requirements include continued grass cutting and salvage of the cuttings as hay, and continued effort to control (kill) small trees and bushes on the side slopes of the disposal cell. Several analytes continued to exceed their respective MCLs in samples collected during ground-water monitoring; but this is expected and consistent with the natural redistribution of uranium and related contaminants associated with mineralization in the aquifers. Most contaminants do not exceed the median value for the contaminant in the tailings pore fluid. In addition, the water level beneath the disposal cell continues to drop. These factors together suggest the disposal cell is performing as designed. No cause for a follow-up inspection was identified.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Falls City, Texas, UMTRCA Title I Disposal Site are in the *Long-Term Surveillance Plan for the Falls City Disposal Site, Falls City, Texas* (July 1997, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-187, Rev. 3), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table FCT-1.

Table FCT-1. License Requirements for the Falls City, Texas, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 6.0 and Section 10.0	Section 1.0
Follow-up or Contingency Inspections	Section 7.0	Section 2.0
Maintenance	Section 8.0	Section 3.0
Ground-Water Monitoring	Pages 5-1, 5-20, and 5-23 through 5-25	Section 4.0
Corrective Actions	Pages 5-25 and 5-26, and Section 9.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The site, west of Falls City, Texas, was inspected by DOE-GJO on January 12-13, 1999. Inspectors determined that the site is in excellent condition.

The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes or new conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. Results of the inspection are

presented in this section. Features mentioned in this report are shown on the attached drawing, Figure FCT-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

The entrance sign and 64 perimeter signs along the site boundary were present and in excellent condition. Theft of signs along Farm-Market Road 1344 has not been a problem in 1999.

There are two granite site markers, SMK-1 at the entrance gate and SMK-2 on top of the disposal cell; and three survey monuments and two boundary monuments at corners along the boundary of the site. All markers and monuments are undisturbed and in excellent condition.

There are seven wells in the ground-water monitoring network. One monitor well, MW-709, is inside the site boundary. The other wells are outside the site boundary on state or private land. All wells in the monitoring network were locked and in excellent condition.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the top and side slopes of the disposal cell; (2) the site perimeter; and (3) outlying areas. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features, such as monitor wells, survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or the long-term performance of the site.

Top and Side Slopes of the Disposal Cell. The top of the disposal cell is covered with well-established coastal Bermuda grass and is in excellent condition. Small amounts of Kleingrass and other species are interspersed with the coastal Bermuda. The grass is in excellent condition. Thin and bare spots in the vegetation have mostly filled in and are no longer a concern.

The side slopes are covered with riprap and in excellent condition, although small amounts of fractured riprap were observed on the side slopes (FCT PL-1). Condition of the riprap will continued to be inspected. Fracturing is believed to result from quarrying and placement operations because the rock does not appear to be breaking down as a result of weathering or diagenetic processes.

Small scattered trees and bushes, including greasewood, "upland willow," Palo Verde, and possibly others, are beginning to grow in the rock on the side slopes. Greasewood, and similar species, are concerns because they are deep-rooted. Inspectors used a systemic herbicide (Roundup) on the shrubs during the 1999 inspection and expect to do so during future inspections.

There are no trees on top of the disposal cell or in grassed areas immediately adjacent to the disposal cell. Grass cutting appears to effectively control these plants. Unfortunately, the riprap-covered side slopes of the disposal cell can not be cut.

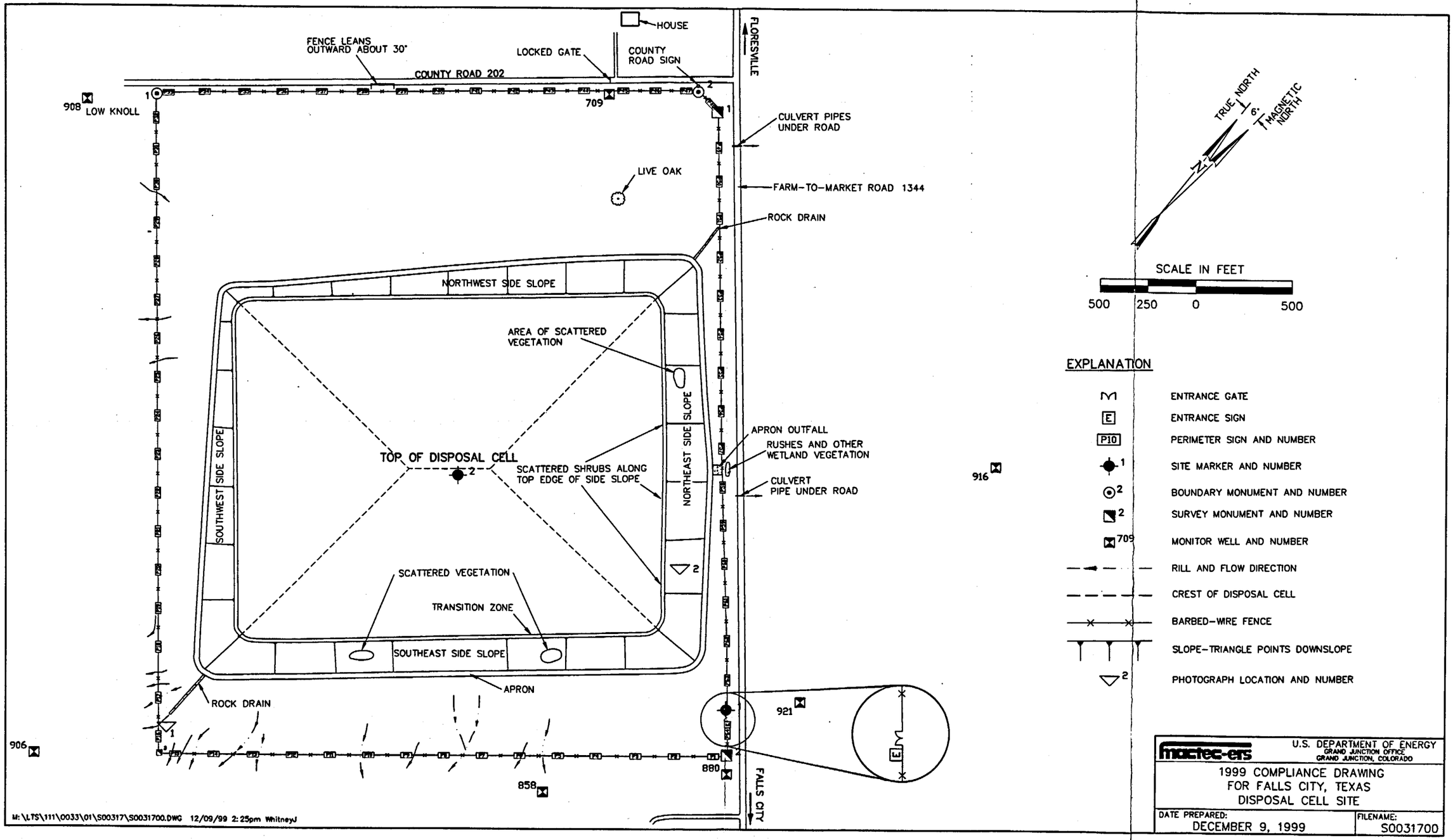


Figure FCT-1. 1999 Compliance Drawings for Falls City, Texas, Disposal Site

Site Perimeter. The barbed-wire fence around the site is in good condition. Along the northwest boundary, the fence leans outward above a steep bank. The fence seems stable in this position and is sufficient to keep cattle and casual intruders out. Repair is not required at this time.

The area between the fence and the toe of the disposal cell is covered with well-established grass, primarily Kleingrass with some coastal Bermuda grass. Kleingrass is a bunch grass and coverage of the ground is not yet 100 percent. Coverage seems to increase each year, and there are no large areas of bare soil.

Grass is managed by cutting and baling two or three times each year, depending on the weather. The haying vendor often stores some bales on site temporarily. The cutting and baling was clean and thorough. A swath of grass was left uncut along the fence and also along rock drains and around some of the as-built features, such as the site markers. The site has a well-maintained appearance.

Grass is beginning to grow in the north and south rock drains (FCT PL-2). The apron outfall, midway along the northeast side slope, is not yet affected. If control of grass in the drains becomes necessary, a controlled burn or herbicide may be used. However, grass growing in the rock drains may in fact assist in dissipating the energy of runoff, thereby improving the performance of the drains in this respect.

Minor gully erosion in areas south of the disposal cell was noted immediately after the site was completed, but is no longer a problem. The gullies are still present, entrenched in the gumbo soil; but they are, for the most part, now stabilized by grass.

Outlying Areas. The area outward from the disposal site for a distance of 0.25 mile was visually inspected. No development or disturbance that could affect the site was observed.

2.0 Follow-up or Contingency Inspections

No follow-up or contingency inspections in response to changed or unusual conditions were required in 1999.

3.0 Maintenance

Maintenance consists of haying operations to manage the grass, and use of herbicide to control encroachment of trees and bushes on the side slopes of the disposal cell. Haying is an annual requirement; efforts to control plants growing on the side slopes is not expected to be an annual requirement.

4.0 Ground-Water Monitoring

Ground-water monitoring is not required at this site because (1) ground water in the upper aquifer is of limited use (Class III), and (2) because it contains widespread natural contamination that cannot be cleaned up. The ground water is in contact with unmined uranium minerals and is in an area in which aqueous redistribution of uranium and related contaminants occurs naturally.

In accordance with the LTSP, DOE will monitor ground water for a limited time as a best management practice to demonstrate the initial performance of the disposal cell (LTSP, p. 5-20).

4.1 Monitor Wells

There are seven wells in DOE's ground-water monitoring network:

- Four wells, MW-709, MW-858, MW-906, and MW-921, are screened in the Conquista sandstone, the uppermost aquifer upgradient and beneath most of the disposal cell.
- One well, MW-880, is screened in the Deweesville sandstone, the uppermost aquifer in the downgradient direction.
- Two wells, MW-908 and MW-916, are screened in the unsaturated zone of the Conquista sandstone. These wells have never produced water and are only used to detect a rise in ground-water level should such rise occur.

4.2 Frequency of Monitoring

The LTSP specifies that DOE will monitor ground water twice yearly for 5 years following completion of the disposal cell. Because twice yearly monitoring did not begin until 1997, DOE will monitor through 2001.

4.3 Analytes

During efforts to determine baseline ground-water conditions at the site, DOE measured hazardous constituents in the tailings pore water. Should contaminants leach from the disposal cell, the leachate would be chemically similar to the tailings pore water.

Hazardous constituents (analytes) in the tailings pore water that have MCLs specified in EPA ground-water protection standards are listed below.

arsenic	nitrate
cadmium	selenium
chromium	uranium
lead	radium-226 and radium-228
molybdenum	gross alpha

4.4 Results of Monitoring

Results of ground-water monitoring from January 1997 to April 1999 are shown in Table FCT-2. Analyte concentrations in the tailings pore fluid are also shown in Table FCT-2 as a worst-case baseline for comparison purposes.

Performance monitoring is based on hazardous inorganic constituents in ground water that have an MCL. MCLs provide a convenient reference for discussing contaminant concentrations; however, comparison of sample results to MCLs is otherwise arbitrary because specific ground-water compliance standards are not applicable to this site.

Table FCT-2. Results of Ground-Water Monitoring at the Falls City, Texas, Disposal Site

Analyte	MCL	Tailings Pore Fluid Low - High Median	MW-709 January 1997 October 1997 April 1998 December 1998 April 1999	MW-858 January 1997 October 1997 April 1998 December 1998 April 1999	MW-880 January 1997 October 1997 April 1998 December 1998 April 1999	MW-906 January 1997 October 1997 April 1998 December 1998 April 1999	MW-921 January 1997 October 1997 April 1998 December 1998 April 1999
Arsenic	0.05	<0.01 - 6.5 0.12	0.00079B 0.001U[a] 0.001U 0.001U 0.001U	0.0023B 0.001U 0.001U 0.001U 0.001U	0.0368 0.0240 0.0366 0.0531 0.0588	0.00079B 0.001U 0.001U 0.001U 0.001U	0.0057 0.0015B 0.0030B 0.0064 0.0060
Cadmium	0.01	<0.01 - 0.58 0.17	0.001U 0.001U 0.001U 0.001U 0.001U	0.0039 0.0051 0.0078 0.0059 0.0125	0.337 0.362 0.456 0.475 0.470	0.0182 0.0185 0.0177 0.0166 0.0168	0.0111 0.0211 0.0220 0.0128 0.0134
Chromium	0.05	<0.01 - 0.50 0.05	0.004U 0.005U 0.004U 0.002U 0.0045B	0.004U 0.005U 0.004U 0.002U 0.0026B	0.0351 0.005U 0.0179 0.002U 0.0091B	0.004U 0.005U 0.004U 0.002U 0.0084B	0.004U 0.005U 0.0043 0.002U 0.0124
Gross alpha	15[b]	-17,309 - 18,996[b] 102[b]	344.8 372.3 154.8 350.6 279.6	151.94U 123.4 70.42U 63.61U 71.29U	2014.98 1584 1013 1876.06 2770	147.55U 136.8 80.09U 80.46 82.90	293.6 238.6 205.3 146.3 266.5
Lead	0.05	<0.005 - 0.08 <0.03	0.0042 0.001U 0.001U 0.001U 0.001U	0.0010B 0.001U 0.0027B 0.0018B 0.0034	0.0063 0.0044 0.0017B 0.0034 0.0041	0.001U 0.001U 0.001U 0.001U 0.001U	0.0017B 0.001U 0.001U 0.001U 0.001U

Table FCT-2 (continued). Results of Ground-Water Monitoring at the Falls City, Texas, Disposal Site

Analyte	MCL	Tailings Pore Fluid	MW-709	MW-858	MW-880	MW-906	MW-921
		Low - High Median	January 1997 October 1997 April 1998 December 1998 April 1999	January 1997 October 1997 April 1998 December 1998 April 1999	January 1997 October 1997 April 1998 December 1998 April 1999	January 1997 October 1997 April 1998 December 1998 April 1999	January 1997 October 1997 April 1998 December 1998 April 1999
Molybdenum	0.10	<0.01 - 11.4 0.14	0.0343 0.0341 0.0311 0.0325 0.0366	0.0051B 0.0043B 0.0029B 0.0029B 0.002U	0.0021B 0.0027B 0.0012B 0.0039B 0.0024B	0.0035B 0.0035B 0.0042B 0.0042B 0.0033B	0.0487 0.0309 0.0330 0.0468 0.0381
Nitrate as NO_3	44	<0.1 - 340 2.1	36.4 36.7 32.9 40.0 39.0	1.94 4.15 7.12 4.59B 1.20	0.008U 0.285B 3.860 1.410B 0.421B	0.185B 0.571B 1.030 0.839 1.030	23.8 22.7 22.4 22.9 24.5
Radium-226 + 228	5	~3 - ~950 ~115	7.50 5.92 6.50 5.17 5.50	20.91 20.15 23.89 20.19 22.46	17.92 16.65 10.83 13.27 15.95	10.26 11.11 9.04 10.22 9.22	3.66 4.79 4.56 <3.80 <3.26
Selenium	0.01	<0.005 - 0.60 <0.05	0.0438 0.0519 0.0424 0.0345 0.0426	0.0052 0.0227 0.0468 0.0238 0.0516	0.0172 0.0249 0.0137 0.0129 0.0134	0.0244 0.0267 0.0192 0.0161 0.0141	0.200 0.236 0.193 0.155 0.171
Uranium	0.044	0.044 - 109 7.57	0.663 0.611 0.453 0.618 0.656	0.0633 0.0225 0.0127 0.0130 0.0099	3.02 2.68 1.79 3.52 4.54	0.111 0.135 0.187 0.153 0.162	0.591 0.395 0.361 0.601 0.662

All results in mg/L except Ra-226 + 228 and gross alpha in pCi/L.
[a]U = undetected at respective laboratory reporting limit. B = less than the required detection limit but greater than or equal to the actual detection limit.
[b]Excludes contributions from uranium and radon-222 decay. Ground water sample results include uranium and radon-222 decay.

The following constituents were detected above the respective MCL in one or more samples collected in December 1998 and April 1999: arsenic, cadmium, gross alpha, combined radium-226 and radium-228, selenium, and uranium. The gross alpha standard (15 pCi/L) excludes the contributions from uranium and radon-222 decay. However, those sources are included in the gross alpha results for the ground water samples shown in Table FCT-2. Subtracting the uranium activity (1 μg uranium ≈ 0.68 pCi/L uranium-234 + 238) from the gross alpha activity indicates that most or all of the alpha activity is attributable to uranium in the ground water.

Arsenic. In December 1998 arsenic appeared above the MCL for the first time since 1997, when LTSM Program began monitoring. Arsenic exceeds the MCL in only one well, MW-880, where it was barely above the MCL in 1999.

Cadmium. Cadmium continues to exceed the MCL in all but one well, MW-709. This is consistent with results from 1997 and 1998. In only one well, MW-880, has cadmium exceeded the median value for cadmium in the tailings pore fluid.

Gross alpha. Gross alpha exceeded the MCL at all five wells and the median tailings pore fluid value at three wells. This, too, is consistent with data collected in 1997 and 1998.

Radium-226 + 228. The combined radium isotopes continued to exceed the MCL in all but one well, MW-921.

Uranium and Selenium. Uranium and selenium concentrations continued above their respective MCL at all wells except MW-858. Uranium continued to be consistently below the MCL at MW-858. Uranium and selenium values, with the exception of selenium at MW-858 and MW-921 in April 1999, were all below the median tailings pore fluid values.

At each well location, the concentration of a given analyte remained relatively uniform during the 1997 through 1999 period. Variability more than one order of magnitude (rounded) above 1997-1998 values was observed only for chromium at MW-880 (decrease) and MW-921 (increase), and nitrate at MW-880 (decrease). To date, data are insufficient to establish trends.

The overall distribution of contaminants reflects radially outward transport of contaminants from the disposal cell in response to ground-water mounding beneath the cell. The mound was created as a result of mining and milling operations at the site. As implied in the preceding discussion, MCLs are exceeded in the Deweesville sandstone and the underlying Upper Conquista clay. Both the Deweesville sandstone and Upper Conquista clay outcrop beneath the disposal cell.

Ground-Water Level Measurement Results. Analysis of water level measurements from monitor wells MW-709, MW-858, MW-880, and MW-921 indicates that the elevation of the water table has declined between 4 and 9 feet since the disposal cell was constructed. The water table at MW-906 has exhibited periods of falling and rising elevation since that time. However, because MW-906 is located a greater distance from the cell and is adjacent to Tordilla Creek, the water table may be less influenced by conditions beneath the cell (mounding) than at the remaining wells. The declining water table trend is also not evident at MW-922, which is screened in the Deweesville sandstone at a location that is assumed to be beyond the influence of the ground-water mound (see well locations in Figure FCT-2). Ground water in the Deweesville sandstone is unconfined at MW-922 and MW-880.

The water level data indicate that the following water table lowering in the vicinity of the cell is probably not part of a regional trend but is instead a localized occurrence resulting from dissipation of the ground-water mound beneath the cell.

4.5 Summary

Ground water beneath and surrounding the disposal cell is contaminated from mining and milling operations and from naturally occurring mineralization. Redistribution of uranium and related contaminants in ground water is a naturally occurring process and one of the reasons the upper aquifer is designated unusable (Class III).

Results of continued ground-water monitoring show that certain analytes, specifically cadmium, gross alpha, radium-226, radium-228, selenium, and uranium continue to exceed their respective MCL. But, as stated above, MCLs are not relevant standards at this site. More relevant is that the concentration of each of these five contaminants, during recent monitoring, is either below the median value established for the tailings pore fluid (selenium, uranium, and both radium isotopes) or slightly above the median value (cadmium and gross alpha). None of the results from recent monitoring was above the highest concentration measured in the tailings pore fluid.

In addition, the water table beneath the disposal cell is dropping. This would not occur if the cover over the tailings in the disposal cell were allowing moisture to enter the disposal cell and flow through the buried tailings. The data so far indicate that the cover is effectively preventing precipitation from entering the disposal cell. The cover is therefore judged to be performing as designed. Unless significant changes begin to appear in the data, consideration should be given to terminating ground-water monitoring after 2001.

5.0 Corrective Actions

Corrective actions in response to new or changed conditions were not required in 1999.

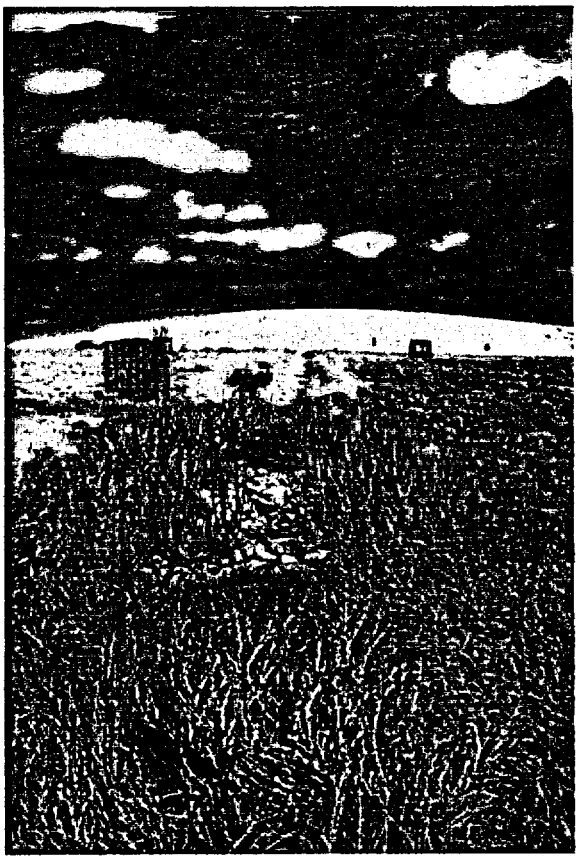
The ground water mound beneath the disposal cell appears to be dissipating. The concentrations of contaminants in ground water are generally less than median values in the tailings pore fluid, and there are no trends in the data to suggest leaching from the disposal cell. Furthermore, ground water chemistry is consistent with redistribution of naturally occurring contaminants in surrounding soils and bedrock. The disposal cell appears to be performing as designed, and no corrective action in response to ground water problems is required.

6.0 Photographs

Table FCT-3. Photographs Taken at Falls City, Texas, Disposal Site, 1999

Photograph Location Number	Description
PL-1	Fractured riprap on side slope.
PL-2	Encroachment of grass in south trench drain.

FCT/99. PL-1. Fractured Riprap on Side Slope



FCT/99. PL-2. Encroachment of Grass in South Trench Drain

Annual Compliance Report
Grand Junction, Colorado, Disposal Site

Compliance Summary

The site, inspected on April 21, 1999, was in excellent condition and met all compliance requirements. The center of the disposal cell remains open to receive additional residual radioactive materials. The open part of the cell is operated by Long-Term Radon Management (LTRM), a project within the LTSM Program. This report covers the annual inspection (and other actions) required by the LTSP for the closed and completed parts of the disposal cell and the area surrounding the disposal site.

In March 1999, this site was brought into conformance with other DOE mill tailings disposal sites with the placement of permanent warning signs around the perimeter of the site and permanent boundary monuments at the corners of the property. Inspectors noted that plants continue to encroach on the disposal cell, especially on the south side, and that revegetation of the former ramp area on the east side of Highway 50 is incomplete. In September, the storm-water retention pond was dredged to increase capacity and eliminate occasional flooding. No requirement for additional maintenance was identified, and there is no cause for a follow-up inspection. Ground-water monitoring by the LTSM Program continued for the second year. No significant trends are so far apparent in the sampling results.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Grand Junction, Colorado, UMTRCA Title I Disposal Site are specified in the *Interim Long-Term Surveillance Plan for the Cheney Disposal Site Near Grand Junction, Colorado* (April 1998, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/6235C-243, Rev. 1), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table GRJ-1.

Table GRJ-1. License Requirements for the Grand Junction, Colorado, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Page 3-1	Section 1.0
Follow-up or Contingency Inspections	Page 3-3	Section 2.0
Maintenance	Pages 2-15 and 4-1	Section 3.0
Ground-Water Monitoring	Pages 2-10 through 2-12	Section 4.0
Corrective Actions	Pages 5-1 through 5-2	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The site, south of Grand Junction, Colorado, was inspected by the DOE-GJO on April 21, 1999. Inspectors determined that the site was in excellent condition.

The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes or new conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspections. Features mentioned in this report are shown on Figure GRJ-1.

1.1 Special Status of the Grand Junction Disposal Site

The center of the disposal cell, called the "open cell," will remain open until 2023, or until filled to its design capacity, to accommodate additional residual radioactive material (RRM) expected from such sources as (1) unremediated tailings buried along water, sewer, and utility lines under Grand Junction city streets; (2) sludge from water treatment plants, at Tuba City, Arizona; (3) private removals; and (4) additional tailings from Monticello.

The open cell is operated by the LTRM Project, which is part of DOE's LTSM Program. The LTRM Project operates the open cell under authority of House Rule (H.R.) 2967 Section 2(a)(1)(B).

Until the open cell is closed, the LTSP for the Grand Junction disposal site is implemented as an "interim" or draft document. The NRC will not license the Grand Junction disposal cell until the NRC has concurred in (1) final closure of the open cell, and (2) the final version of the LTSP. An open cell within a closed but unlicensed disposal cell makes the Grand Junction disposal site unique among the 19 UMTRCA Title I disposal sites.

Only the closed and completed parts of the disposal cell and surrounding disposal site are included in the annual inspection. The open cell and temporary structures associated with the LTRM Project are not formally inspected. Temporary structures include office buildings, a laundry building, and a vehicle decontamination station with a holding pond. Inspectors noted that none of these features currently affect the long-term safety and integrity of the closed portion of the disposal cell or the surrounding area.

1.2 Specific Site Surveillance Features

The following section details specific site surveillance features investigated during the inspection.

Site Access. The access gate at U.S. Highway 50 is a steel, double-swing stock gate secured by a chain and padlock.

A paved all-weather access road extends approximately 1.7 miles east along DOE's right-of-way to the site entrance gate. The road is along a Right-of-Way Grant on land administered by the U.S. Bureau of Land Management (BLM). This road is the former two-lane haul road that was used to haul tailings and other contaminated materials from the railroad off-load point to the disposal cell. Buckles, ruts, and potholes are beginning to appear in the road at several places. The road may eventually have to be repaired or resurfaced to accommodate continuing use by the LTRM Project.

The site entrance gate is a chain-link, double-swing gate secured by a chain and padlock. The entrance gate is in excellent condition.

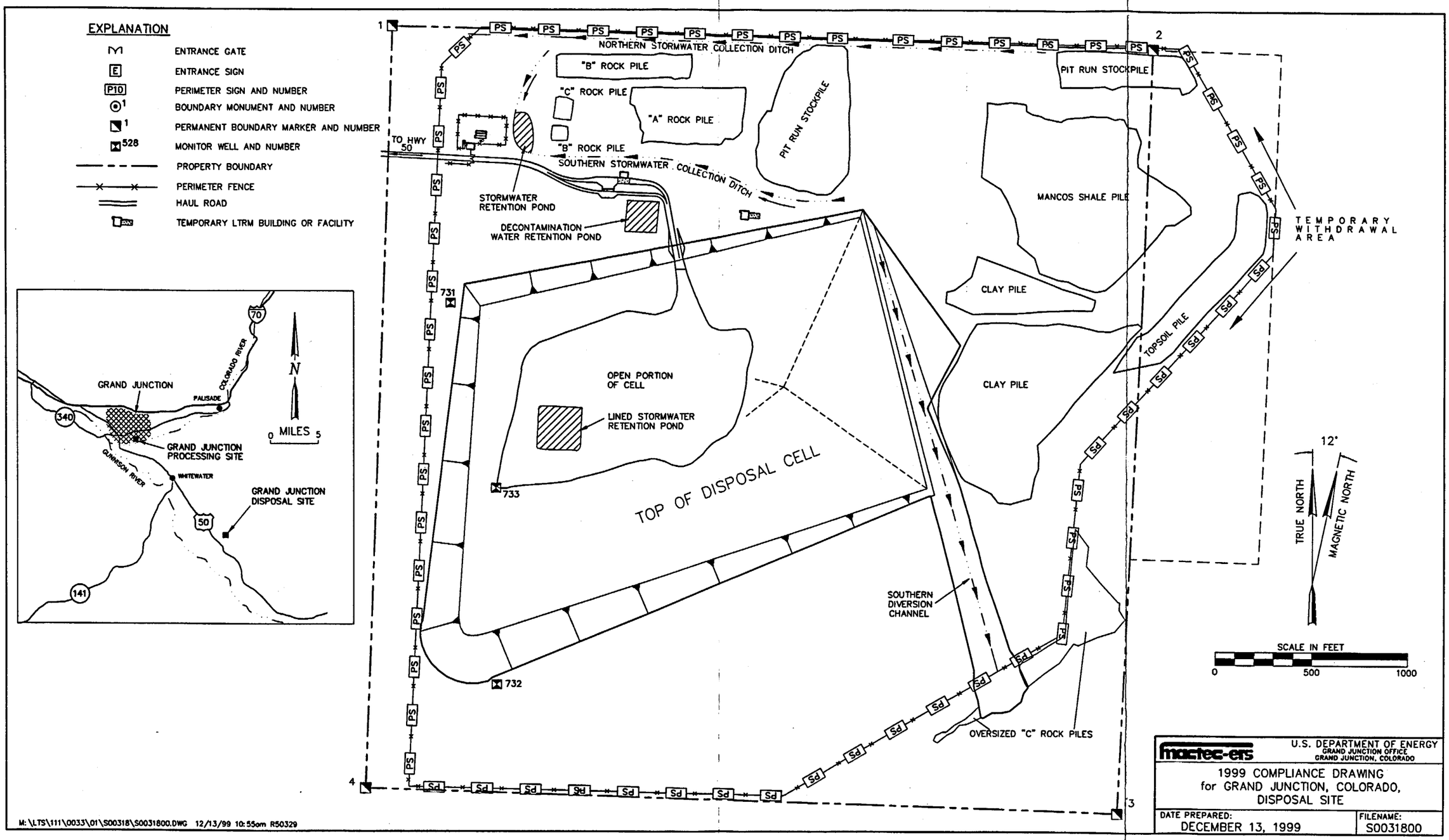


Figure GRJ-1. 1999 Compliance Drawings for Grand Junction, Colorado, Disposal Site

The stock fence along the right-of-way corridor is in excellent condition.

Entrance and Perimeter Signs. In March 1999, temporary warning signs were replaced with standard entrance and perimeter signs to bring the site into conformance with other UMTRCA Title I sites. There are now 75 perimeter signs on steel posts, each about 200 feet apart, along the site boundary.

Site Marker and Boundary Monuments. Unlike other UMTRCA Title I sites, there are no granite site markers at this site. DOE considers this an acceptable variance until the entire disposal cell is closed and comes under the general license at the end of the LTRM Project.

Also in March 1999, permanent boundary monuments were set at the four corners of the site to replace temporary pins. Monuments conform to monument specifications for Title I sites.

Monitor Wells. Three monitor wells comprise the monitoring network at this site. All are inside the site boundary. Two of the wells, MW-731 and MW-732, are downgradient wells completed in the alluvium (unconfined aquifer) just west of the disposal cell. These two wells monitor ground water in the alluvium that fills paleochannels eroded in the top of the underlying Mancos Shale. The third well, MW-733 is at the southwest corner of the open cell. It is used to measure water levels in the deepest part of the cell. All three wells are in excellent condition.

1.3 Transects

To ensure a thorough and efficient inspection, the site was divided into five areas referred to as transects: (1) the closed portion of the disposal cell; (2) diversion structures and drainage channels; (3) the area between the disposal cell and the site boundary; (4) the site perimeter; and (5) outlying areas.

Within each transect, inspectors examined specific site surveillance features, such as survey markers, perimeter signs, and monitor wells. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or the long-term performance of the disposal cell.

Closed Portion of the Disposal Cell. As explained above, the area in the center of the disposal cell is to remain open until 2023 or until filled to capacity. The annual inspection required by the LTSP does not include the open cell or temporary structures associated with the operation of the open cell—except as they may affect the long-term safety and performance of the closed portion of the disposal cell.

The top and side slopes of the closed disposal cell are covered with basalt riprap. The rock is durable and in excellent condition.

Plant encroachment is occurring mostly on the southeastern part of the top of the disposal cell. Encroaching plants consist primarily of cheat grass, Kochia, Russian thistle, halogeton, four-wing saltbush, and shadscale. The grasses are not robust. They appear to sprout and then die for lack of moisture.

Four-wing saltbush and shadscale are bushy plants, but neither has an extensive or deep root system. Kochia and Russian thistle, however, have deep roots and may affect the long-term integrity of the radon barrier. The effect of these plants needs to be evaluated. Therefore, this site will be included in the DOE's LTP and Cover Monitoring Project to determine if control of these plants is necessary.

Riprap on the side slopes of the disposal cell is in excellent condition. There is very little plant encroachment on the side slopes and no evidence of slope instability.

Diversion Structures and Drainage Channels. The southern diversion channel is a large riprap-armored structure that conveys runoff from the disposal cell southeast into a natural drainage that flows away from the site to the southwest. The diversion channel is in excellent condition.

Other drainage features at the site include northern and southern stormwater collection ditches and a stormwater retention pond. These are along the northern edge of the disposal site. The ditches are small and unimproved. The northern stormwater collection ditch captures run-on from a large catchment area north and east of the disposal site. Water captured in this ditch flows into a large natural drainage north and west of the disposal cell. The ditch, at places, is filling with tumbleweeds. If the ditch is still deemed important for the diversion of runoff, it may have to be cleaned out from time to time.

Minor erosion is occurring west of the perimeter fence where the northern stormwater collection ditch ends and water spills downslope into the natural drainage northwest of the site. The outflow area below the mouth of the northern stormwater collection ditch should be monitored. If erosion increases significantly, intervention may be required to stabilize the slope and prevent headward migration of the erosion.

The southern stormwater collection ditch collects on-site stormwater from the cover material stockpile areas (see below) and other places across the northern part of the site. This ditch flows west into the northern stormwater retention pond. A second ditch, rather short, flows south into the northern stormwater retention pond. Both ditches are small and filling with sediment and weeds. At some point, it may be necessary to clean out the ditches if they are still considered essential to control runoff.

After heavy storms, the water level in the northern stormwater retention pond has risen to within a few inches of the top of the bank around the pond. Capacity of the pond was increased by dredging in September 1999. This will prevent stormwater from overflowing and flooding areas used during LTRM Project operations.

Area Between the Disposal Cell and the Site Boundary. In addition to temporary buildings and structures used by the LTSM Project, there are 12 discrete stockpiles of rock and soil located between the disposal cell and the site boundary on the north and east sides of the disposal cell. These materials eventually will be used to cover and close the open cell.

Rill erosion is occurring on some of the soil stockpiles, but significant sediment has not been displaced. Natural vegetation is beginning to grow on these stockpiles and will eventually hold the soil in these stockpiles in place. If not, the soil stockpiles may be reseeded to stabilize the slopes.

On the south and west sides of the disposal site, between the disposal cell and the perimeter fence, the ground is relatively flat and covered with native vegetation that consists primarily of perennial grasses and small shrubs. Unlike the areas north and east of the disposal cell, the south and west areas are mostly undisturbed. No erosion was observed south and west of the disposal cell.

Site Perimeter. The perimeter fence that surrounds the site consists of square wire mesh at the bottom and two strands of barbed wire along the top supported by steel t-posts. The fence is in excellent condition.

The fence appears to be on or near the property line along the north and south sides of the site. The fence is perhaps 200 to 300 feet inside the property line on the west, and as much as 1,000 feet inside at the southeast corner of the site. On the east side, the fence extends beyond the site boundary to enclose part of an adjoining 40-acre temporary withdrawal area administered by BLM. (The temporary withdrawal area is not included in the interim LTSP; and is, therefore, not formally inspected.) The temporary withdrawal area is used by DOE to stockpile cover materials for the progressive closure of the open cell.

Outlying Areas. The area outward from the disposal site for a distance of 0.25 mile was visually inspected. No development or disturbance that could affect the disposal site was observed.

The land surrounding the site is range land administered by BLM. The land is covered by native grass and shrubs; it is used primarily for cattle grazing.

2.0 Follow-up or Contingency Inspections

Follow-up or contingency inspections in response to new or changed conditions were not required in 1999.

3.0 Maintenance

Standard warning signs were installed along the site boundary, and permanent monuments were set at the four corners of the property. No further maintenance was required.

4.0 Ground-Water Monitoring

Ground-water monitoring is required to demonstrate the initial performance of the disposal cell.

There is no shallow aquifer at this site in the usual sense. The disposal cell was constructed directly on relatively impermeable Mancos Shale. The Mancos Shale crops out at the surface, or is covered by a thin veneer of unconsolidated soil and alluvium, and extends to a depth of approximately 700 feet. The uppermost aquifer at the site, the Dakota Sandstone, lies beneath this 700-foot section of the Mancos Shale. The Dakota is not a usable aquifer because of low yield and poor water quality.

During construction of the disposal cell, widely separated paleochannels were discovered in the top of the Mancos Shale. These paleochannels are filled with the same unconsolidated materials that thinly blanket the Mancos Shale. The object of ground-water monitoring is, as a best

management practice, to ensure that water in the paleochannels is not affected by seepage or leaching from the disposal cell. Because there is no continuous shallow aquifer at the site, the paleochannels are the most likely places for leachate to appear should seepage from the disposal cell occur.

4.1 Monitor Wells

The monitoring network consists of three wells: two, MW-731 and MW-732, are screened in or near paleochannels adjacent to the disposal cell. The third well, MW-733, is located in the southwest corner of the open cell. It is used to measure water levels in the deepest part of the cell; although samples from this well are also analyzed for contaminants as a reference. Monitor well locations are shown on Figure GRJ-1. All three wells are in excellent condition.

4.2 Frequency of Monitoring

The LTSP requires that the two wells, MW-731 and MW-732, be sampled twice each year for 5 years, beginning in 1998. After the initial 5-year period (beginning in 2003), the two wells will be sampled annually; and the need to continue monitoring on an annual basis will be evaluated every 5 years thereafter. Although DOE was only required to sample twice in 1998, data are available from four sampling events. Wells were sampled twice in 1999. Monitor well MW-733 was not sampled in April 1998 because of construction activity in the open cell at that time.

4.3 Analytes

Samples are analyzed for standard field parameters and eight specific analytes including polychlorinated biphenyls (PCBs). Analytes with MCLs are underlined.

molybdenum	sulfate
nitrate	total dissolved solids (TDS)
PCBs	uranium
selenium	vanadium

4.4 Results of Monitoring

Results of sampling in 1998 and 1999 for the eight analytes listed above are presented in Table GRJ-2. The MCL for each analyte, if established, is also listed in the table.

Molybdenum. The concentration of molybdenum at all three wells continues to be very low for all sampling events. In each case, the concentration is near the laboratory detection limit.

Nitrate. Concentrations of nitrate at all wells consistently exceed the MCL. Concentrations may be decreasing in two of the wells, MW-731 and MW-733; but there is no trend in the third well, MW-732, despite a lower value at that well in November 1998.

Table GRJ-2. Summary of Ground-Water Sampling Analytical Results

Analyte	Maximum Concentration Limit	Date	Monitor Well MW-731	Monitor Well MW-732	Monitor Well MW-733
Molybdenum, mg/L	0.1 mg/L	Feb. 1998	0.0039B	0.0032B	0.0040B
		Apr. 1998	0.0034B	0.0025B	NA
		Aug.-Sept. 1998	0.0038B	0.0027B	0.0042B
		Nov. 1998	0.0042B	0.0032B	0.0037B
		Feb. 1999	0.0030B	0.0025B	0.0034B
		Aug. 1999	0.0025B	0.0020B	0.0067B
Nitrate as NO_3, mg/L	44 mg/L	Feb. 1998	302	180	425
		Apr. 1998	242	165	NA
		Aug.-Sept. 1998	239	175	375
		Nov. 1998	164	98	358
		Feb. 1999	145	177	362
		Aug. 1999	90	186	316
PCBs, µg/L	None	Not determined in 1998	—	—	—
		Feb. 1999	<1.085 U	<1.085 U	<1.085 U
		Aug. 1999	<1.0 U	<1.0 U	<1.0 U
Selenium, mg/L	0.01 mg/L	Feb. 1998	2.05	0.408	0.0107
		Apr. 1998	1.87	0.388	NA
		Aug.-Sept. 1998	1.77	0.414	0.015
		Nov. 1998	1.56	0.258	0.0134
		Feb. 1999	1.40	0.406	0.0096
		Aug. 1999	0.936	0.366	0.0078
Sulfate, mg/L	None	Feb. 1998	7530	3860	6580
		Apr. 1998	7090	3650	NA
		Aug.-Sept. 98	7260	963	6400
		Nov. 1998	6730	3970	6280
		Feb. 1999	6300	3810	6380
		Aug. 1999	5820	3650	5910
Total Dissolved Solids (TDS), mg/L	None	Feb. 1998	13700	6910	12000
		Apr. 1998	13100	7100	NA
		Aug.-Sept. 98	13000	7090	12700
		Nov. 1998	12600	7140	12400
		Feb. 1999	11900	7490	12500
		Aug. 1999	11200	7550	12600
Uranium, mg/L	0.044 mg/L	Feb. 1998	0.0402	0.0189	0.0196
		Apr. 1998	0.0406	0.0184	NA
		Aug.-Sept. 98	0.0413	0.0181	0.0200
		Nov. 1998	0.0520	0.0140	0.0204
		Feb. 1999	0.0454	0.0172	0.0187
		Aug. 1999	0.0488	0.0182	0.0187
Vanadium, mg/L	None.	Feb. 1998	0.0040U	0.0040U	0.0227
		Apr. 1998	0.0022B	0.0010U	NA
		Aug.-Sept. 98	0.0018B	0.0010U	0.0293
		Nov. 1998	0.0010U	0.0010U	0.0269
		Feb. 1999	0.0010U	0.0010U	0.0193
		Aug. 1999	0.0039B	0.0011B	0.0191

NA = Not available.
U= Analyte not detected. Value less than detection limit.
B = Value less than the required detection limit but greater than or equal to the actual detection limit.

PCBs. PCBs are included among the analytes because of the permitted disposal of a very small amount of PCB-contaminated materials in the disposal cell in 1998. Sampling for PCBs began during 1999. Values for all seven Aroclor species were below the laboratory detection limit in 1999. PCBs are expected to have very low mobility because they are adsorbed by other cell materials.

Selenium. Selenium exceeds the MCL in all three wells, although the concentration of selenium varies noticeably among the wells. There seems to be a decreasing trend at MW-731. There is also an apparent decreasing trend for selenium at MW-733. Selenium barely exceeded the MCL at this well in 1998. In 1999, the concentration was slightly below the MCL.

Sulfate. Sulfate values continue to be fairly high for all wells, exceeding the secondary drinking water standard of 250 mg/L by more than one order of magnitude. Sulfate values are decreasing slightly at MW-731, but remain fairly constant in the other two wells. (The low result for August-September 1998 sampling at MW-732 is unexplained.)

Total Dissolved Solids (TDS). The concentration of TDS is high at all wells. TDS in two of the wells, MW-731 and MW-733, exceeds the 10,000 mg/L cutoff used to define "limited-use" water. Concentrations at MW-732 continue to be a little more than half the concentration at the other two wells. A gradually increasing trend is evident for MW-732 and MW-733; a slight decreasing trend is occurring at MW-731.

Uranium. Uranium continues to be below the MCL at MW-732 and MW-733. Uranium is just slightly above the MCL at MW-731. Concentrations at MW-731 appear to be on a slightly increasing trend, but concentrations at the other two wells show no trend. Uranium in the other two wells was about half the concentration at MW-731.

Vanadium. Vanadium continues near the laboratory detection limit at monitor wells MW-731 and MW-732. A decreasing trend may be occurring at MW-732. At monitor well MW-733, vanadium values continue at about the 0.02 mg/L level with no apparent trend.

Summary. No significant trends are evident in the monitoring data from 1998 and 1999. For a given analyte, some wells showed increases, some showed decreases, and some showed no trend at all. At a given well, one contaminant may demonstrate a decrease while another contaminant may show an increase over the same monitoring period. Trends in the data may only become apparent after additional sampling.

5.0 Corrective Actions

Corrective actions to address problems that might affect the integrity of the disposal cell were not required in 1999.

Annual Compliance Report
Green River, Utah, Disposal Site

Compliance Summary

The site, inspected March 24, 1999, was in excellent condition and met all compliance requirements. Only minor maintenance is recommended. No cause for a follow-up inspection or corrective action has been identified. Ground-water monitoring results are influenced by historical processing-related contamination and do not indicate a cell performance concern.

Compliance Requirements

Requirements for long-term surveillance and maintenance at the Green River, Utah, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Green River, Utah, Disposal Site,* (July 1998, U.S. Department of Energy, Albuquerque, N.M., DOE/AL62350-89, Rev. 2), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table GRN-1.

Table GRN-1. License Requirements for the Green River, Utah, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 6.0	Section 1.0
Follow-up or Contingency Inspections	Section 7.0	Section 2.0
Maintenance	Section 8.0	Section 3.0
Ground-Water Monitoring	Section 5.2	Section 4.0
Corrective Actions	Section 9.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The Green River Disposal Site was inspected on March 24, 1999. The purposes of the inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in this report are shown on Figure GRN-1.

1.1 Specific Site Surveillance Features

The specific site surveillance features, including fences and gates, entrance and perimeter signs, the two granite site markers, and the several survey and boundary markers, were all inspected and found to be in excellent condition.

During 1999, boundary monuments BM-9, BM-10, and BM-11 were installed to mark the modified boundary along the southeast side of the site. Three perimeter signs were relocated to the new boundary.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) disposal cell and adjacent area inside the security fence; (2) site perimeter between the security fence and the site boundary; and (3) outlying areas.

Within each transect, inspectors examined specific site surveillance features, such as monitor wells, survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other disturbance that might affect site integrity or the long-term performance of the site.

Disposal Cell and Adjacent Area Inside the Security Fence. The side slopes and crest of the disposal cell are covered with riprap and are in excellent condition. Several widely scattered plants representing last year's growth were noted on the side slopes. These plants apparently died before reaching maturity and are not considered a problem. The diversion channel along the base of the disposal cell on all sides is in excellent condition.

During previous inspections, minor tumbleweed accumulations were noted in the diversion channels. Tumbleweed accumulations were not observed during this year's inspection in the diversion channels or along the security fence.

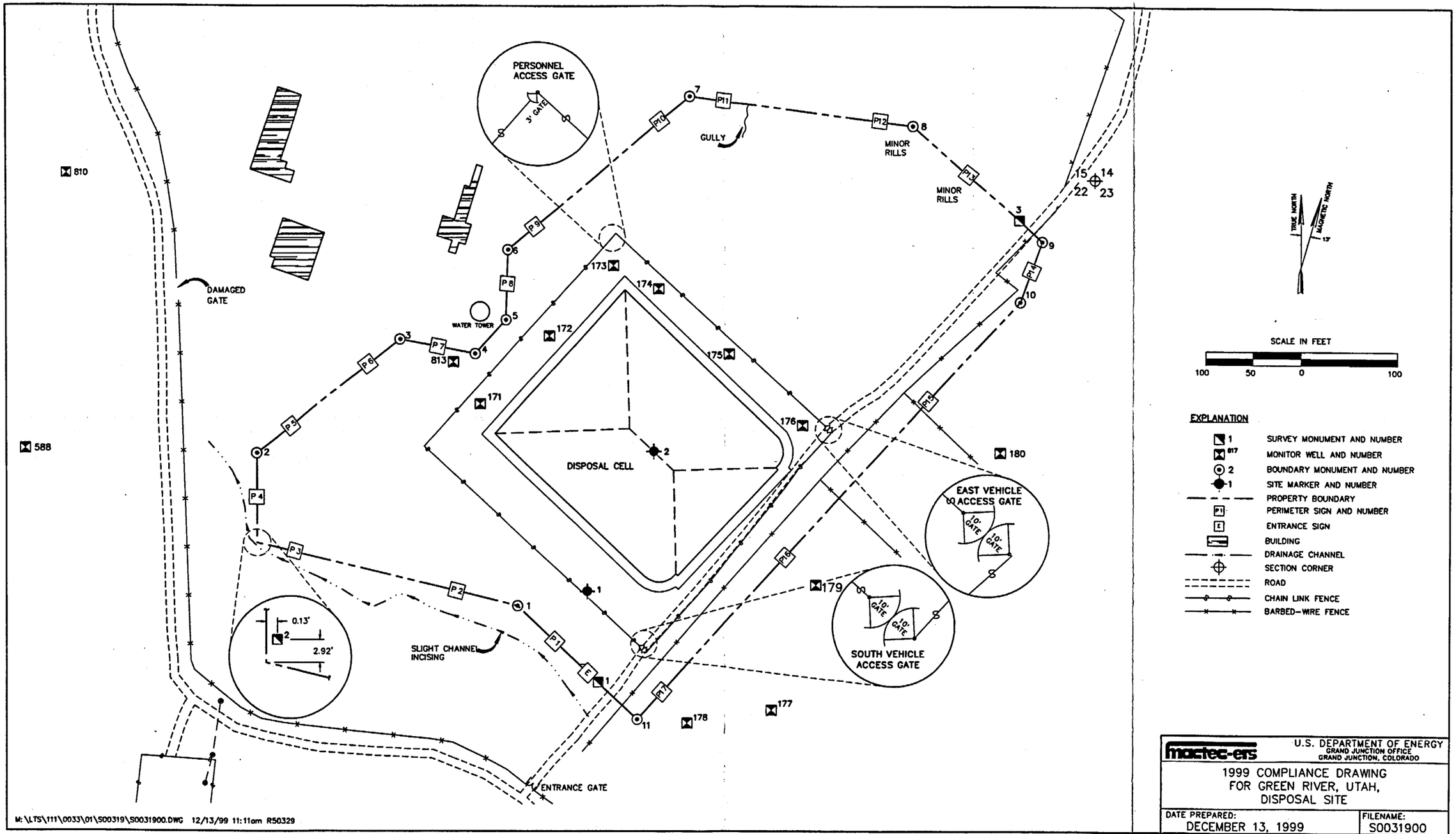
Natural vegetation continues to establish in the graded area between the diversion channel and the security fence. Animal burrows were noted in this area. The burrows are too small and shallow, and too far from the buried tailings, to threaten site integrity.

Site Perimeter between the Security Fence and the Site Boundary. Vegetation in reseeded areas continues to be sparse. Most of the existing vegetation consists of indigenous small desert forbs and grasses that have colonized the site naturally. Sparse vegetation is typical of this region.

Shortly before this site was licensed, DOE negotiated with the state to extend the southeastern site boundary approximately 125 feet farther southeast in order to enclose a perimeter drainage ditch, access road, and security fence within the actual site boundary. The new boundary is shown on Figure GRN-1. In February 1999, three new boundary monuments were installed to mark the new boundary.

Rill and gully erosion noted during previous inspections on the hillside northeast of the disposal cell in the area between BM-7 and SM-3 does not appear to be active. New vegetation is establishing in the bottom of the gully southeast of BM-7. This hillside is outside the DOE security fence and can be accessed by the public. No recent tracks were seen by inspectors this year. However, the installation of the security fence so close to the disposal cell leaves large portions of the site unsecured and unprotected.

Outlying Areas. The area extending outward from the site for a distance of 0.25 mile was observed for signs of erosion, development, or other disturbance that might affect site security or integrity. Areas of erosion noted during previous inspections include the natural drainage southwest of the site, several rills near survey marker SM-2, and gullies northwest of the water tower. Erosion in these areas appears unchanged from previous inspections and monitoring will continue.



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1999 COMPLIANCE DRAWING FOR GREEN RIVER, UTAH, DISPOSAL SITE	
DATE PREPARED: DECEMBER 13, 1999	FILENAME: S0031900

Figure GRN-1. 1999 Compliance Drawings for Green River, Utah, Disposal Site

2.0 Follow-up or Contingency Inspections

The LTSP stipulates that DOE will conduct follow-up or contingency inspections if evidence exists that disposal cell integrity is threatened. No follow-up or contingency inspections were required at this site in 1999.

3.0 Maintenance

The LTSP stipulates that DOE will conduct maintenance to maintain the site in a secure and protective condition.

A gate in the state right-of-way fence northwest of the site was upgraded in 1998 to restrict unauthorized public access to portions of the disposal site outside the security fence. Inspectors found the gate bent in the middle and open. The gate is still serviceable although the closing mechanism is unusable. During the next site visit, DOE will secure the gate with a chain and padlock.

4.0 Ground-Water Monitoring

The LTSP stipulates that ground water will be sampled and analyzed quarterly from four designated point-of-compliance (POC) wells located along the downgradient edge of the disposal cell, and that water levels will be continuously monitored in two of the point-of-compliance wells and in a third, offsite, well. Monitoring requirements will be re-evaluated in 2001.

Historical site processing activities resulted in process-related contamination of ground water in the uppermost aquifer beneath the cell. Ground water beneath the Green River disposal site is not a potential present or future source of potable water because ambient concentrations of total dissolved solids, chloride, and sulfate exceed primary and secondary drinking water standards.

Analytes. The process-related contamination beneath the disposal cell is similar in composition to any leachate that might escape the cell. However, if the disposal cell is controlling infiltration as designed, concentrations of three contaminants (nitrate, sulfate, and uranium) should decrease with time. Samples are analyzed for these three constituents, as well as standard water quality indicators and field parameters.

Results of Ground-Water Monitoring. Ground-water concentration limits are either established in 40 CFR 192.02 or are taken as the maximum ambient (or background) concentration of a given constituent. Ground water sampling results and site ground-water standards for the three indicator constituents are presented in Table GRN-2.

Nitrate. Each sample from the four most recent calendar quarters from MW-171, MW-172, and MW-173 exceeded the proposed concentration limit (standard) for nitrate (Figure GRN-2). The standard was not exceeded in any sample from MW-813.

Table GRN-2. Ground-Water Limits and Sample Results for the Green River, Utah, Disposal Site

Analyte	Sample Date	Sample Location							
		MW-171		MW-172		MW-173		MW-813	
		Proposed Standard	Result	Proposed Standard	Result	Proposed Standard	Result	Proposed Standard	Result
Nitrate (as NO_3)	12/98	44	197	102	1570	44	540	44	0.491B
	3/99		219		1500		292		0.141B
	7/99		217		1480		48.7		0.01U
	9/99		194		1590		167		0.209B
Sulfate	12/98	3,334	4010	4,985	7380	4,000	4910	4,440	3720
	3/99		4100		7520		4360		3810
	7/99		4420		8510		3910		4120
	9/99		3900		7140		3990		3580
Uranium	12/98	0.044*	0.0211	0.067	0.0060	0.044*	0.0031	0.069	0.0079
	3/99		0.0203		0.0065		0.0028		0.0084
	7/99		0.0184		0.0062		0.0016		0.0087
	9/99		0.0277		0.0059		0.0017		0.0085

Note: All concentrations are expressed in mg/L.
* Maximum Concentration Limit per 40 CFR 192.02, Table 1. All other limits are background concentrations.
Bold results exceed the applicable standard.
U = Not detected at laboratory reporting limit.

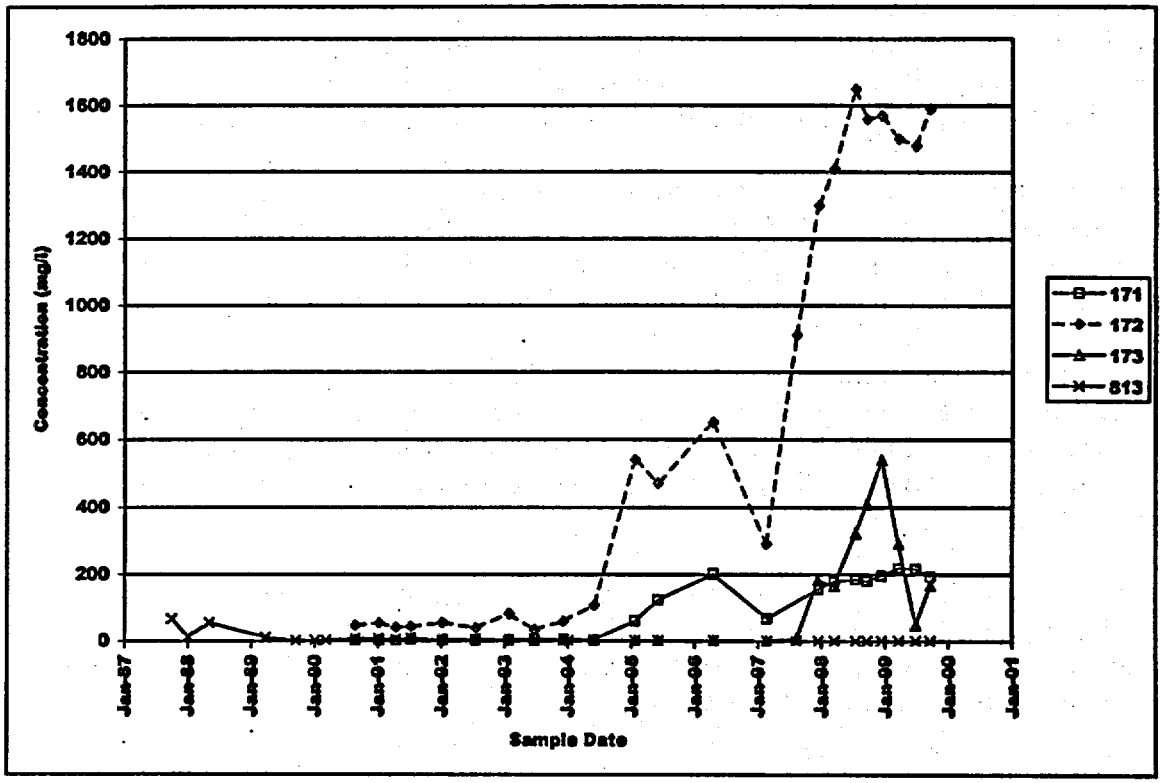


Figure GRN-2. Nitrate Concentrations at the Green River, Utah, Disposal Site

In the past year, nitrate concentrations have generally decreased in MW-172 and MW-173, after rising in recent years. Further monitoring may be necessary to determine if these trends continue. The nitrate concentration in MW-171 remains essentially unchanged. The nitrate concentration remains near the laboratory detection limit in MW-813.

The nitrate standard was not significantly exceeded at MW-171 and MW-172 until January 1995. All subsequent samples from these wells have exceeded the standard. In MW-172, the nitrate concentration rose to about 1,600 mg/L in 1998 from relatively uniform levels of 40 mg/L to 60 mg/L prior to December 1993. Until August 1997, samples from MW-173 were near or below the detection limit. After that time, nitrate concentrations steadily increased to 540 mg/L in December 1998 and generally have been decreasing since then.

The standard for nitrate was exceeded at MW-813 in the early period, 1987 to 1989; but concentrations have since decreased to low or nondetectable levels.

The disposal cell was constructed in 1988 and 1989. Prior to construction, from 1986 to 1988, nitrate in samples from MW-562 and MW-816 ranged between 45 mg/L and 173 mg/L. These two wells, both decommissioned, were formerly in the area now occupied by the disposal cell. Nitrate concentrations of 2 mg/L and 4,500 mg/L were detected in samples of tailings pore water collected from lysimeter 714 prior to surface remediation. (Lysimeter 714 was located at the old tailings storage area north of the disposal site. Samples from this well were used to determine chemistry of the tailings pore-water fluid.)

Uranium. The standard for uranium was not exceeded in any POC well sample collected in 1998, nor has it ever been exceeded at a POC well since the disposal cell was constructed in 1989 (Figure GRN-3).

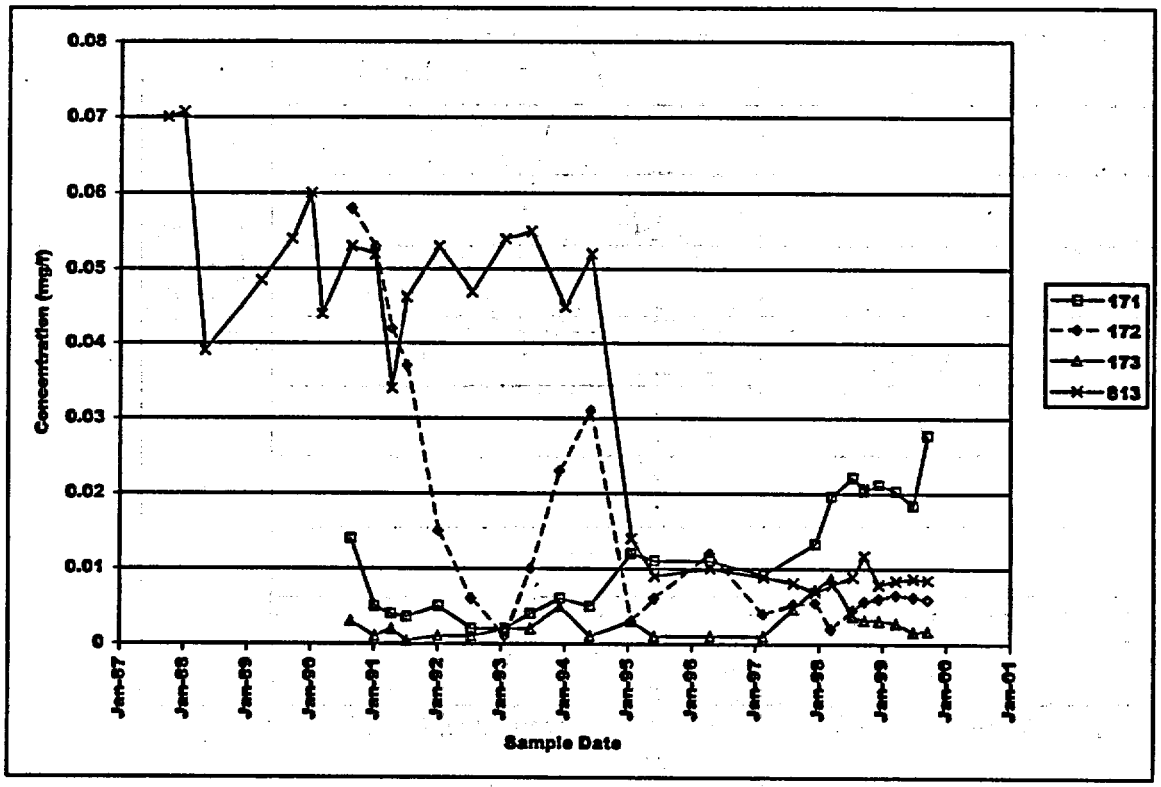


Figure GRN-3. Uranium Concentrations at the Green River, Utah, Disposal Site

Concentrations of uranium at MW-171 increased from when postconstruction monitoring began until July 1998 and have remained generally constant since then. The concentrations of uranium in 1999 samples from MW-171 average about one-half the standard. Uranium concentrations in MW-172 trended lower between 1990 and March 1998, after which time the uranium concentration has consistently been approximately 0.006 mg/L. At MW-173, concentrations have typically been below or slightly above the detection limit and no trend is apparent. A five-fold decease in uranium concentration occurred at MW-813 from June 1994 through January 1995. Levels have since stabilized at about 0.01 mg/L.

Prior to construction of the disposal cell, uranium in samples from MW-562 and MW-816 ranged between 0.038 mg/L and 0.146 mg/L. Those levels are higher than present day concentrations at the four POC wells. Uranium concentrations of 221 mg/L and 675 mg/L were detected in samples of tailings pore water collected from lysimeter 714 prior to surface remediation.

Sulfate. Sulfate concentrations exceeded the proposed standard in each sample collected in 1999 at MW-171 and MW-172, and exceeded the proposed standard for December 1998 and March 1999 at MW-173 (Figure GRN-4). The proposed standard was not exceeded in any sample from MW-813 in 1999, nor since monitoring began at this well in 1987.

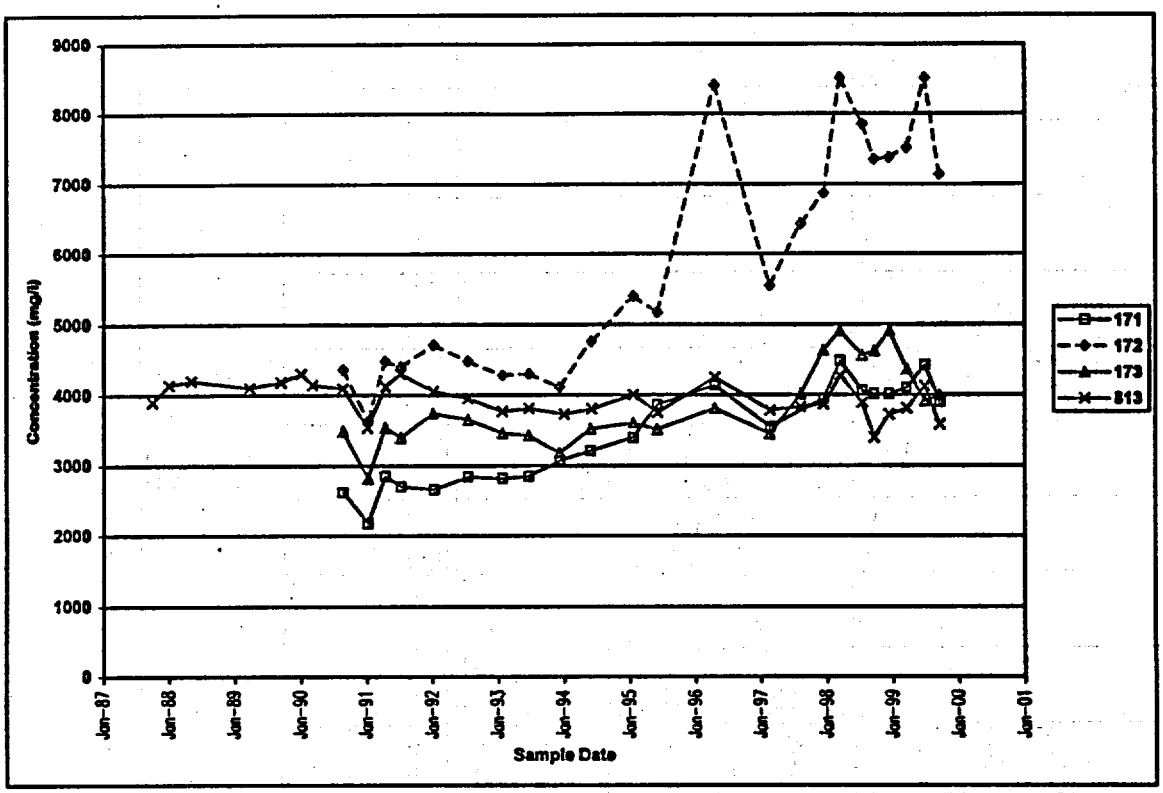


Figure GRN-4. Sulfate Concentrations at the Green River, Utah, Disposal Site

Sulfate concentrations at MW-171 and MW-172 have generally increased since sampling began at these wells in August 1990. The proposed standard was exceeded in each sample collected since January 1995. Sulfate concentrations in samples from MW-173 ranged from approximately 3,500 mg/L to 4,500 mg/L between 1990 and February 1997, after which time

concentrations started to increase to approximately 4,900 mg/L between December 1997 and December 1998. Sulfate concentrations have decreased since then. Sulfate concentrations in the four POC wells fluctuated between mid-1994 and December 1998, after which time sulfate concentrations have been decreasing in MW-173 while still fluctuating in the other three POC wells.

Prior to construction of the disposal cell, sulfate in samples from MW-562 and MW-816 ranged between 3,940 mg/L and 4,600 mg/L (1986 to 1988 data). Those levels are similar to or higher than present day concentrations at all wells except MW-172. Sulfate concentrations of 16,000 mg/L and 56,200 mg/L were detected in samples of tailings pore water collected from Lysimeter 714 prior to surface remediation.

Ground-Water Level Monitoring. Water level hydrographs for the wells surrounding the disposal cell indicate relatively stable conditions (Figure GRN-5). The observed water level fluctuations do not appear abnormal and generally occur in phase among the wells. However, the most recent observation indicated an abrupt rise in water level in MW-172 while the levels in the remaining wells decreased slightly. Additional observations are necessary to define a trend or develop a hypothesis.

There is no indication of a regional change in water levels or flow direction over the period of observation. The ground-water gradient in the vicinity of the disposal site is to the west or northwest. However, in the immediate vicinity of the disposal cell, a prevailing direction of flow is difficult to determine because the hydraulic head distribution does not provide a well-defined potentiometric surface. The head potentials indicate that a wide range of flow directions is possible, including a southerly component. It is probable that hydraulic heads and ground-water flow in the relatively complex hydrostratigraphic units at the site are fracture controlled.

Ground Water Summary. Quarterly ground-water monitoring is required for 3 years beginning in 1999, after which time the monitoring requirements will be re-evaluated. The data for the four most recent quarters are summarized as follows:

- Nitrate exceeds the standard at three of the four POC wells. A pattern of increasing concentrations is apparent at two wells; concentrations are decreasing at MW-173.
- Nitrate concentrations prior to cell construction were much lower than recently observed at MW-172.
- Uranium concentrations are below the standard at each POC well. Uranium concentrations have decreased significantly at some wells. No major trend in uranium concentration is apparent at the remaining wells. Uranium concentration in ground water prior to cell construction was greater than recent values at all four POC wells.
- Sulfate concentration prior to cell construction was similar to, or greater than, present day levels in three of the POC wells. At MW-171 and MW-172, sulfate has exceeded the proposed standard since 1995. Sulfate concentrations have recently been decreasing at MW-173 to below the proposed standard, but a trend can not be predicted yet.
- Water level fluctuations appear normal and generally in phase among the wells. There is no indication of a regional change in water level or flow direction over the period of observation.

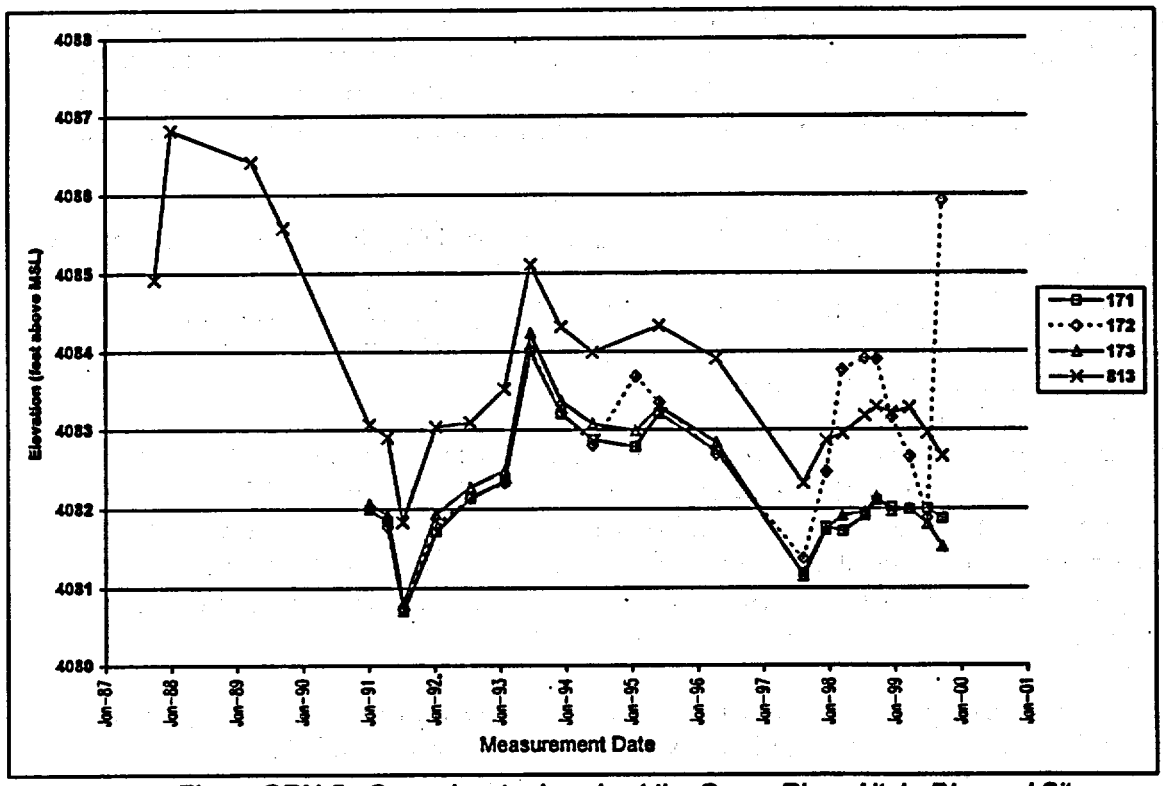


Figure GRN-5. Ground-water Levels at the Green River, Utah, Disposal Site

5.0 Corrective Actions

The LTSP stipulates that DOE will implement corrective actions if evidence exist that the disposal cell is not functioning as designed. No corrective actions were required at this site in 1999.

Annual Compliance Report
Gunnison, Colorado, Disposal Site

Compliance Summary

The Gunnison, Colorado, disposal site was inspected on August 18, 1999 and met all compliance requirements. Revegetation of graded and disturbed areas around the disposal cell is improved and no longer a concern. Rock at key locations around the disposal cell base was in excellent condition. Modifications to the fence were completed during 1999 and two missing perimeter signs were replaced. No other maintenance tasks were identified. No cause for a follow-up or contingency inspection was identified. Ground-water monitoring results do not indicate any concerns regarding disposal cell performance.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Gunnison, Colorado, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Gunnison, Colorado, Disposal Site* (April 1997, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-222, Rev. 2), and in procedures established by DOE to comply with requirements of 10 CFR 40.27. These requirements are listed in Table GUN-1.

Table GUN-1. License Requirements for the Gunnison, Colorado, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 3.1	Section 1.0
Follow-up or Contingency Inspections	Section 3.5	Section 2.0
Maintenance	Section 5.0	Section 3.0
Ground-Water Monitoring	Section 4.1	Section 4.0
Corrective Actions	Section 6.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The Gunnison, Colorado, disposal site was inspected on August 18, 1999. The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. Features mentioned in this report are shown on Figure GUN-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

Access Road, Entrance Gate, and Entrance and Perimeter Signs. The road to the site is a good, all-weather gravel road that is maintained by BLM. The south entrance gate is a simple barbed

wire gate in the stock fence that surrounds the site. The gate is secured by a padlock and chain and is in good condition.

Perimeter signs P3 and P23 had been stolen and were replaced. The entrance sign and all perimeter signs are in excellent condition.

Site Markers, Survey Monuments, and Boundary Monuments. Both granite site markers, SMK-1 just inside the south entrance gate and SMK-2 on the top of the disposal cell, are in excellent condition. Survey/boundary monuments, SM-1/BM-1, SM-2/BM-2, and SM-3/BM-3, and eight additional boundary monuments, BM-4 through BM-11, are also in excellent condition.

Monitor Wells. The 16 wells in the ground-water monitoring network are secured with locks and in excellent condition.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the top and side slopes of the disposal cell; (2) the rock aprons, drainage ditches, and other features between the cell toe and the perimeter fence; and (3) the perimeter fence and outlying areas extending 0.25 mile beyond the site property boundary. Each of these transects was inspected by walking a series of traverses.

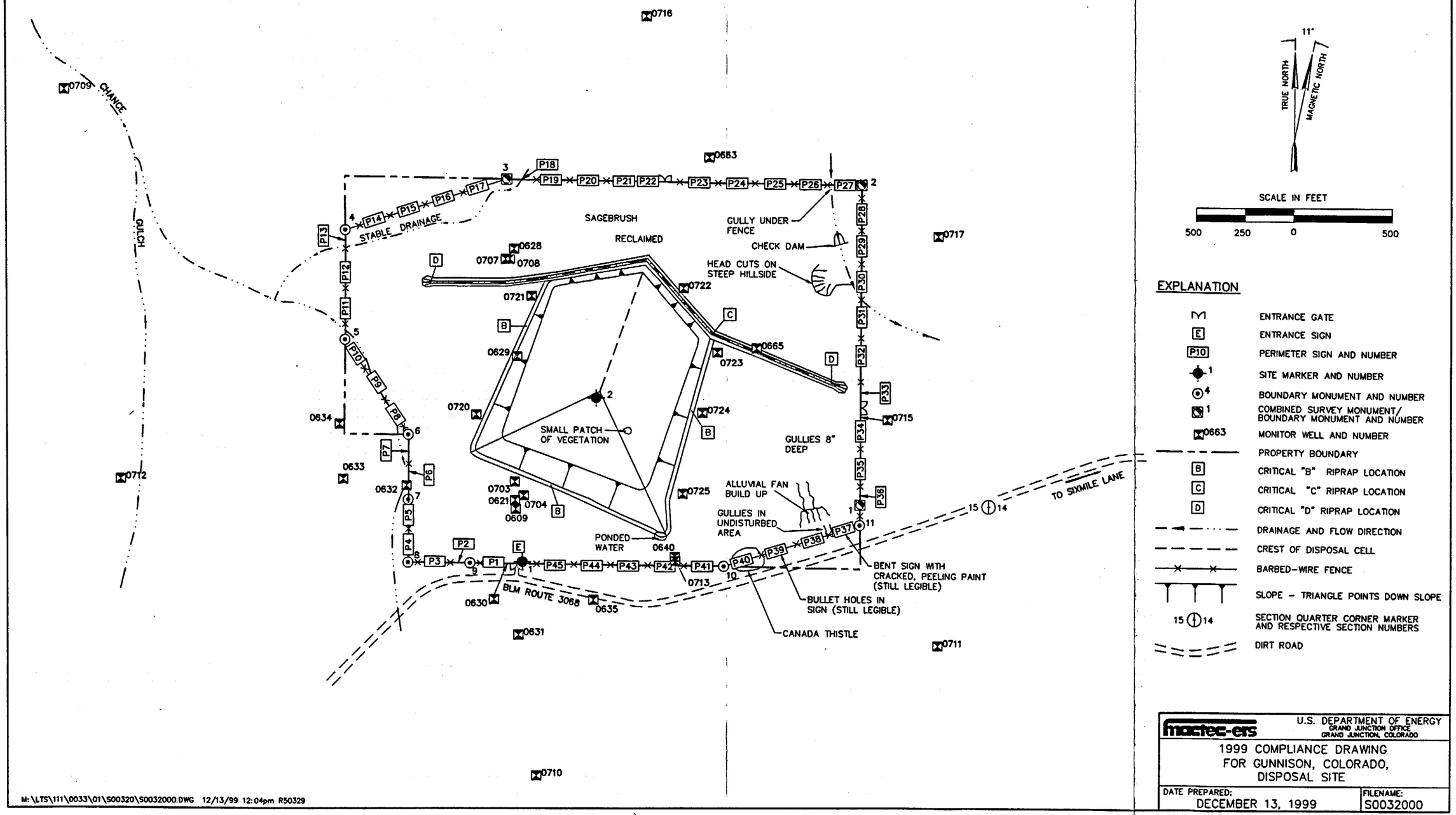
Within each transect, inspectors examined specific site surveillance features. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or long-term disposal cell performance.

Disposal Cell. The top of the disposal cell is in excellent condition. The riprap-covered side slopes, apron, and diversion ditches are also in excellent condition. There was no evidence of slumping, settling, or significant encroachment of vegetation.

Area Between Cell and Fence. Both disturbed and undisturbed areas occur between the disposal cell and the site perimeter. Disturbed areas typically were regraded to promote surface drainage away from the disposal cell and reseeded. Undisturbed areas were left in their natural state. Dominating the reseeded areas are crested wheatgrass, pennycress, rabbitbrush, and annual weeds. Overall, the revegetation effort appears to have been successful, although some areas exhibit denser plant growth than others. Revegetation monitoring will continue.

As required by the LTSP, the condition of the riprap in six test areas was carefully inspected and photographed. Each test square, roughly 1 square meter, is in a "critical flow path" location in the diversion channels. Corners of each test square are marked with orange paint. Each square was photographed from the south. Rock-by-rock comparison of the 1999 photographs with those taken since 1997 shows no deterioration of any rock.

Inspectors found standing water at the south corner of the cell in August 1999. The water was gone in November 1999. This was not noticed previously, but precipitation during the summer of 1999 was unusually heavy. The water lies below the encapsulated tailings, but LTSM Program personnel will drain this area during the 2000 inspection.



11°
TRUE NORTH
MAGNETIC NORTH

SCALE IN FEET
500 250 0 500

EXPLANATION

- ENTRANCE GATE
- E — ENTRANCE SIGN
- P10 — PERIMETER SIGN AND NUMBER
- 1 — SITE MARKER AND NUMBER
- 4 — BOUNDARY MONUMENT AND NUMBER
- 1 — COMBINED SURVEY MONUMENT/ BOUNDARY MONUMENT AND NUMBER
- 0663 — MONITOR WELL AND NUMBER
- PROPERTY BOUNDARY
- B — CRITICAL "B" RIPRAP LOCATION
- C — CRITICAL "C" RIPRAP LOCATION
- D — CRITICAL "D" RIPRAP LOCATION
- DRAINAGE AND FLOW DIRECTION
- CREST OF DISPOSAL CELL
- BARBED-WIRE FENCE
- SLOPE – TRIANGLE POINTS DOWN SLOPE
- 15 14 — SECTION QUARTER CORNER MARKER AND RESPECTIVE SECTION NUMBERS
- DIRT ROAD

mactec-ers	U.S. DEPARTMENT OF ENERGY GRAND JUNCTION OFFICE GRAND JUNCTION, COLORADO
1999 COMPLIANCE DRAWING FOR GUNNISON, COLORADO, DISPOSAL SITE	
DATE PREPARED: DECEMBER 13, 1999	FILENAME: S0032000

Figure GUN-1. 1999 Compliance Drawings for Gunnison, Colorado, Disposal Site

Active erosion is occurring in an undisturbed area in the southeast portion of the site. Erosion has occurred on the northeast and northwest portions of the site, but appears to have stabilized and natural vegetation is becoming established. None of the eroded areas threatens cell integrity.

Outlying Areas. A wire fence delineates the site perimeter. The three upper strands of the fence are barbed wire and the bottom strand is slick wire. Two barbed-wire gates—one on the north fence line and one on the east fence line—provide monitor well access. The fence and gates are in excellent condition. At the request of local BLM personnel, the bottom strand was removed from the perimeter fence to prevent injury to antelope.

Natural drainages occur on the west, northwest, and northeast areas of the site boundary. No significant erosion was observed, but drainages should be monitored during future inspections for potential erosion.

The Gunnison County Landfill is located north and northeast of the site. No active landfill operations are presently occurring within 0.25 mile of the disposal site. No other evidence of activity was noted near the site boundary.

2.0 Follow-up or Contingency Inspections

The LTSP stipulates that DOE will conduct follow-up or contingency inspections if evidence exists that the disposal site is threatened. No cause for a follow-up or contingency inspection was identified during the past year.

3.0 Maintenance

The LTSP stipulates that DOE will conduct maintenance to maintain the site in a secure and protective condition. Two missing perimeter signs were replaced. No other maintenance was required at this location during 1999.

4.0 Ground-Water Monitoring

The LTSP stipulates that DOE will monitor ground water at this site to demonstrate compliance with the ground-water protection standards in 40 CFR 192.03 and to demonstrate that the disposal cell is performing as designed. Monitoring will entail analysis for selected analytes and recording static water levels.

4.1 Monitoring Network

The ground-water monitoring network consists of six downgradient point-of-contact (POC) wells and two upgradient (background) wells. In addition, water levels are measured in eight outlying wells to detect changes in regional ground-water conditions (Table GUN-2). Monitor well locations are shown on Figure GUN-1.

4.2 Monitoring Frequency

Monitoring frequency, established in the LTSP, is presented in Table GUN-3.

The ground-water monitoring network was sampled in September 1998 and May 1999.

Table GUN-2. Ground-Water Monitoring Network at the Gunnison, Colorado, Disposal Site

Point of Compliance Wells	Background (Upgradient) Wells	Water Level Wells
720	609	630
721	716	634
722		663
723		709
724		712
725		714
		714
		715

Table GUN-3. Ground-Water Monitoring Frequency at the Gunnison, Colorado, Disposal Site

Year	Frequency	Time of Year
1997	Semi-Annually	Fall and early summer
1998	Annually	Early summer
1999	Annually	Early summer
2000	Annually	Early summer
2001	Annually	Early summer
Beyond	Every 5th year, i.e., 2006, 2011, etc.	Early summer

4.3 Analytes

The indicator analyte at the Gunnison site is uranium. This analyte was selected on the basis of its presence in tailings pore water, its relatively high mobility in ground water, and its low concentration in background water. Ground water sample analysis also includes major cations and anions, and field parameters. The action level for uranium, as stated in the LTSP, is 0.013 mg/L.

4.4 Results of Ground-Water Monitoring in 1999

Ground-Water Sample Analytical Results. The concentrations of uranium in ground-water samples collected in September 1998 and May 1999 are shown in Table GUN-4.

Table GUN-4. Uranium Concentrations in Ground Water at the Gunnison, Colorado, Disposal Site

Monitor Well	Hydrologic Relationship	September 1998	May 1999
609	Background	0.0034	0.004
716	Background	0.0022	0.0028
720	POC	0.0047	0.0052
721	POC	0.001U	0.0012
722	POC	0.0017	0.0022
723	POC	0.0033	0.0038
724	POC	0.001U	0.0014
725	POC	0.0024	0.0027

All concentrations are expressed in mg/L. U = result below laboratory reporting detection limit.

Uranium was detected in one or more samples from each background and POC well sampled in 1998 and 1999. Uranium concentrations in the POC wells were statistically similar to those in the background wells, and the uranium concentration did not vary significantly at any given well during the period. The uranium concentrations in samples from MW-720 are slightly higher than in samples from background wells. However, they are well within the historical range for the background wells. The uranium concentrations in all wells are very close to the laboratory detection limit of 0.001 mg/L and are much lower than the action level of 0.013 mg/L. Thus, there is no indication that uranium is leaching from the disposal cell or that ground-water quality has degraded due to disposal cell processes.

Ground-Water Level Monitoring Results. Hydrographs for the wells in the monitoring network show very minor fluctuations in water table elevations since cell closure in 1995. Hydraulic head potentials and gradients between wells also have not changed and ground-water flow directions have remained static.

The disposal cell is approximately centered in a topographic saddle that slopes down to the east and west, and rises to the north and south. The shape of the potentiometric surface generally replicates that of the surface topography, such that ground-water flow is toward the site from north and south and away from the site on the west and east. The disposal cell is located near the mid-point of the north-south trending divide in the potentiometric surface, and immediately east of the saddle point. As a result, the ground water flows beneath the disposal cell and away from the disposal cell to the east (toward POC wells MW-722, MW-723, MW-724, and MW-725). The compliance-monitoring network continues to be effective because hydrogeologic conditions at the site remain stable and as characterized before the monitoring network was established.

5.0 Corrective Actions

The LTSP stipulates that DOE will implement corrective action if evidence exists that the disposal cell is not functioning as designed. No corrective actions were required at this site in 1999.

End of current text

Annual Compliance Report
Mexican Hat, Utah, Disposal Site

Compliance Summary

The site, inspected on September 28, 1999, was in excellent condition and met all compliance requirements. Minor maintenance was performed. No cause for a follow-up inspection was identified. Ground-water monitoring results do not indicate any concerns with disposal cell performance.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Mexican Hat Disposal Site are specified in the *Long-Term Surveillance Plan for the Mexican Hat Disposal Site, Mexican Hat, Utah*, (June 1997, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-207, Revision 2), and procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table HAT-1.

Table HAT-1. License Requirements for the Mexican Hat, Utah, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 3.1	Section 1.0
Follow-up or Contingency Inspections	Section 3.4	Section 2.0
Maintenance	Section 5.0	Section 3.0
Ground-Water Monitoring	Section 4.3	Section 4.0
Corrective Actions	Section 6.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The Mexican Hat Disposal Site was inspected on September 28, 1999. The purposes of the inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in this report are shown on Figure HAT-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features examined during the inspection.

The site is surrounded by a high-quality barbed-wire fence. The entrance gate is chain link. Gate and fencing are generally in excellent condition.

At the Mexican Hat site, there are 43 perimeter signs and one entrance sign. All signs are clearly legible, including signs that were previously noted to have been defaced or faded.

The 2 site markers, 4 survey monuments, 12 boundary monuments, and 6 settlement plate casings were inspected and found to be in good condition.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into four areas referred to as transects: (1) the top of the disposal cell; (2) the side slopes of the disposal cell and surrounding diversion ditches; (3) the site perimeter; and (4) outlying areas. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features, such as survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or the long-term performance of the site.

Top of Disposal Cell. The top of the disposal cell is in excellent condition. The inspectors saw no evidence of differential settling, cracking, erosion, plant growth, or burrowing.

Side Slopes and Diversion Ditches. The riprapped side slopes on the disposal cell and the surrounding diversion ditches are in excellent condition. There is no plant encroachment on the side slopes or in the riprap-armored diversion ditches. Tumbleweeds are growing in the southwest diversion ditch where no growth was apparent in previous years. This is probably the result of an unusually wet monsoon season in 1999. The weeds will not interfere with proper functioning of the ditch and no control is warranted.

Sloughing of rock and soil from the cliffs above the south apron of the disposal cell continues, but the scree slope along the base of the cliffs is not significantly larger than before. The scree slope is approximately 18-to-24-inches-high against the base of the vertical face of native rock. Some larger pieces of sandstone (up to 12 inches in diameter) have rolled down the cliff face and out onto the riprap apron, as noted during previous inspections. Mass wasting from the cliffs above the south apron is a slow process that is expected to continue. It is not a result of large-scale erosion in the cliffs above, nor is this small accumulation of scree at the base of the cliffs a threat to the long-term performance of the disposal cell.

Site Perimeter. Boundary monument BM-11 is on a steep slope and erosion has occurred beneath the concrete pedestal that anchors the monument. This monument moves slightly when tested. Several perimeter signs and boundary monuments are also on steep slopes and exposed to erosion. Monuments and signs in unstable locations will be monitored during future inspections.

Tumbleweed accumulation along the west fence is less this year than in the past.

Outlying Areas. The area outward from the disposal site for a distance of 0.25 mile was visually inspected. No development or disturbance that could affect the site was observed. Nothing notable seems to have changed since the site was constructed in 1994.

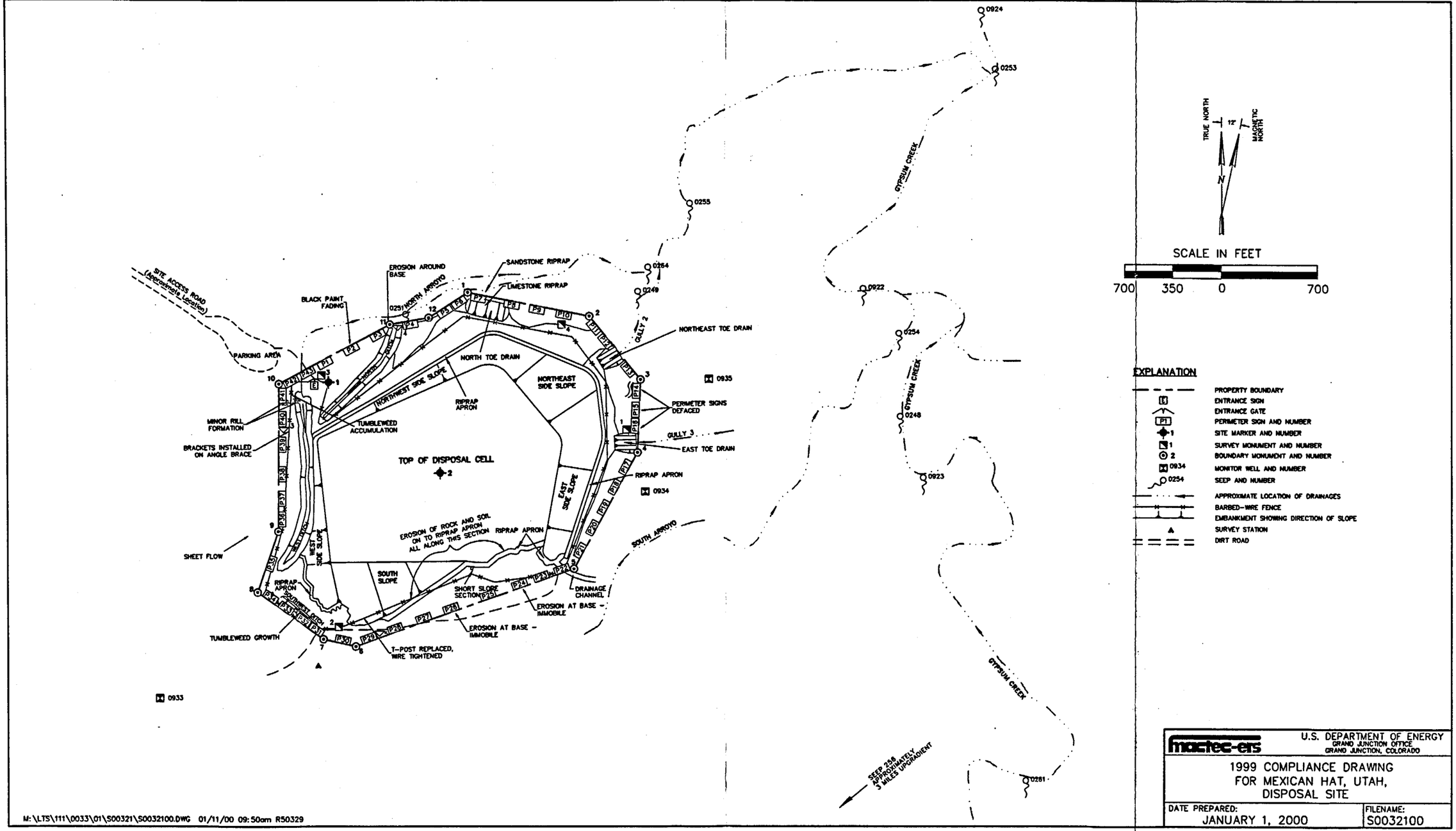


Figure HAT-1. 1999 Compliance Drawings for Mexican Hat, Utah, Disposal Site

2.0 Follow-up or Contingency Inspections

The LTSP stipulates that DOE will conduct follow-up or contingency inspections if evidence exists that disposal cell integrity is threatened. No follow-up or contingency inspections were required at this site in 1999.

3.0 Maintenance

The LTSP stipulates that DOE will conduct maintenance to maintain the site in secure and protective condition. DOE performed minor fence repairs at the Mexican Hat site in 1999.

4.0 Ground-Water Monitoring

The lower unit of the Halgaito Formation constitutes the uppermost aquifer at the Mexican Hat Disposal Site. The water in this aquifer is not a potential present or future source of drinking water because of hydrocarbons and entrained hydrogen sulfide. Aquifer waters are isolated from overlying strata by impermeable rock and an upward gradient. Monitoring is not required for the uppermost aquifer.

Permeable strata in the upper unit of the Halgaito Formation contain contaminated processing-related fluids, which migrate downdip to the north and emerge as seeps in North Arroyo and Gypsum Creek.

In accordance with the LTSP, DOE analyzes ground water at six seeps near the site to monitor cell performance (Seeps 248, 249, 251, 254, 261, and 922). Five additional seeps are analyzed as a best management practice. The seeps are along North Arroyo and Gypsum Creek (Figure HAT-1). Seep 261 is upgradient from the disposal site and is considered to be representative of background ground water. The LTSP states that seep water will be sampled in the vicinity of Seep 249. Seep 249 has been dry for at least 2 years, but samples have been collected and analyzed from nearby Seep 264. Those results are presented as representative of Seep 249 in this report and are labeled as such.

These seeps are surface expressions of water in the upper unit of the Halgaito Formation. This is not an aquifer because of scattered ephemeral water poor quality and low yield. Water from historical processing operations, limited precipitation, and perhaps, transient drainages from the cell or seepage from nearby sewage lagoons, represents the only recharge for this stratum.

The seeps are sampled when there is sufficient water. Only a few of the seeps flow perennially. Flow in the others is dependent on recent precipitation. Some seeps are dry or yield too little water to be sampled after periods of dry weather.

4.1 Frequency of Monitoring

The LTSP specifies that DOE will monitor the seeps periodically. The period is unspecified. In 1999, DOE sampled the seeps quarterly.

4.2 Analytes

The LTSP specifies that seep water be analyzed for uranium, sulfate, and nitrate. In addition, DOE currently analyzes samples for standard water-quality indicators, field parameters, and hazardous constituents for which there is an EPA MCL.

4.3 Results of Ground-Water Monitoring in 1999

Ground water in the seeps was sampled in November 1998 and February, May, August, and November 1999. (Results of sampling in November 1999 will not be available for inclusion in this report. The November 1999 results will be included in the 2000 annual report). Results of sampling in November 1998 and February, May, and August 1999 are presented in Table HAT-2.

Table HAT-2. Analytical Results for Seep Sampling in 1999

Analyte	MCL	Sample Date	Sample Location					
			261 (upgradient)	248	249	251	254	922
Nitrate (as NO_3)	44	11/98	0.220B	ND	ND	2070	ND	171
		2/99	0.577B	183	1110	576	ND	182
		5/99	0.0693B	ND	ND	ND	ND	199
		8/99	0.0160B	229	ND	ND	ND	157
Sulfate	N/A	11/98	3220	ND	ND	4780	ND	2880
		2/99	3440	2460	4440	2460	ND	3050
		5/99	3950	ND	ND	ND	ND	3000
		8/99	3610	3180	ND	ND	ND	3040
Uranium	0.044	11/98	0.0324	ND	ND	1.57	ND	0.342
		2/99	0.0301	0.411	1.44	0.633	ND	0.334
		5/99	0.0324	ND	ND	ND	ND	0.372
		8/99	0.0170	0.605	ND	ND	ND	0.346

U = undetected at respective laboratory reporting limit.; ND = no data due to insufficient water.
All results in mg/L. Samples shown in bold exceed the MCL.

The nitrate concentration at Seeps 249 and 251 does not indicate a clear trend with time, and individual results vary erratically (Figure HAT-2). These seeps are located downgradient from the cell and are assumed to be most sensitive to precipitation runoff or transient drainage. These seeps could be sampled only in February 1999; there was insufficient water to collect a sample during the other sampling episodes. The nitrate concentration in ground water at Seeps 248 and 922 has remained essentially steady since 1995. The background nitrate concentration remains below 1 mg/L. Seep 254 has been too dry to collect a sample since 1995. All sample results for Seeps 248, 249, 251, and 922 exceed the MCL for nitrate of 44 mg/L.

Sulfate concentrations at upgradient and downgradient seeps are essentially constant with time. The native rock is likely naturally gypsiferous, and white salts have been deposited at many of the sample locations. Background sulfate concentrations do not differ from downgradient concentrations.

Uranium concentrations exceeded the MCL of 0.044 mg/L at all downgradient seeps that were sampled and has remained essentially unchanged since sampling began in 1985.

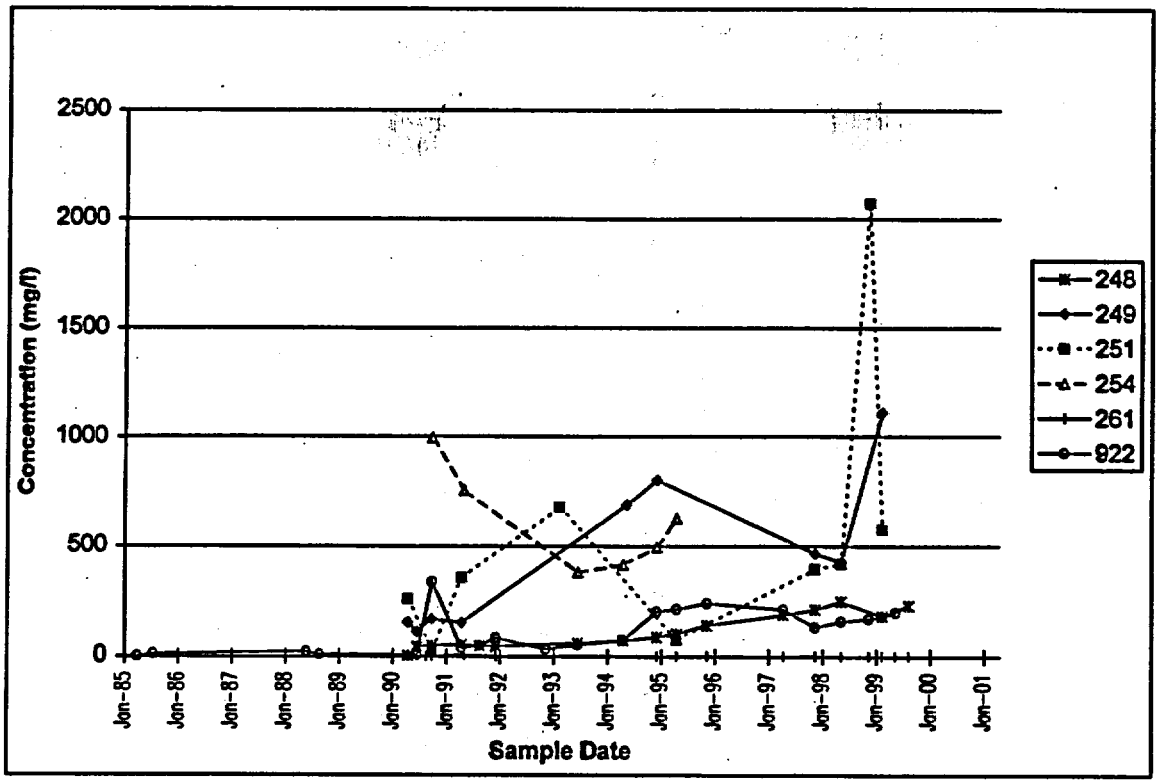


Figure HAT-2. Nitrate Concentrations at the Mexican Hat, Utah, Disposal Site

5.0 Corrective Actions

The LTSP stipulates that DOE will implement corrective actions if evidence exists that the disposal cell is not functioning as designed. No corrective actions were required at this site in 1999.

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Annual Compliance Report
Lakeview, Oregon, Disposal Site

Compliance Summary

The site was inspected on May 19, 20, and 21, 1999 and met all compliance requirements The results of the rock size sampling and evaluation determined that the median diameter by weight continues to satisfy the D_{50} design requirement. No cause for a follow-up or contingency inspection was identified. Minor fence maintenance will be required. Ground-water monitoring results indicate that the disposal cell is performing as designed.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Lakeview, Oregon, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Collins Ranch Disposal Site, Lakeview, Oregon* (August 1994, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-19F, Rev. 3), and in procedures established by DOE to comply with requirements of 10 CFR Part 40.27. These requirements are listed in Table LKV-1.

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

Requirement	LTSP	This Report
Annual Inspection and Report	Section 6.1	Section 1.0
Follow-up or Contingency Inspections	Section 7.0	Section 2.0
Maintenance	Section 8.0	Section 3.0
Ground-Water Monitoring	Section 5.3	Section 4.0
Corrective Actions	Section 9.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The Lakeview, Oregon, disposal site was inspected on May 19, 20, and 21, 1999. The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in this report are shown on Figure LKV-1.

1.1 Specific Site Surveillance Features

This section describes specific site surveillance features investigated during the inspection.

A private road allows access to the site entrance. DOE has a permanent easement to use this road. Approximately 0.5 mile east of the site, the landowner has placed a cable across the road. By arrangement with the landowner, DOE has a padlock on the cable so DOE access to the site

is unimpeded. The entrance gate and barbed-wire fence surrounding the site are in good condition. The purpose of the gate and fence is to keep out cattle to prevent over grazing.

The entrance sign and 10 of 12 perimeter signs are in excellent condition. Two perimeter signs, P10 and P12, are damaged by bullet holes but remain fully legible. The two site markers, three survey monuments, and three boundary monuments are in excellent condition. All monitor wells were inspected and are locked and in good condition.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the top of the disposal cell; (2) the side slopes of disposal cell, north drainage channel including the energy dissipation area (EDA), rock aprons, and trench drains; and (3) the site perimeter and outlying areas extending 0.25 mile beyond the site property boundary. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or long-term disposal cell performance.

Top 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 top slope was seeded with grasses; sparse cover of relatively shallow-rooted grasses is a consequence of the thin (nominal 4-inches-thick) topsoil layer. The low water storage capacity of the topsoil layer will continue to limit perennial grass growth under current climatic conditions. Movement of precipitation through the riprap and bedding layers and into the radon barrier favors the growth of shrubs. Many mature rabbitbrush plants and a few mature sagebrush and bitterbrush plants grow on the top of the disposal cell. Shrub density likely will increase until it approaches or exceeds population levels observed in native plant communities adjacent to the site. Deep-rooted plants have the potential to increase the hydraulic conductivity of the radon barrier, allowing meteoric water to infiltrate the cell and potentially leach contaminants from the encapsulated tailings and into the underlying soil and ground water.

Radon monitoring was completed in May 1999. The monitoring consisted of placing passive radon detectors around the disposal cell and at background locations located away from any site influence. Detectors were changed quarterly for four quarters. The EPA standard states that the disposal cell can not cause annual offsite radon concentrations to increase by more that 0.5 pCi/L. The average radon concentration both on the site and at background locations was 0.2 pCi/L, which demonstrates compliance with the EPA standard. Equipment associated with the monitoring exercise was removed from the site by the inspection team.

Measurements of leaf area index were conducted in July 1999. The results will complement the plant community and soil profile studies conducted in May 1999. This information will be available for modeling the water balance of the cover, if necessary.

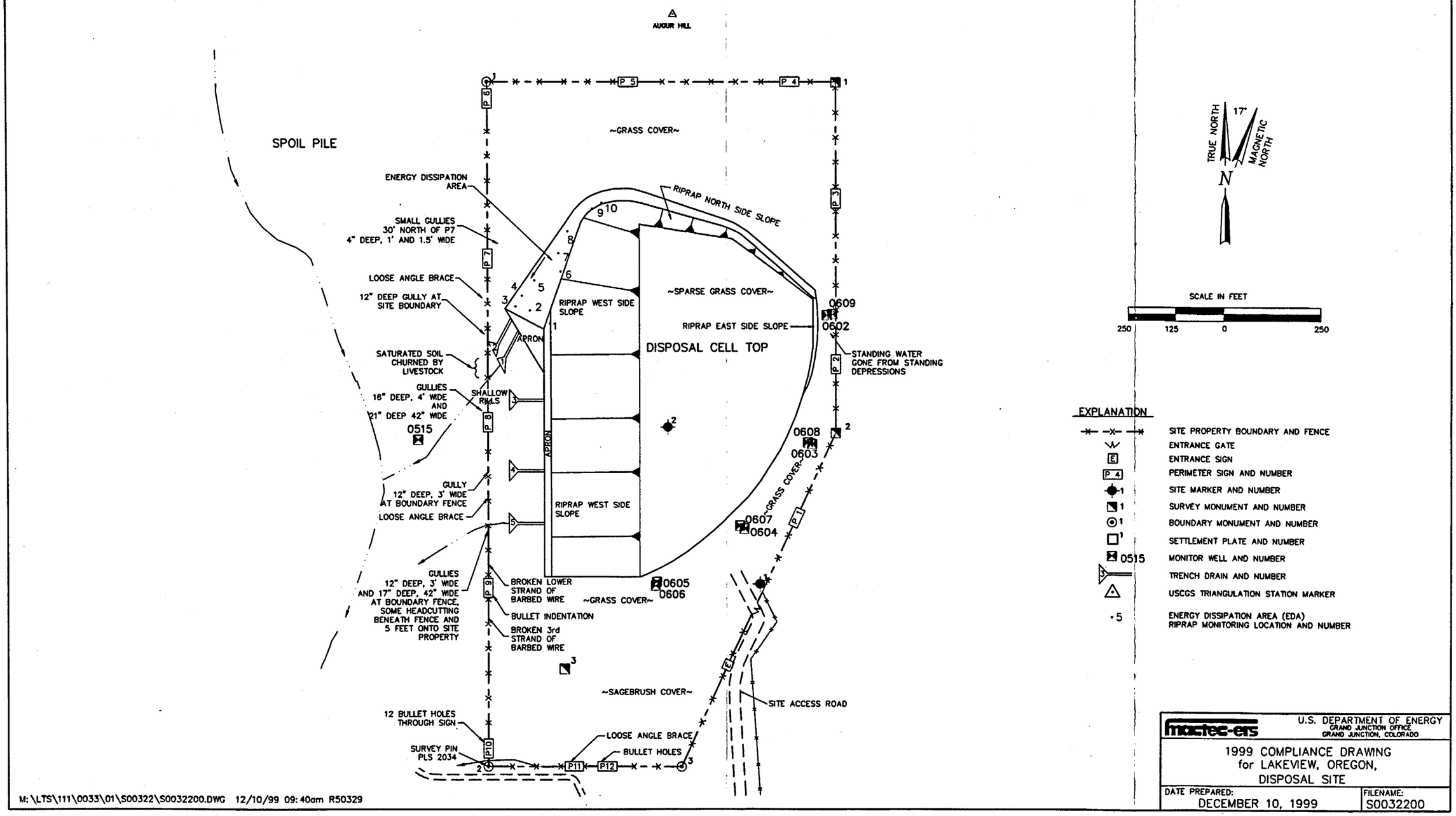


Figure LKV-1. 1999 Compliance Drawings for Lakeview, Oregon, Disposal Site

Side Slopes of Disposal Cell and Adjacent Drainage Channel, Aprons, and Trench Drains. Deterioration of riprap on the west and north side slopes and in the EDA at the lower end of the drainage channel is an ongoing concern because the riprap was sized to withstand the erosive potential of a probable maximum precipitation event. The percentage of crumbling rocks on the surface has noticeably increased since the riprap was placed in 1989.

The revised side slope riprap field monitoring procedure was implemented during the 1999 inspection, as specified in revisions to the LTSP. The revision entails the addition of 1.5- and 3-inch standard testing screens into the particle size distribution by weight (gradation) testing. Gradation data were collected at 10 random locations to confirm the baseline D_{50} determination. Size-distribution-by-count data were collected at 40 locations, including the 10 gradation locations, to establish a correlation between gradation and count results. The NRC representative observed the field monitoring procedure and found it to be acceptable. The results indicated a side slope riprap D_{50} of between 2.43 and 2.77 inches at 95 percent confidence, which is within the design specification. The D_{50} of the riprap exposed on the surface is 3.3 inches.

Ten photograph points for long-term rock monitoring in the EDA were established in 1997. Photographs of the monitoring locations were obtained during this inspection. No significant rock deterioration was discernable over the past year.

Grass encroachment persists in the riprap on the north side slope, in the upper or eastern part of the drainage channel, and in the EDA at the lower end of the drainage channel. Relatively sparse plant growth in the drainage channel will not influence the function of the channel and is not considered a problem.

Standing water was absent in the large depression in the EDA at the lower end of the drainage channel. Trench Drains 1 and 2 extend southwest from the EDA and appear to be 2 to 3 feet higher than the bottom of the EDA. Standing water was observed in the past in the EDA. This is a concern because inundation may accelerate deterioration of the large riprap due to freeze-thaw processes and secondary mineralization or alteration.

Site Perimeter and Outlying Areas. This transect includes the seeded grass area extending from the disposal cell to the site boundary, the site fence perimeter signs and boundary markers, and the native shrub/grass communities within 0.25 mile surrounding the site.

Minor gullies have formed in seeded areas extending west of Trench Drain Numbers 1 through 5 past the site boundary. The outflow from Trench Drain Number 2 has formed a 10-inch-deep gully at the site boundary. At the time of the inspection, the soil downslope from all five trench drains was saturated. Two gullies have formed west of Trench Drain Number 3, one gully west of Trench Drain Number 4, and two gullies west of Trench Drain Number 5. Dimensions of the gullies at the site perimeter are shown on Figure LKV-1. Most of the gullies appear to have become armored with gravel washed out of the native soil, but evidence of recent head cutting was observed at the gully downslope from Trench Drain Number 5. The gullies have not damaged the trench drains but may affect neighboring property and will be monitored during future inspections.

No standing water was observed in a depression just south of MW-602 and MW-609. Apparently, the shallow ditch excavated by inspectors during 1997 has corrected this problem.

Some strands of the perimeter fence were loose or broken. The top and second strands of the barbed-wire fence were loose and entangled in many places, probably caused by mule deer jumping the fence. Inspectors separated the strands. The bottom strand is broken north of P9 along the west boundary and the third strand is broken south of P9 along the west boundary. There was no evidence of livestock entering the site. Angle braces have popped out of brackets at three locations, and erosion from the trench drains has loosened two steel t-posts. The fence continues to keep livestock out of the disposal site. Fence maintenance will be required in the future.

2.0 Follow-up or Contingency Inspections

The LTSP stipulates that DOE will conduct follow-up or contingency inspections if evidence exists that the disposal site is threatened. No cause for a follow-up or contingency inspection was identified during the past year.

3.0 Maintenance

The LTSP stipulates that DOE will conduct maintenance to maintain the site in a secure and protective condition. No maintenance was required at the Lakeview site during the past year.

4.0 Ground-Water Monitoring

In accordance with the LTSP, DOE monitors ground water at this site to demonstrate the initial performance of the disposal cell. During remediation, tailings were moved from the former mill to the Lakeview, or Collins Ranch, Disposal Site, a "clean" site where ground water in underlying geologic formations was not contaminated except by naturally occurring minerals. The initial performance of the disposal cell will be considered demonstrated and acceptable if, after a period of ground-water monitoring, the results demonstrate that contaminants are not leaching from the disposal cell into local ground water. The estimated travel time for leachate to reach the ground water is between 50 and 100 years.

4.1 Monitoring Network

There are nine wells in the monitoring network: one upgradient well, MW-515, and four pairs of downgradient wells, MW-602 through MW-609 (Figure LKV-1). All wells are screened in the uppermost aquifer. In each pair of downgradient wells, one is screened at a depth of approximately 100 feet; the second is screened at approximately 150 feet. Since monitoring began, the shallower of the two wells in each downgradient pair has been dry.

4.2 Frequency of Monitoring

Wells in the monitoring network are sampled once every 5 years. The Lakeview site was included under the NRC general license in 1994. Therefore, the first postclosure sampling event was scheduled for 1999. However, at NRC request, DOE sampled in August 1998. DOE sampled again in 1999. The wells will be sampled next in 2004.

The ground-water section of the LTSP is to be evaluated on the same 5-year basis to determine the need for continued monitoring.

4.3 Analytes

Three hazardous analytes, arsenic, cadmium, and uranium, exceeded EPA MCLs in samples from the tailings pore fluid. Therefore, DOE analyzes ground-water samples for these three analytes plus standard water quality indicators and field parameters.

4.4 Results of Ground-Water Monitoring

Analytical results for arsenic, cadmium, and uranium in ground-water samples collected in 1999 are shown in Table LKV-2.

Table LKV-2. Summary of Ground-Water Sample Results at the Lakeview, Oregon, Disposal Site

Analyte	MCL	Ground-Water Sample Location				
		MW-515 (upgradient)	MW-606 (POC)	MW-607 (POC)	MW-608 (POC)	MW-609 (POC)
Arsenic	0.05	0.0092	0.0143	0.0076	0.0043B	0.001U
Cadmium	0.01	0.0003U	0.0003U	0.0003U	0.0003U	0.0003U
Uranium	0.044	0.00047B	0.00084B	0.00081B	0.00047B	0.0002U

All results in mg/L.
B = The reported value is less than the contract required detection limit but greater than or equal to the instrument detection limit
U = undetected at respective laboratory reporting limit

Cadmium and uranium were below the contract-required detection limit in all samples collected in 1999. Cadmium has never been above the contract-required detection limit in any downgradient monitor well since the disposal cell was completed in 1988. Similarly, uranium concentrations have remained at or below the detection limit in all downgradient monitor wells over the same period.

As in 1998, arsenic was detected in the 1999 samples from the upgradient well and in three of the downgradient wells (Figure LKV-4). The highest concentration of arsenic, 0.0143 mg/L at MW-606, is approximately 1.6 times greater than the concentration of arsenic, 0.0092 mg/L, in the upgradient well. Arsenic in the remaining downgradient wells was equal to or less than that in the upgradient well. The concentration of arsenic in DOE wells has remained stable or essentially constant since the disposal cell was completed and DOE monitoring began.

Prior to construction of the disposal cell, the concentration of naturally occurring arsenic in local monitoring wells was as high as 110 mg/L. The natural abundance of arsenic in the area around the disposal cell, particularly at the deeper monitoring interval, is caused by the hydrothermal activity that has occurred—and that is still occurring—in the area.

Ground-Water Level Monitoring. The LTSP stipulates that ground-water level data will be provided with water quality data. Regional ground-water levels have been rising since 1995 (Figure LKV-2). The gradient, or direction of ground-water flow, continued to be to the southeast in August 1999. Therefore the downgradient monitor wells are in the correct location downgradient from the cell.

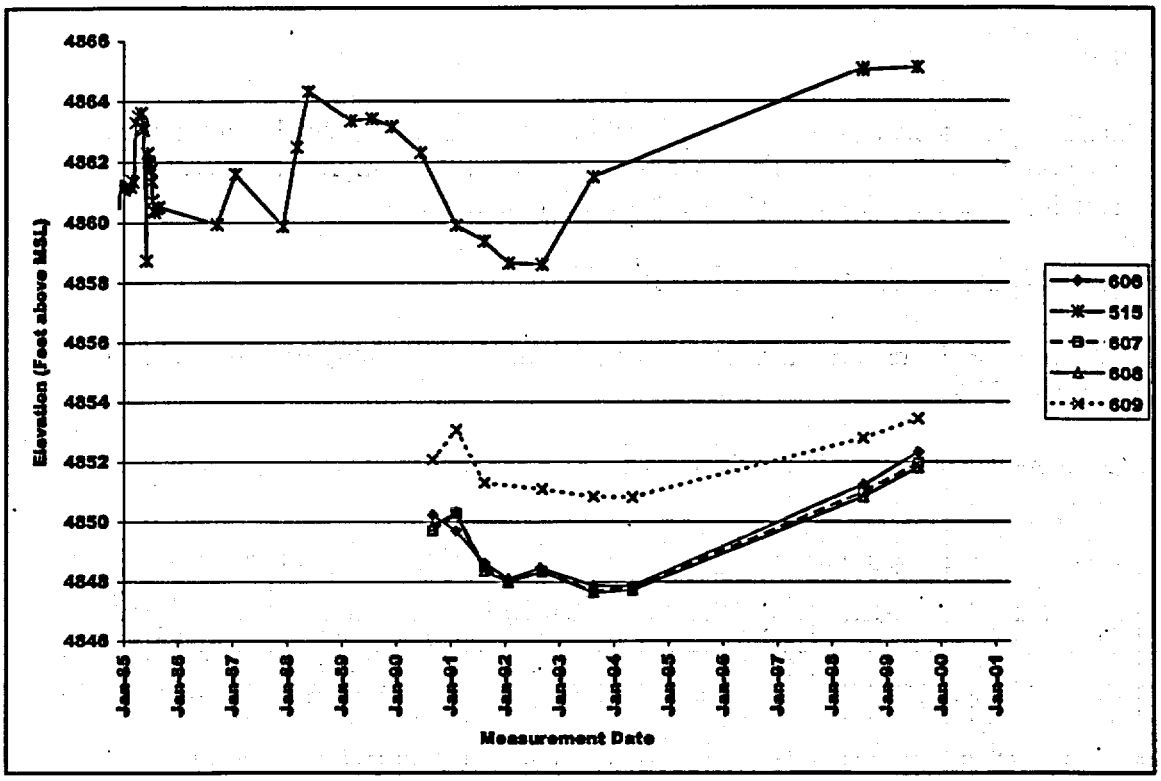


Figure LKV-2. Water Levels at the Lakeview, Oregon, Disposal Site

Ground-Water Monitoring Summary. The results of ground-water monitoring show that—10 years after the disposal cell was completed—the concentrations of all three target analytes are far below the MCL for each analyte and are at essentially background levels. No evidence that hazardous constituents are leaching from the enclosed tailings has been detected.

5.0 Corrective Actions

The LTSP stipulates that DOE will implement corrective actions if evidence exists that the disposal cell is not functioning as designed. No corrective actions were required at this site in 1999.

Annual Compliance Report
Lowman, Idaho, Disposal Site

Compliance Summary

The site, inspected on September 15, 1999, was in excellent condition and met all compliance requirements. Minor repairs were made to the erosion-control project built in 1998, which sustained some damage from spring runoff. No additional maintenance tasks are required. Encroachment of vegetation in the riprap is increasing and will be evaluated. No cause for follow-up inspection or corrective action has been identified. Ground-water monitoring results indicate that the disposal cell is performing as designed.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Lowman, Idaho, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Lowman, Idaho, Disposal Site*, (April 1994, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-36, Rev. 1), and procedures established by DOE to comply with requirements of 10 CFR 40.27. These requirements are listed in Table LOW-1.

Table LOW-1. License Requirements for the Lowman, Idaho, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 6.1	Section 1.0
Follow-up or Contingency Inspections	Section 7.0	Section 2.0
Maintenance	Section 8.0	Section 3.0
Ground-Water Monitoring	Section 5.3	Section 4.0
Corrective Actions	Section 9.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The Lowman, Idaho, disposal site was inspected on September 15, 1999. The purposes of the annual inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that may affect site integrity, and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in this report are shown on Figure LOW-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

Entrance and Perimeter Signs. Entrance sign E1, adjacent to the entrance gate, was stolen. Entrance sign E2, at the site boundary near site marker SMK-1, has bullet holes but is still legible. DOE recommends that sign E1 not be replaced.

Eighteen perimeter signs mark the site boundary. All signs are legible and in good condition. Erosion was noted previously at the base of sign posts P1, P6, P8, and P18. Erosion around these signs did not increase over the past year, and all signs remain stable.

Site Markers. Site markers SMK-1, just inside the site boundary near the end of the access road, and SMK-2, on top of the disposal cell, are in excellent condition.

Survey Monuments and Boundary Monuments. Seven monuments mark the boundary of the site. Three are combined survey-boundary monuments, SM-1/BM-1, SM-2/BM-2, SM-4/BM-4; and four are boundary monuments with less precise elevation control, BM-3, BM-5, BM-6, and BM-7. All seven monuments were in good condition. Erosion previously noted around the base of SM-2/BM-2 appears to have been corrected during the erosion control project completed in 1998 (see Section 2, "Follow-up or Contingency Inspections").

Monitor Wells. Six ground-water monitoring wells are located near the disposal cell. All wells are locked and in good condition.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the top and side slopes of the disposal cell; (2) on-site areas immediately adjacent to the disposal cell, including the site boundary; and (3) areas adjacent to the site property, extending 0.25 mile beyond the property boundary. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features, such as monitor wells, survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or the long-term performance of the site.

Top and Side Slopes. The top and side slopes of the disposal cell are armored with basalt riprap. An apron of large diameter riprap, 25 to 35 feet wide, surrounds the disposal cell on all sides to protect the disposal cell from erosion. The riprap is in excellent condition. Inspectors observed no cracks, depressions, slumps, or other indication of slope instability on or around the disposal cell.

Encroachment of vegetation (biointrusion) on the top and side slopes of the disposal cell is increasing. Ponderosa pine is the most noticeable species. Some of these trees are now more than 4 feet tall. Other species include redosier dogwood, whortleberry, Norway cinquefoil, common mullein, and thistle. The long-term effect of these plants on the integrity of the disposal cell should be evaluated to determine if vegetation control is required to preserve cell integrity.

Areas Adjacent to the Disposal Cell. The steep slopes east and south of the site are stable with well established ponderosa pine and grasses.

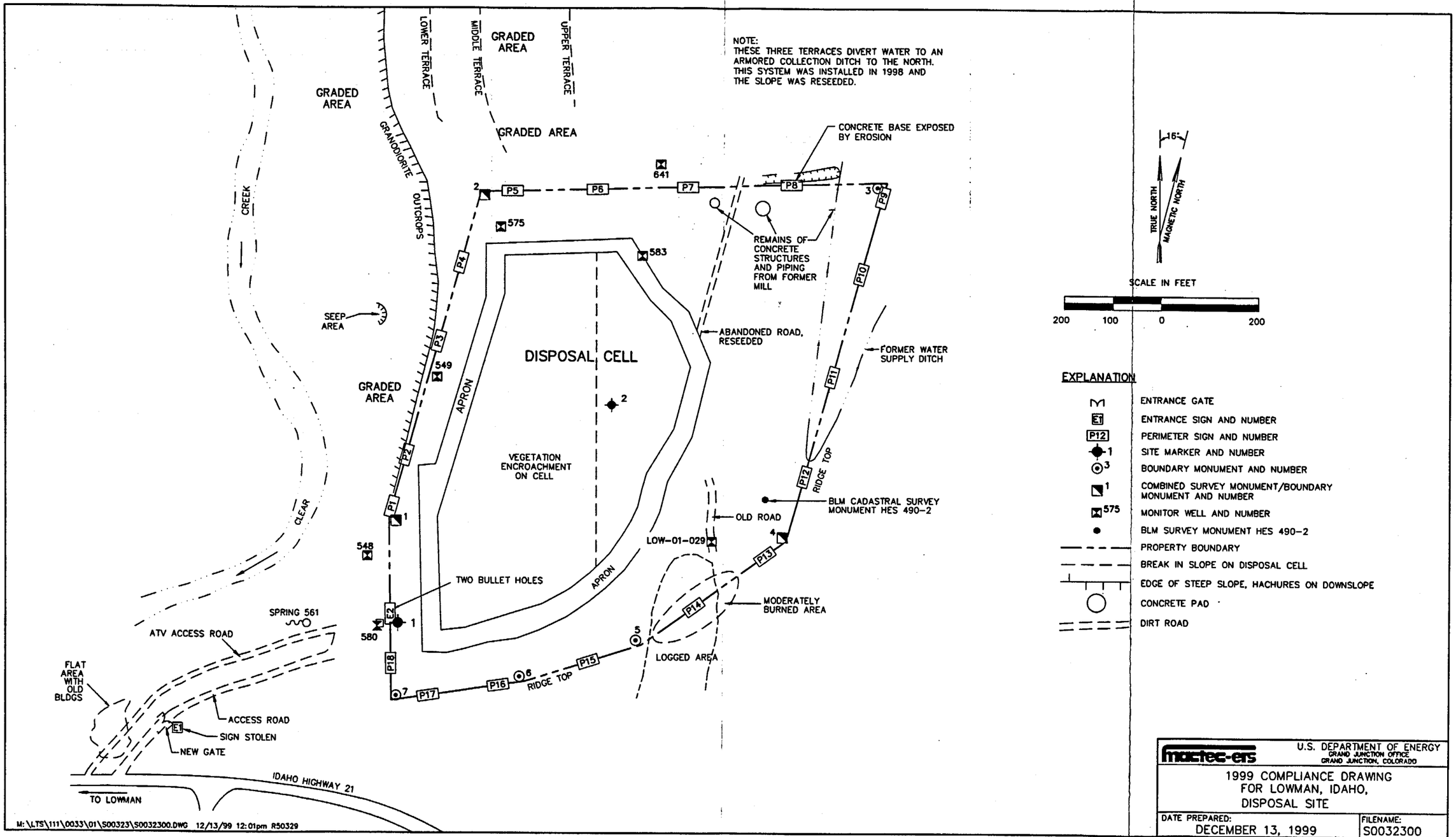


Figure LOW-1. 1999 Compliance Drawings for Lowman, Idaho, Disposal Site

Rills, reported previously along the slopes north and west of the disposal cell, are gone as a result of the erosion control project completed in fall 1998. Rills may reappear if vegetation does not establish in these areas.

Areas Adjacent to the Site Property. The area outward from the disposal site for a distance of 0.25 mile was visually inspected for evidence of construction, development, logging, or changes in land use that might affect the site. None was observed.

2.0 Follow-up or Contingency Inspections

The LTSP stipulates that DOE will conduct a follow-up or contingency inspection if site conditions have changed or if evidence exists that the disposal site is threatened. A follow-up inspection was conducted at this site in May 1999 to evaluate the condition of an erosion control remedy built in fall 1998.

In September and October 1998, DOE completed an erosion control project to reclaim the land damaged by erosion and to prevent erosion from migrating toward the disposal cell. The erosion control project included regrading the slope north of the disposal site and constructing three terraces to intercept runoff and divert it off site to the north and into Clear Creek. Erosion protection rock was placed west of the cell. A silt fence was installed above Clear Creek to preserve water quality in protected Bull Trout habitat. The soils in the affected areas, consisting mostly of weathered country rock, were amended and reseeded.

In May 1999, inspectors found that small portions of the upper interceptor terraces had washed out as a result of snowmelt and spring rains. DOE repaired the damage to these terraces in September 1999. As a result of the reseeding that occurred in conjunction with the erosion control project, there is significantly more vegetation on the slopes than ever before. Additional seeding was planned for fall 1999.

Another follow-up inspection is recommended in spring 2000 to evaluate the success of the erosion control structures and revegetation after a second winter season.

3.0 Maintenance

The LTSP stipulates that DOE will conduct maintenance to maintain the site in a secure and protective condition. DOE repaired the erosion control system at the Lowman site in 1999. No other maintenance was required this past year.

4.0 Ground-Water Monitoring

Ground water is monitored in accordance with the LTSP to demonstrate the initial performance of the disposal cell.

The Lowman site is unique among UMTRCA tailings sites in that the mill processed heavy mineral sands by a mechanical separation process to produce columbite-euxenite and monazite sand concentrates. The concentrates were shipped elsewhere for chemical processing. No chemical process was used at the mill, so there are no process-related chemicals in underlying soils or local ground water. Ground water at the site is not contaminated. Only residual,

radioactive sand, consisting of refractory oxides and silicates with very low leachability characteristics, remained on site for remediation.

4.1 Monitoring Network

The LTSP designates seven sampling locations at the Lowman site. Sampling locations consist of the following six wells and one spring:

MW-583	Upgradient, north of the disposal cell
MW-641	Upgradient, north of the disposal cell
MW-548	Downgradient, west of the disposal cell
MW-549	Downgradient, west of the disposal cell
MW-575	Downgradient, northwest of the disposal cell
MW-580	Downgradient, southwest of the disposal cell
Spring 561	Downgradient, southwest of the disposal cell

Location of the wells and spring are shown on Figure LOW-1.

4.2 Sampling Frequency

The six wells and one spring are sampled annually.

4.3 Analytes

Cell performance will be demonstrated by continued background levels of antimony, which was detected in tailings pore fluids. The compliance limit of 0.007 mg/L was derived on the basis of the background antimony concentration. Samples are also analyzed for standard water quality indicators and field parameters.

4.4 Results of Ground-Water Monitoring

DOE sampled the six wells and one spring in 1999. In all samples, the concentration of antimony was below the detection limit. (The instrument detection limit for antimony and similar metals is about 0.001 mg/L.)

5.0 Corrective Actions

The LTSP stipulates that DOE will implement corrective actions if evidence exists that the disposal cell is not functioning as designed. No corrective actions were required at this site in 1999.

Annual Compliance Report
Maybell, Colorado, Disposal Site

Compliance Summary

The site, inspected on September 21, 1999, was overall in excellent condition and met all compliance requirements. Inspectors noted unauthorized grazing as a result of vandalism to the perimeter fence and improper installation of the fence. The fence was repaired subsequent to the inspection. No further maintenance is required. Water level monitoring reveals a gradual increase since 1997 with no component in the increase attributable to transient drainage. No other ground-water monitoring is required. There is no cause for follow-up or contingency inspections, or corrective actions.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Maybell, Colorado, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Maybell, Colorado, Disposal Site* (July 1999, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-247, Rev. 2), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table MAY-1.

Table MAY-1. License Requirements for the Maybell, Colorado, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Sections 3.0 and 6.2	Section 1.0
Follow-up or Contingency Inspections	Section 3.0	Section 2.0
Maintenance	Section 4.0	Section 3.0
Ground-Water Monitoring	Section 2.6	Section 4.0
Corrective Actions	Section 5.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The site, northeast of Maybell, Colorado, was inspected by DOE-GJO on September 21, 1999. Inspectors determined that the site was overall in excellent condition.

The purposes of the annual inspection were to confirm the integrity of visible features at the site, to identify changes or new conditions that may affect site integrity, and to determine the need, if any, for maintenance or additional inspections and monitoring. Features mentioned in this report are shown on Figure MAY-1.

This site was licensed by the NRC on August 25, 1999. The 1999 inspection was the first by DOE-GJO.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

Access Road and Entrance Gates. Access to the site is from Moffat County Road 53. The access road is graveled and for the most part in good condition. A small gully crosses the road at one place.

The entrance gate is a steel stock gate secured by a chain and padlock. Another gate, farther west along the access road, is for grazing access to a reclaimed area outside the disposal site boundary. This second gate is also chained and locked. Both gates are in excellent condition.

Entrance and Perimeter Signs. The entrance sign is mounted on a t-post in the fence line near the entrance gate.

Fifty-four perimeter or warning signs, designated P1 through P54 on Figure MAY-1, surround the site more or less along the site boundary. (The exact number of signs will be confirmed during the next inspection.) Where the fence is on or near the site boundary, the signs are mounted on t-posts in the fence. Along the east boundary, the signs are mounted about 5 feet above the ground on steel posts set in concrete. All signs are new and in excellent condition.

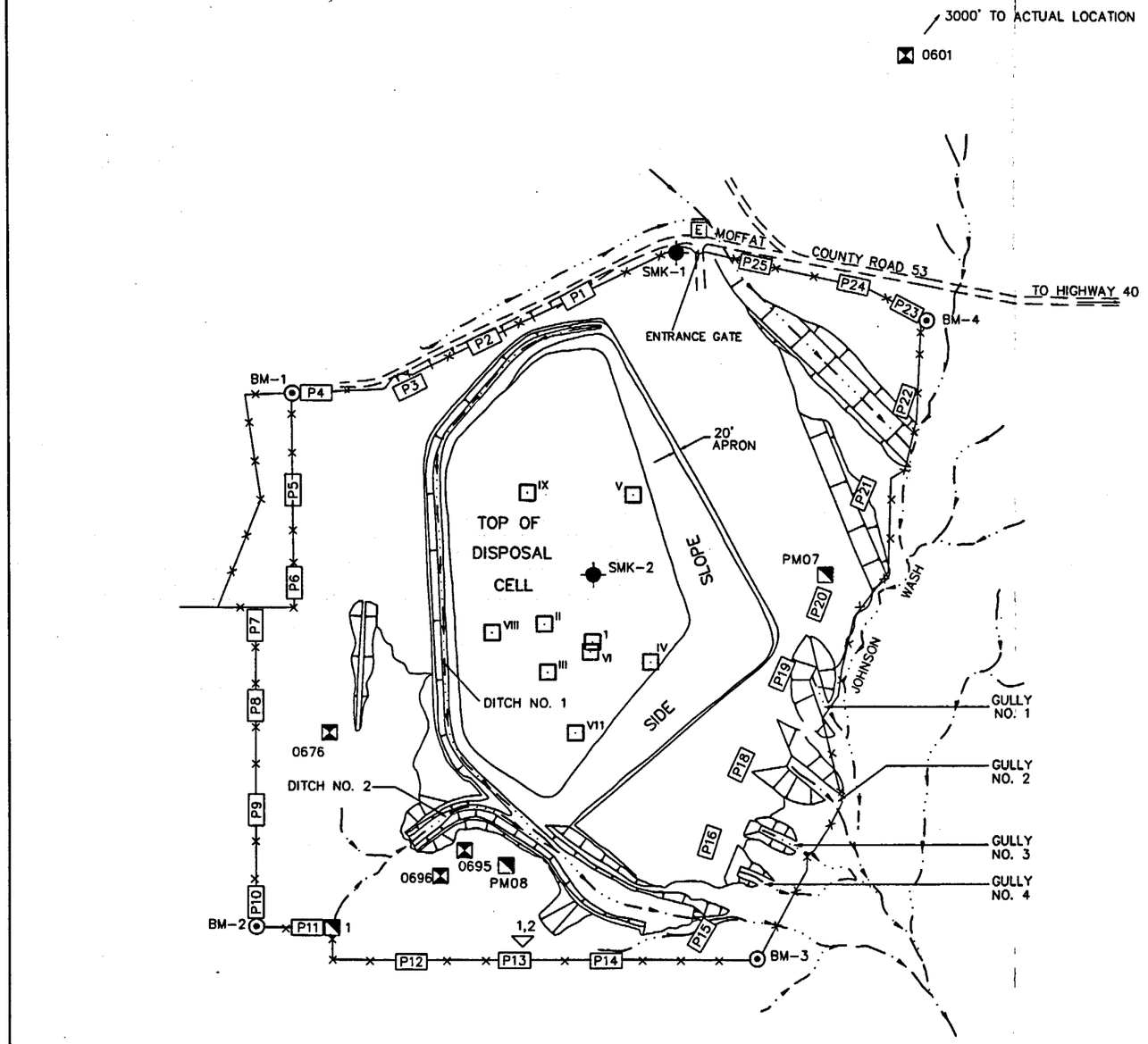
Site Markers, Boundary and Survey Monuments. The two granite site markers are also new and in excellent condition. Site marker SMK-1 is near the entrance gate just west of the entrance sign; the second marker, SMK-2, is on top and at the approximate center of the disposal cell.

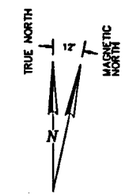
Two survey monuments establish horizontal and vertical control for the site. Survey monument PM-07 is east and PM-08 is south of the disposal cell.

Four boundary monuments identify the four corners of the site. Boundary monuments BM-1 through BM-4 are numbered counterclockwise from BM-1 at the northwest corner of the site. All monuments, including survey and boundary, are new and in excellent condition.

Monitor Wells. There are four monitor wells in the monitoring network at this site. These wells are used to monitor water levels only (Section 4.0, this report.) Several additional wells exist, but they are not monitored and were not formally inspected.

Settlement Plates. There are nine settlement plates on top of the disposal cell. Elevations of the settlement plates will be surveyed annually for 5 years (from 2000 through 2004) to detect settlement. These measurements are required because of the large volume of slimes contained in the cell. Settlement plates are labeled SP-I through SP-IX on Figure MAY-1. Casings that cover the settlement plates are new and in excellent condition.





SCALE IN FEET

700 350 0 700

EXPLANATION

- GRAVEL ROADS
- E — ENTRANCE SIGN
- ENTRANCE GATE
- P1 — PERIMETER SIGN AND NUMBER
- SMK-1 — SITE MARKER AND NUMBER
- PM07 — SURVEY MONUMENT AND NUMBER
- BM-1 — BOUNDARY MONUMENT AND NUMBER
- IV — SETTLEMENT PLATE AND ROMAN NUMERAL NUMBER
- 0695 — MONITOR WELL AND NUMBER
- APPROXIMATE LOCATION OF DRAINAGES
- 1 — PHOTOGRAPH LOCATION AND NUMBER
- BARBED-WIRE FENCE
- EMBANKMENT SHOWING DIRECTION OF SLOPE

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1999 COMPLIANCE DRAWING FOR MAYBELL, COLORADO, DISPOSAL SITE	
DATE PREPARED: DECEMBER 13, 1999	FILENAME: S0032400

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Figure MAY-1. 1999 Compliance Drawings for Maybell, Colorado, Disposal Site

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects (1) the disposal cell; (2) other areas onsite; and (3) the site perimeter and outlying areas. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features, such as monitor wells, survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other disturbance that might affect site integrity or the long-term performance of the site.

Disposal Cell. The disposal cell is covered with riprap to provide long-term protection from wind and water erosion. The riprap and the top and side slopes of the disposal cell are in excellent condition. There was no evidence of cracking, settlement, slumping, or erosion on any riprapped surface. Panoramic views of the 66-acre disposal cell from the south are shown in the accompanying photographs (MAY PL-1 and MAY PL-2).

Other Areas Onsite. This transect comprises the area onsite between the disposal cell and the site boundary.

Areas within this transect that were disturbed during construction of the disposal cell were graded and seeded to complete remedial action at the site. Grasses expected, as a result of the seeding, have not yet established. Part of the problem appears to be overgrazing on a site where grazing is not part of the management plan for the grass. Cattle have entered the site where the fence was vandalized or otherwise inadequate to keep them out. Fencing is discussed in the next section of this report.

There are stockpiles of unused riprap east of the disposal cell. Rill development was also noted east of the disposal cell. Rilling will not be an issue if the grass is allowed to establish. The condition of the grass and rill formation will continue to be evaluated.

Site Perimeter and Outlying Areas. The perimeter fence is a barbed-wire stock fence. Although fencing materials were in good to excellent condition, inspectors found two problems. First, the fence had been intentionally opened (vandalized) at several locations to allow cattle to graze on site; and second, erosion along several arroyos was sufficient to allow cattle to walk under the fence to graze onsite.

Inspectors closed the fence at all locations where it had been vandalized. Subsequent to the inspection, additional wires were strung across the arroyos to prevent cattle from using the arroyos to enter the site.

The area beyond the site boundary for a distance of 0.25 mile was visually inspected for erosion, development, change in land use, or other disturbance that might affect the long-term integrity of the site. None was seen.

2.0 Follow-up or Contingency Inspections

Other than a return to the site for fence maintenance, no follow-up or contingency inspections in response to new or changed conditions at the site were required in 1999.

3.0 Maintenance

Regularly scheduled, routine maintenance is not identified for this site. Maintenance to upgrade and repair the perimeter fence is described in Section 1.0 of this report.

4.0 Ground-Water Monitoring

Ground-water monitoring to demonstrate compliance with EPA ground-water protection standards is not required at this site because ground water in the uppermost aquifer is of limited use and a narrative supplemental standard has been applied. The limited use designation is based on the fact that ground water in the uppermost aquifer is not a current or potential source of drinking water. The ground water is contaminated by widespread, naturally occurring mineralization and associated exploration and mining activities and cannot be cleaned up by using methods reasonably employed by public water supply systems.

As a best management practice, DOE will monitor water levels in selected wells, for a limited time, in an attempt to detect transient drainage related to disposal cell construction.

DOE, NRC, and the state understand that detection and evaluation of transient drainage by ground-water level monitoring very likely will not be definitive. This is because the potential increase in water levels that might result from transient drainage is likely to be masked by (1) a decrease in water levels, as a processing-related mound of ground water beneath the disposal cell dissipates; and (2) the natural fluctuation in ground-water levels in response to precipitation.

Consequently, because of these variables, an increase in water levels downgradient from the disposal cell may or may not be due to transient drainage, and very likely will not be due to transient drainage alone. Should an increase in ground-water levels be due, in part, to transient drainage, it will likely be impossible to measure the size of the transient drainage component relative to other contributing factors that have no bearing on the performance of the disposal cell.

4.1 Monitor Wells

Monitor well MW-695 is the downgradient or control well. MW-696 is nearby and serves as a backup for MW-695. Data from MW-696 will be reported if the data logger in MW-695 fails or if data from two wells differ significantly. Monitor well MW-601 is approximately 1 mile northeast of the disposal site and serves as the background or reference well. Monitor well MW-676 is west of the disposal cell and serves as a cross-gradient well. Well locations are on the drawing, Figure MAY-1.

4.2 Frequency of Monitoring

Water levels are monitored by data loggers installed in four wells. Data loggers are downloaded quarterly.

4.3 Results of Water Level Monitoring

Hydrographs from MW-601, MW-695, and MW-676 are shown in Figure MAY-2. The hydrographs for MW-695 and MW-676 show that water levels near the disposal cell began to rise in late summer or early fall of 1997. A rise in the water level is also evident in the hydrograph for the more distant background well MW-601, but it is less certain when the rise began. The intermittent results for MW-601 are due to malfunctioning data loggers. A new data logger was installed in this well in August 1999.

Although data from background well MW-601 are intermittent, the data are of primary interest. The arrow point at the right end of the hydrograph for MW-601 is a manual measurement of the water level obtained in August 1999. The manual reading was used to calibrate the new data logger as it was installed in the well.

Simply, the gradual increase in water levels in control well MW-695 and cross-gradient well MW-676 both track with the rising water level measured at background well MW-601. Therefore, the rise in ground-water levels, so far, appears to be regional and not due to transient drainage. These data will be updated in next year's annual report.

5.0 Corrective Actions

Corrective actions to protect the integrity of the disposal cell were not required in 1999.

6.0 Photographs

Table MAY-2. Photographs Taken at Maybell, Colorado, Disposal Site, 1999

Photograph Location Number	Description
PL-1	Panorama of site from south boundary, View 1.
PL-2	Panorama of site from south boundary View 2.

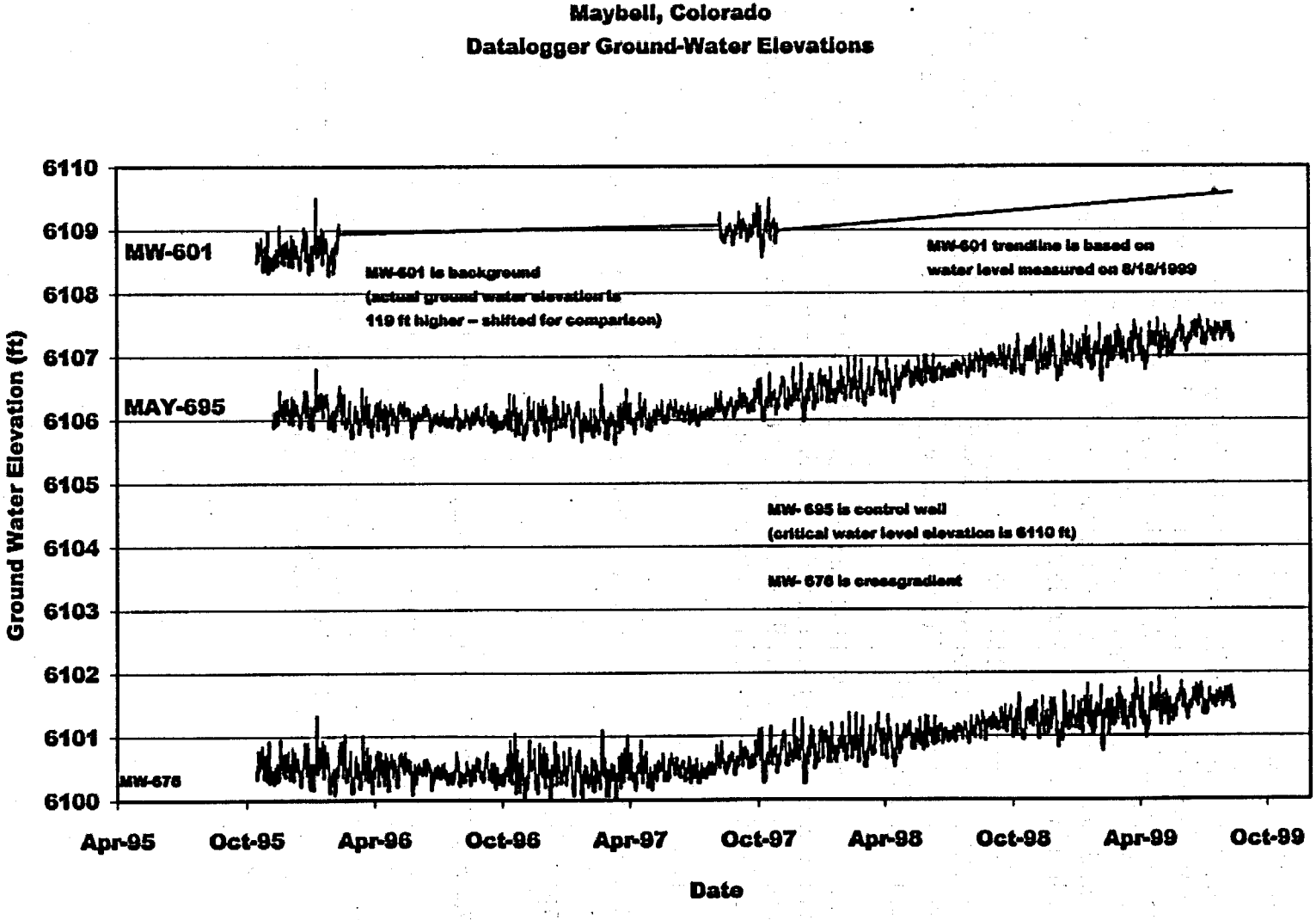


Figure MAY-2. Data Logger Ground-Water Elevations at Maybell, Colorado, Disposal Site

MAY/99. PL-1. Panorama of Site From South Boundary, View 1

MAY/99. PL-2. Panorama of Site From South Boundary, View 2

Annual Compliance Report
Naturita (Upper Burbank), Colorado, Disposal Site

Compliance Summary

The Naturita, Colorado, disposal site was inspected on September 22, 1999 and met all compliance requirements. Revegetation of graded and disturbed areas north of the disposal will require more time to evaluate success. Little erosion is occurring in areas adjacent to the cell as most of the site is armored with riprap or has exposed bedrock. No additional maintenance tasks are required. Ground-water monitoring will begin in 2000. No cause for a follow-up inspection, contingency inspection, or corrective action has been identified.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Naturita, Colorado, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Upper Burbank (Naturita), Disposal Cell, Uravan, Colorado*, (July 1999, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-250, Rev. 1), and in procedures established by DOE to comply with requirements of 10 CFR 40.27. These requirements are listed in Table NAT-1.

Table NAT-1. License Requirements for the Naturita (Upper Burbank), Colorado, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 3.1	Section 1.0
Follow-up or Contingency Inspections	Section 3.4	Section 2.0
Maintenance	Section 4.0	Section 3.0
Ground-Water Monitoring	Section 2.6.2	Section 4.0
Corrective Actions	Section 5.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The Naturita, Colorado, Disposal Site was inspected on September 22, 1999. The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in this report are shown on Figure NAT-1.

This site was licensed by the NRC on August 25, 1999. The 1999 inspection was the first by DOE-GJO.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated at the site.

Access Road, Entrance Sign, and Perimeter Signs. Access to the Naturita disposal site is from Montrose County Road EE22 that intersects State Highway 141 at Uravan. Road EE22 borders the site on the east. The entrance gate (NAT PL-1) consists of a pair of tubular metal gates that hang on galvanized steel gate posts. A chain with a padlock secures the two gates. Conventional barbed-wire stock fence surrounds the site. Two additional metal gates allow access to monitor wells adjacent to the west side of the cell.

Standing just to the right (northwest) of the entrance gate, the entrance sign displays the 24-hour GJO telephone number. Perimeter warning signs of the standard UMTRA design, mounted on galvanized steel posts placed a few feet inside the perimeter fence, mark the site in 23 places.

The access road, gate, entrance sign, and all perimeter signs are new and in excellent condition.

Site Markers, Survey and Boundary Monuments Two granite site markers (SMKs) identify the Naturita site. SMK-1 is set just inside and left of the entrance gate, and SMK-2 (NAT PL-2) is located on the disposal cell in the south-central portion of the top slope. Both markers were undisturbed and in good condition.

Three survey monuments of the standard UMTRA design, SM-3, SM-4, and SM-11, were located and photographed. The survey monuments were undisturbed and in good condition.

The site property boundary has 17 corners. The corners are marked by boundary monuments BM-1 through BM-17. Boundary monument BM-3, BM-4 and BM-11 do not exist as their function is served by survey monuments SM-3, SM-4 and SM-11. All boundary monuments were undisturbed and in good condition.

Standpipe and Monitor Wells. The standpipe installed on the northeast slope of the disposal cell and the wells in the monitoring network are secured with padlocks and in good condition.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the top and side slopes of the disposal cell; (2) the area between the disposal cell toe and the site boundary, including the riprap-covered toe drains, toe drain outlets and interceptor trench, and the reclaimed areas surrounding the disposal cell; and (3) outlying areas adjacent to the site property, extending 0.25 mile beyond the property boundary. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features, such as monitor wells, survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or the long-term performance of the site.

Disposal Cell Top and Side Slopes. Rock covers the 2-acre top (NAT PL-3) of the disposal cell and the approximate 8 acres of the side slopes. The rock shows no signs of degradation and no vegetation is evident.

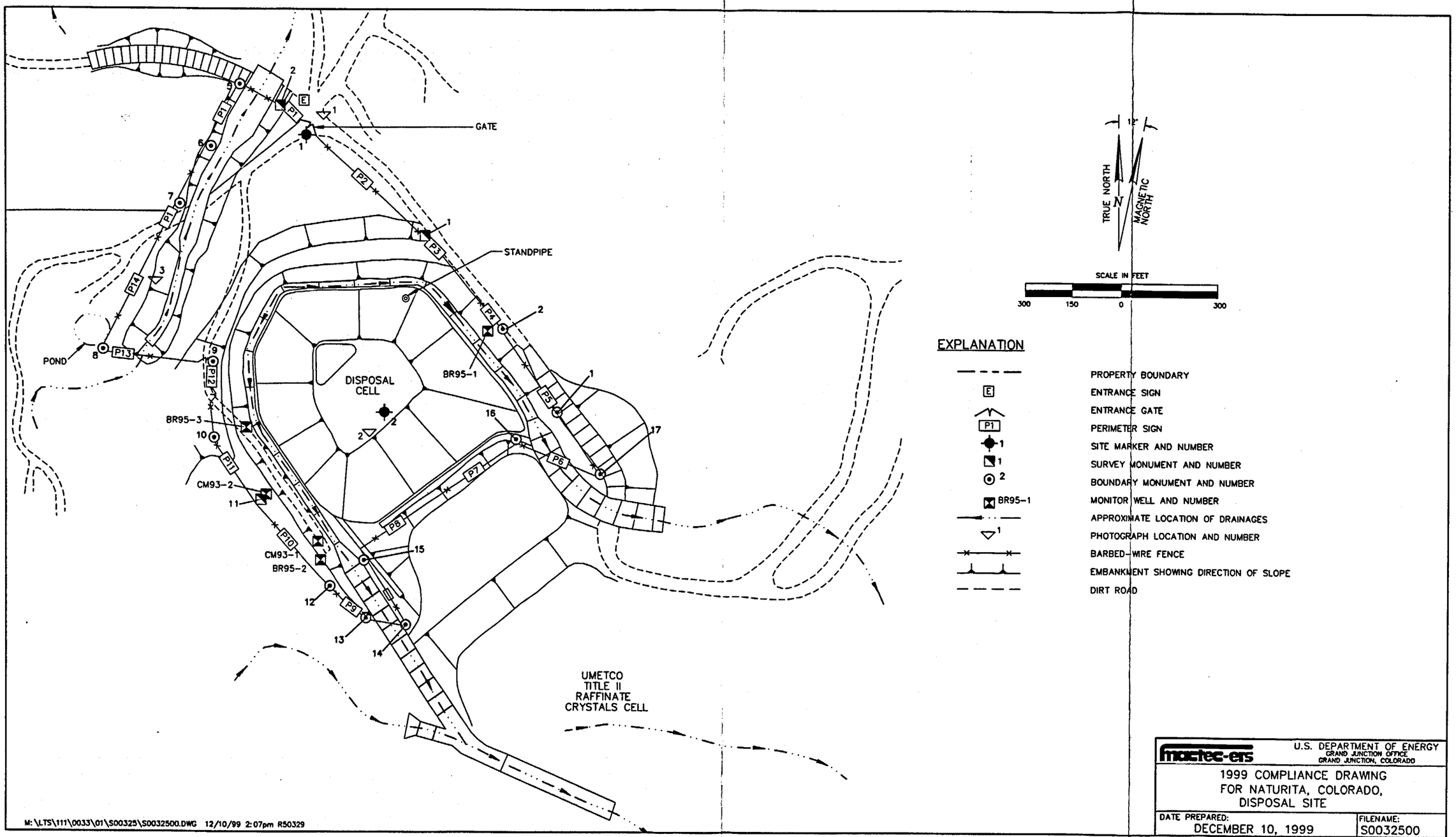


Figure NAT-1. 1999 Compliance Drawings for Naturita, Colorado, Disposal Site

Area Between the Disposal Cell Toe and the Site Boundary. Two riprap-filled toe drains collect water from the cell side slopes and divert it to the southeast. The toe drain on the western side of the cell exits through a channel quarried through the wall of the native sandstone and into a deep canyon leading to the San Miguel River. The eastern toe drain exits through the adjacent Title II disposal site and crosses County Road EE22. Both toe drains are in good condition.

A riprap-armored interceptor channel situated north of the disposal cell diverts storm water and snow melt run-on to the east across County Road EE22. The channel is in excellent condition but the county road may become eroded when storm water exits the channel onto the road as no culvert under the road was provided. A dam was constructed beyond the west end of the interceptor channel to minimize deposition of sediment in the channel

The disturbed area north of the disposal cell and south of the interceptor channel was seeded. Some grass is growing under a sparse cover of annual weeds, primarily Kochia. The level of revegetation success will not be evident for several years and will be monitored during future inspections.

Stopes and adits from the Cotter mine are located north of the cell on the embankment above the access road leading to the monitor wells. Some maintenance activity by Cotter can be expected but no adverse impacts to the integrity of the disposal cell are expected.

The site is enclosed with a barbed-wire stock fence. The fence is in excellent condition and cattle grazing should be of little concern because forage within the site or in the immediate area is minimal.

Outlying Areas. The site boundary and the area within 0.25 mile of the site boundary are highly disturbed by former mining, quarrying, and road building activities. Work continues on the UMETCO (formerly Union Carbide Corporation) UMTRCA Title II tailings pile across County Road EE22 east of the site. The completed UMETCO Title II disposal cell (containing raffinate crystals) abuts the Title I disposal cell on south. No threats to site integrity were observed.

2.0 Follow-up or Contingency Inspections

The LTSP stipulates that DOE will conduct follow-up or contingency inspections if evidence exists that the disposal site is threatened. No cause for follow-up or contingent inspections was identified.

3.0 Maintenance

The LTSP stipulates that DOE will conduct maintenance to maintain the site in secure and protective condition. No maintenance was required this past year.

4.0 Ground-Water Monitoring

The LTSP stipulates that DOE will monitor the ground water beneath the site to demonstrate initial cell performance. Water levels will be measured in designated monitor wells for at least 5 years following licensing to detect any seepage from the cell. If enough water is present in the

wells, samples will be collected and analyzed. The need for continued monitoring will be evaluated after the fifth year.

4.1 Monitoring Network

The LTSP designates five sampling locations at the Naturita site (Table NAT-2). DOE will monitor only the three BR95 wells unless sample results indicate that contamination relating to the disposal cell has reached the Salt Wash/Summerville contact, where these wells are screened. In that case, the deeper Wingate Formation (uppermost aquifer) wells will be monitored. UMETCO samples the CM93-series wells quarterly and the analytical results are available to DOE. Contamination has not been detected in the Wingate Aquifer after more than 40 years of uranium processing activities in the region.

Table NAT-2. Ground-Water Monitoring Network at the Naturita, Colorado, Disposal Site

Well Identifier	Zone of Completion
BR95-1	Salt Wash/Summerville Contact
BR95-2	Salt Wash/Summerville Contact
BR95-3	Salt Wash/Summerville Contact
CM93-1	Wingate
CM93-2	Wingate (POC well)

Well locations are shown on Figure NAT-1.

4.2 Sampling Frequency

Water level measurements (and samples, if possible) will be collected once each during the first, third, and fifth years following licensing.

4.3 Analytes

Indicator analytes and compliance standards for the POC at the Naturita Disposal Cell are arsenic (0.05 mg/L), molybdenum (0.1 mg/L), and uranium (0.044 mg/L). Ground water samples also will be analyzed for the constituents listed in Table 2.2 of the LTSP, standard water quality indicators, and field parameters.

4.4 Results of Ground-Water Monitoring

Postlicensing monitoring under the LTSM Program will begin in 2000. Wells BR95-2 and BR95-3 were sampled in 1997 and 1998. Sample results are presented in Table NAT-3. Fluids at the Salt Wash/Summerville contact are known to be elevated in uranium because of local mineralization and mining activities.

Wells CM93-1 and CM93-2 were sampled in May 1997. Arsenic concentrations were 0.0071 and 0.0059 mg/L, respectively. Molybdenum and uranium concentrations were below the laboratory reporting limit.

Table NAT-3. Indicator Analyte Concentrations in Ground Water at the Naturita, Colorado, Disposal Site

Analyte	MCL	Sample Date	BR95-1	BR95-2	BR95-3
Arsenic	0.05	3/97	–	0.001U	0.001U
		9/97	–	0.001U	–
		2/98	–	0.001U	–
		8/98	–	0.001U	0.0051
Molybdenum	0.1	3/97	–	0.0104	0.0309
		9/97	–	0.0102	–
		2/98	–	0.0107	–
		8/98	–	0.0067U	0.0186
Uranium	0.044	3/97	–	0.0429	0.0133
		9/97	–	0.0427	–
		2/98	–	0.0386	–
		8/98	–	0.0382	0.0249

All concentrations are expressed in mg/L. "–" indicates the well was not sampled, presumably because not enough water was present after purging the well.

Water levels were measured in Wells BR95-1, BR95-2, and BR95-3 in 1997 and 1998. No trends were discernable.

Standpipe. A standpipe was placed in the cell during construction to monitor water accumulation. Transient drainage should percolate through the porous sandstone floor of the cell. Water levels in the standpipe have recovered after pumping in June 1998, but have since fallen slightly. The water level will be measured once each during the first, third, and fifth years following licensing. The need for continued monitoring will be evaluated after each measurement.

5.0 Corrective Actions

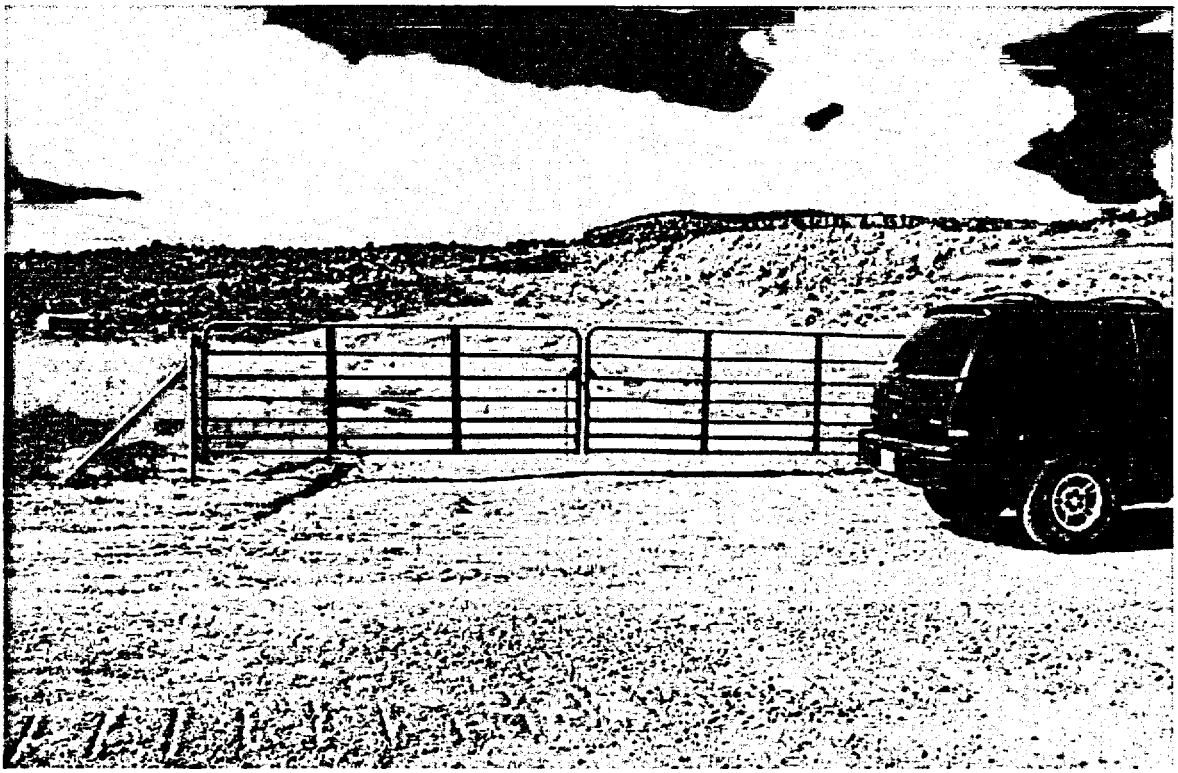
The LTSP stipulates that DOE will implement corrective actions if evidence exists that the disposal cell is not functioning as designed. No corrective actions were required at this site in 1999.

6.0 Photographs

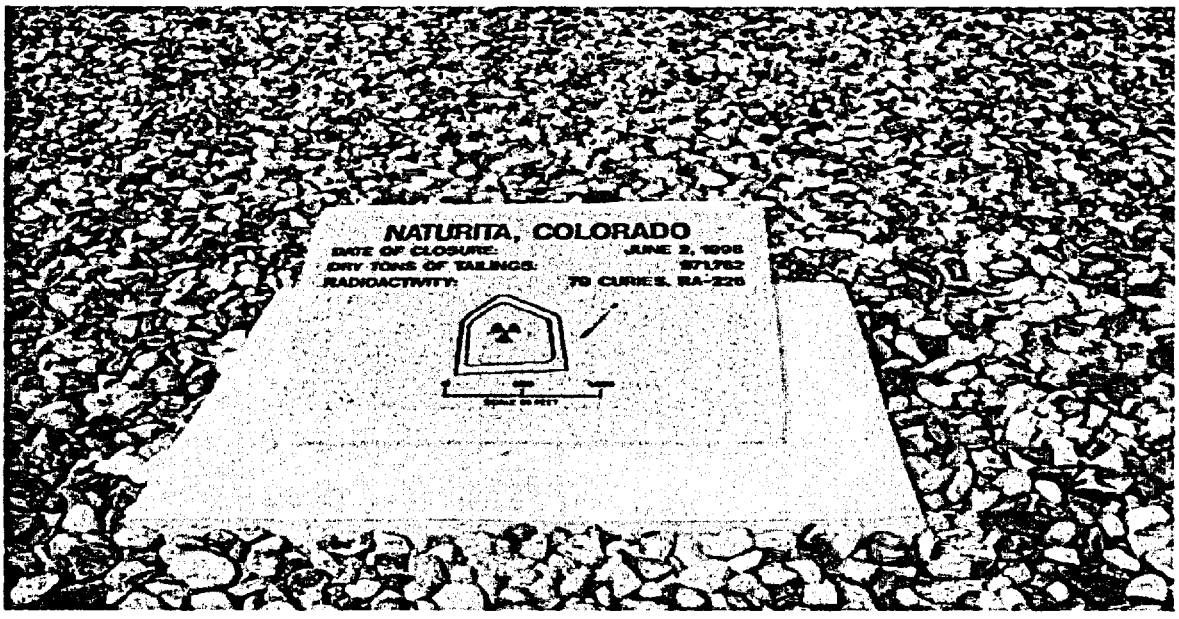
Table NAT-4. Photographs Taken at Naturita, Colorado, Disposal Site, 1999

Photograph Location Number	Description
PL-1	Entrance gate
PL-2	Site marker SMK-2 on top slope
PL-3	Disposal cell top and side slopes

End of current text



NAT/99. PL-1. Entrance Gate



NAT/99. PL-2. Site Marker SMK-2 on Top Slope

NAT/99. PL-3. Disposal Cell Top and Side Slopes

Annual Compliance Report
Rifle, Colorado, Disposal Site

Compliance Summary

The site, inspected on August 10, 1999, was in excellent condition and met all compliance requirements. Rock covering the disposal cell and toe ditch is in excellent condition and undisturbed. Revegetation is in excellent condition. There was no evidence this year of grazing other than by deer and elk. Erosion at the outlet of the toe ditch and in three arroyos south of the disposal cell is occurring, as anticipated; but rock placed above these areas is dropping into the eroding channels to prevent significant erosion. Rills noted previously east of the disposal cell are coming to grade and stabilizing with the establishment of vegetation. No maintenance is required and there is no requirement for a follow-up or contingency inspection, or for corrective action. Monitoring of water levels within the disposal cell suggests that water levels may soon peak below the 6,016-foot action level and then begin to decrease. No additional ground-water monitoring is required.

Compliance Requirements

Requirements for the long-term surveillance maintenance of the Rifle, Colorado, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Estes Gulch Disposal Site Near Rifle, Colorado,* (November 1997, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-235, Rev. 1), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table RFL-1.

Table RFL-1. License Requirements for the Rifle, Colorado, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Pages 3-1 through 3-3, and pages 6-1 through 6-2	Section 1.0
Follow-up or Contingency Inspections	Pages 3-3	Section 2.0
Maintenance	Page 4-1	Section 3.0
Ground-Water and Water-Level Monitoring	Pages 2-19 and Appendix	Section 4.0
Corrective Actions	Pages 5-1 through 5-2	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The site, north of Rifle, Colorado, was inspected by DOE-GJO on August 10, 1999. Inspectors determined that the site was in excellent condition.

The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes or new conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in this report are shown on Figure RFL-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

Access Road, Gate, Fence and Entrance and Perimeter Signs. The site is reached by driving north on an improved gravel road from State Highway 13. The entrance gate consists of a pair of tubular metal gates hinged to galvanized steel posts. A chain and padlock secures the two gates.

There is a conventional barbed-wire stock fence about half way between the southern edge of the toe ditch and southern boundary of the site. The fence extends, at both ends, to the edge of steep-sided arroyos that bound the site on the east and west.

It was discovered in 1998 that cattle were going around one or both ends of the fence to graze revegetated areas adjacent to the disposal cell. To correct this problem, extensions were added to the fence. The first extension runs for 600 feet from perimeter sign P11 north-northeast into the riprap along the edge of the toe ditch. The second extension continues the fence a short way down the slope into the arroyo that bounds the site on the west. There was no evidence of cattle on site since the fence was extended, although deer and elk sign is abundant. The grass is in excellent condition.

The entrance sign was found missing and presumed stolen. A new entrance sign was installed by ground water personnel after the inspection. Perimeter signs surround the disposal cell. On the south, they are aligned along the stock fence. Elsewhere they are on posts along the edge of the rock that armors the disposal cell. Perimeter signs were undisturbed.

Site Markers, Survey and Boundary Monuments. Two granite site markers, one just inside and left of the entrance gate and the other on the disposal cell, are undisturbed and in good condition.

There are three survey monuments and 15 boundary monuments. Boundary monuments are set at corners along an irregular site boundary. Although the LTSP mentions monuments at all 20 corners along the site boundary, monuments were set at only 15 of the corners because of the rough terrain.

Subsequent to the inspection, personnel returned to the site to survey all survey and boundary monuments with GPS equipment. The site drawing was corrected accordingly.

Standpipes. Three standpipes, MW-1, MW-2, and MW-3, are installed on the south sideslope of the disposal cell. All were undisturbed and in excellent condition. Dataloggers are installed in MW-2 and MW-3 to measure water levels. There is no datalogger in MW-1 because it is shallow and dry. Dataloggers in standpipes MW-2 and MW-3 are downloaded every 90 days. Results of water level monitoring are discussed in Section 4.0 of this annual report.

Monitor Wells. Ground-water monitoring is not required at this site, so monitor wells were not formally inspected.

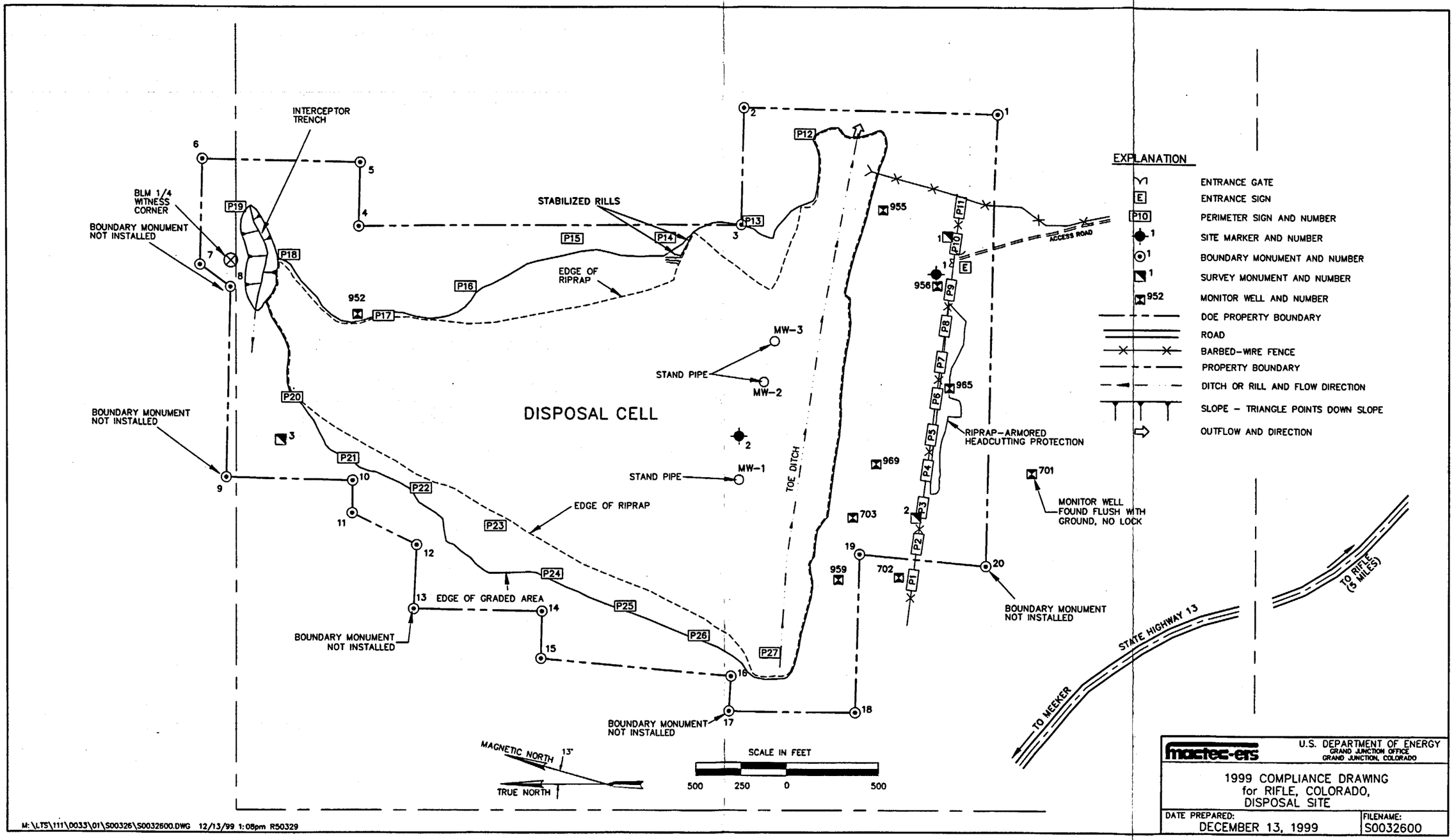


Figure RFL-1. 1999 Compliance Drawings for Rifle, Colorado, Disposal Site

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into four areas referred to as transects: (1) the disposal cell and interceptor trench, (2) the toe ditch and toe ditch outlet, (3) reclaimed areas, and (4) outlying areas.

Within each transect, the inspectors examined specific site surveillance features, such as site markers, survey and boundary monuments, perimeter signs, monitor wells, drainage structures, as well as vegetation, and other features.

Disposal Cell and Interceptor Trench. Rock armor covers the 71-acre disposal cell. The rock is in excellent condition. Inspectors found no plant encroachment in rock armored areas.

A revegetated interceptor trench was constructed at the top of the disposal cell to protect the cell from stormwater and snow-melt run on. The trench diverts water to the arroyo west of the site. The trench was designed so that erosion below the outfall of the trench would eventually erode to bedrock. Erosion is occurring, but it is still in the colluvium above the bedrock.

Toe Ditch and Toe Ditch Outlet Transect. The toe ditch runs along the southern (downslope) edge of the disposal cell. The toe ditch is armored with the same rock that protects the disposal cell. The toe ditch diverts runoff from the disposal cell off site to the east.

Minor erosion, anticipated in the design, has occurred below the outlet to the toe ditch. Bedrock is now exposed below the outlet, and rock in the bottom of toe ditch outlet is armoring the channel from further erosion.

Reclaimed Areas. Disturbed areas around the disposal cell and south of the disposal cell were reseeded in 1996. The vegetation, primarily grasses, is in excellent condition, as explained above. Limited cattle grazing occurred in the spring of 1998, but apparently not since the fence was improved by adding extensions. There was no evidence of grazing over the past year except by deer and elk.

In the reclaimed area south of the disposal cell, there are three large arroyos. To prevent headward migration of these arroyos, a rock apron was installed at the head of the arroyos. Where erosion has migrated into the rock apron, the rock has dropped into the arroyos to armor them from further erosion.

Rills noted during previous inspections in regraded areas east of the disposal cell are coming to grade and stabilizing with the establishment of vegetation.

Outlying Areas. The area beyond the site for a distance of 0.25 mile was visually inspected for signs of erosion, development, or other disturbance. The primary land use in the area is grazing and wildlife habitat. Inspectors observed no activity or development that might affect the site or the long-term performance of the disposal cell.

2.0 Follow-up or Contingency Inspections

No follow-up or contingency inspections in response to changed or unusual conditions were required in 1999.

3.0 Maintenance

No maintenance other than replacement of a stolen entrance sign was required in 1999.

4.0 Ground-Water and Water-Level Monitoring

Ground-Water Monitoring. Ground-water monitoring is not required because (1) the multiple component cover over the tailings will prevent infiltration and leaching of hazardous constituents; (2) ground water in the underlying Wasatch Formation is of limited use; and (3) the disposal cell is geologically isolated from the uppermost useable aquifer by 3,800 feet of low-permeability sedimentary rocks (siltstones).

Water-Level Monitoring. The disposal cell was constructed with a berm or earthen dam beneath the cover at the southern (downslope) end of the disposal cell. A liner extends part way up on the inside of the berm to an elevation of 6,018 feet. If water in the disposal cell should rise above this elevation, the concern is that it might overflow the liner and saturate the berm. DOE has agreed to monitor the water level in the disposal cell against this possibility. Dataloggers are installed in two standpipes, MW-2 and MW-3, for this purpose. (Standpipe MW-1 is dry and therefore not monitored.)

The LTSP Appendix identifies action levels when water in the standpipes reaches elevations of 6,014 feet and 6,016 feet. At 6,014 feet, DOE will begin to evaluate the need to intervene. At 6,016 feet, DOE must intervene by implementation of the contingency plan described in the LTSP Appendix. The contingency plan requires DOE to pump the standpipe wells to lower the water level to 6,014 feet.

Results of monitoring since August 1997 are shown in the accompanying figures RFL-2, RFL-3, and RFL-4. The data from MW-2 are incomplete because of a datalogger that shut down (Figure RFL-2). The datalogger in this standpipe was replaced in October 1998. The data for MW-3 are continuous (Figure RFL-3). Data from the two standpipes overlay, so DOE considers the second standpipe, MW-2, redundant or backup to MW-3 (Figure RFL-4).

The data show water levels in both standpipes at essentially the same elevation and gradually increasing in elevation. Noise or oscillations in the data are attributed to variations in barometric pressure. Most recently, water levels have varied between 6,014.5 feet. and 6,015 feet.

Superimposed on the data in each of the figures is a solid line that represents a second-order polynomial trend or fit for the data. An apparent flattening of the trend line is apparent from about the third quarter of 1998 on (Figure RFL-4). This trend line suggests that water levels will not significantly exceed the elevation of 6,015 feet, which is less than the action level elevation at 6,016 feet. DOE will continue to monitor water levels by downloading data loggers in the two standpipes on a quarterly basis.

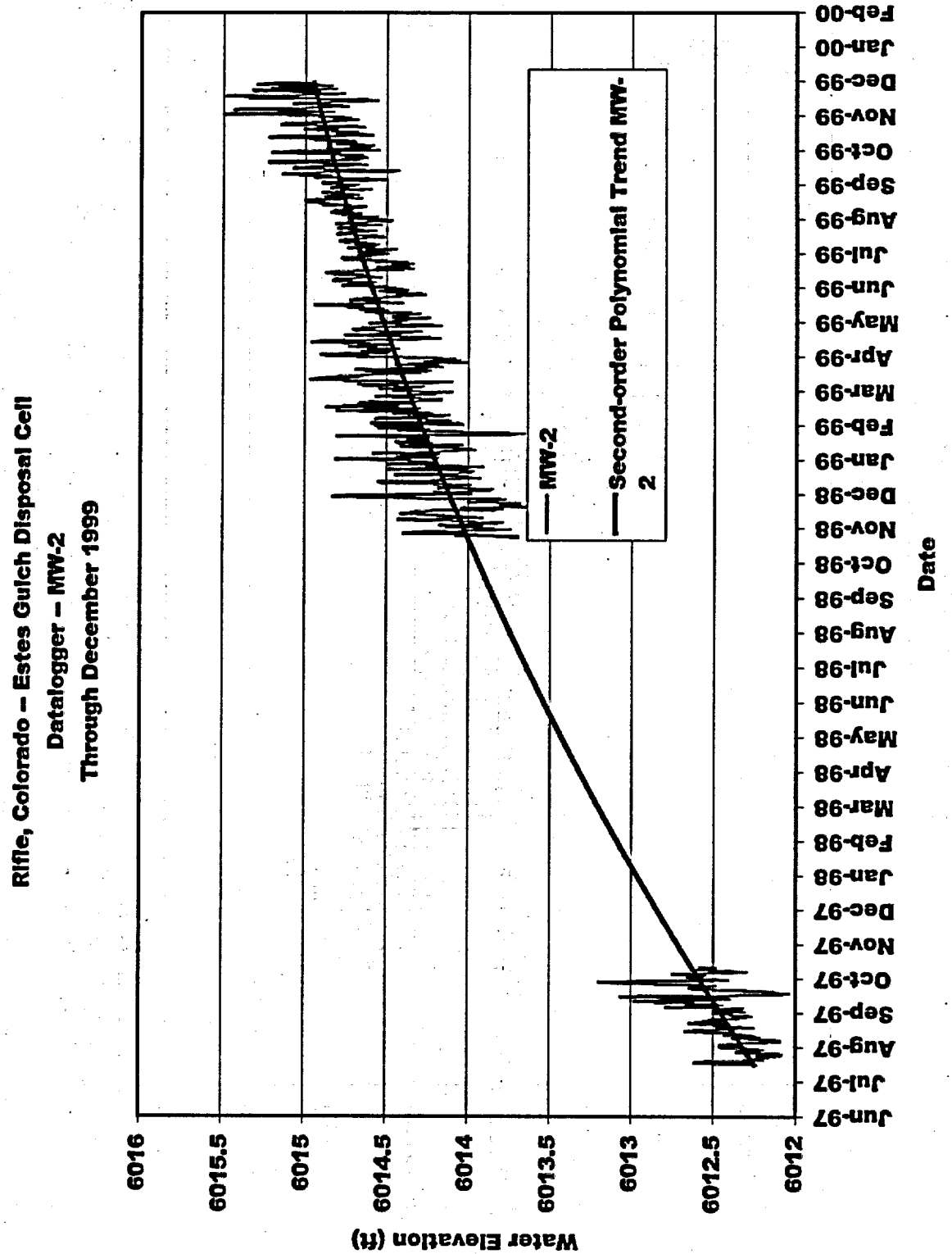


Figure RFL-2. Datalogger Information from MW-2 at Rifle, Colorado, Disposal Site

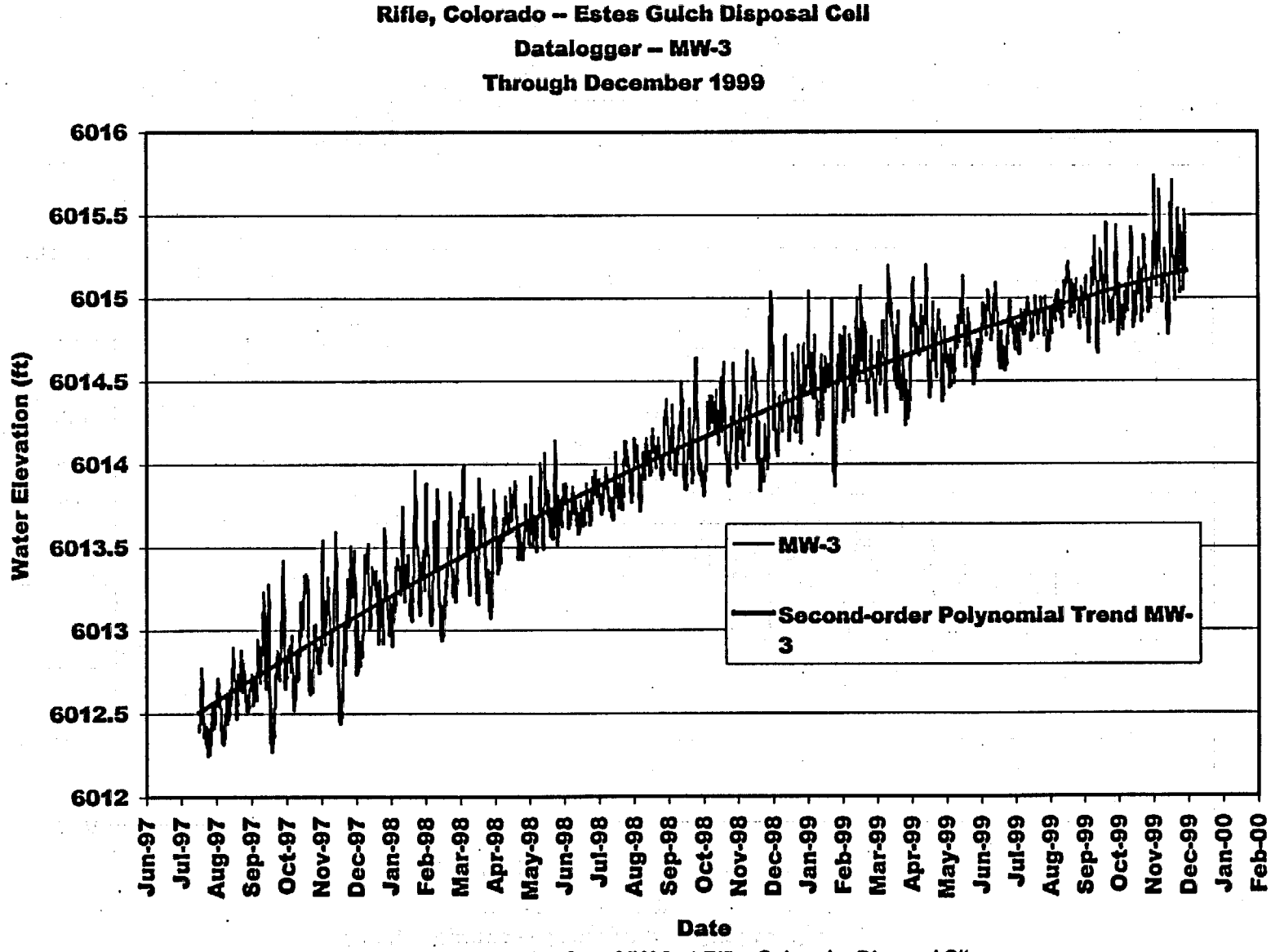


Figure RFL-3. Datalogger Information from MW-3 at Rifle, Colorado, Disposal Site

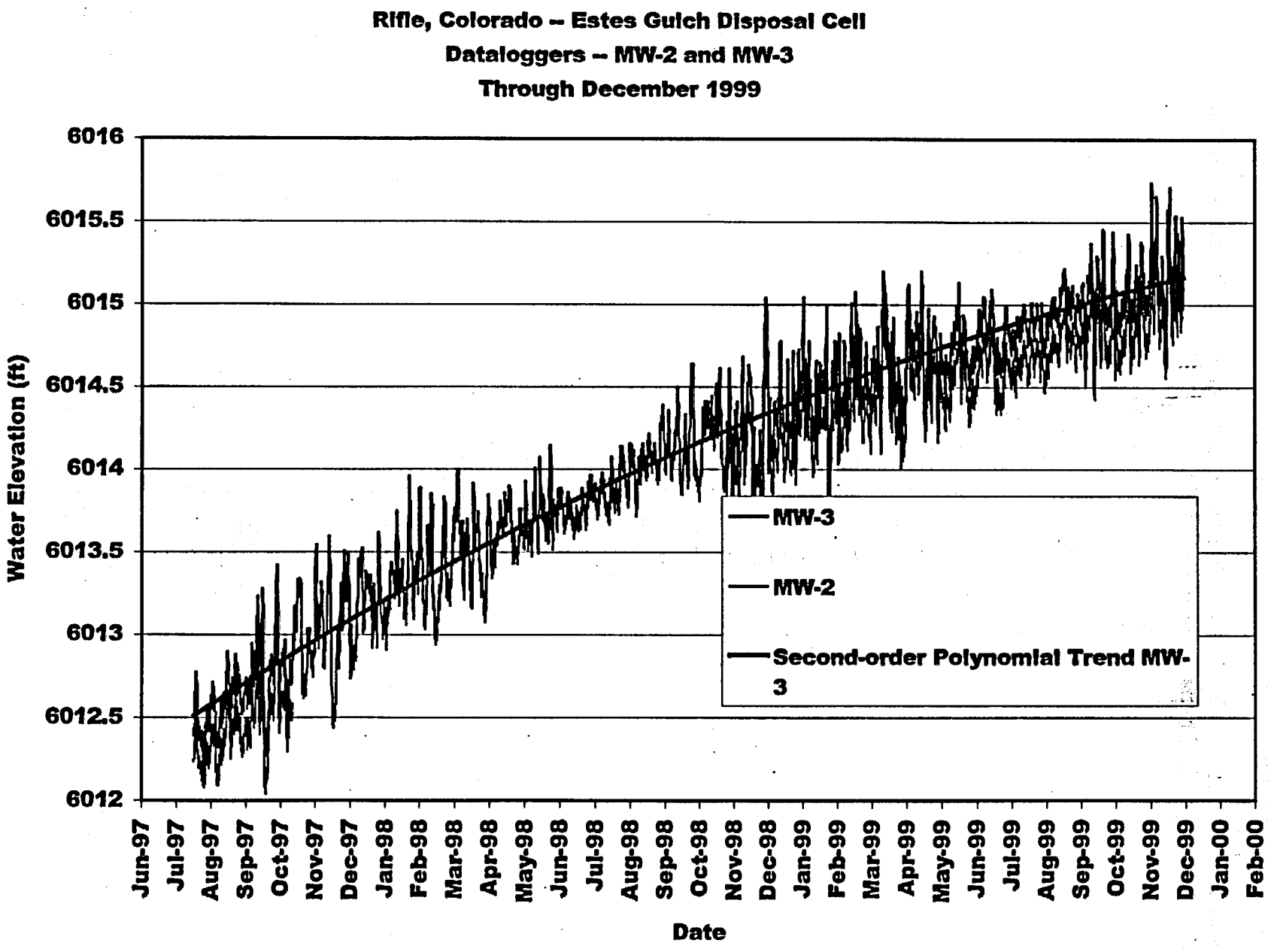


Figure RFL-4. Datalogger Information from MW-2 and MW-3 at Rifle, Colorado, Disposal Site

5.0 Corrective Actions

Corrective actions to lower water levels in the disposal cell or to correct conditions that threaten the integrity of the disposal cell were not required in 1999.

Annual Compliance Report
Shiprock, New Mexico, Disposal Site

Compliance Summary

The site, inspected on June 16, 1999, was in good-to-excellent condition and met all compliance requirement. Encroachment of vegetation in the riprap and the accumulation of trash and tumbleweeds continue to require maintenance. Gravel pit operations south of the disposal cell hinder access to the new access gate but do not otherwise affect the site. Ground-water monitoring is not required by the LTSP. There is no requirement for a follow-up or contingency inspection, and corrective actions are not required.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Shiprock, New Mexico, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Shiprock Disposal Site, Shiprock, New Mexico* (September 1994, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-60F, Rev. 1), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table SHP-1.

Table SHP-1. License Requirements for the Shiprock, New Mexico, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 6.0 and Section 10.0	Section 1.0
Follow-up or Contingency Inspections	Section 7.0	Section 2.0
Maintenance	Section 8.0	Section 3.0
Ground-Water Monitoring	Page 5-1	Section 4.0
Corrective Actions	Section 9.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The site at Shiprock, New Mexico, was inspected by DOE-GJO on June 16, 1999. Inspectors determined that the site was in good-to-excellent condition.

The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes or new conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. Features mentioned in this report are shown on Figure SHP-1.

1.1 Specific Site Surveillance Features

This section details site surveillance features investigated at the inspection.

Access Road, Fence and Gates, and Signs. All three entrance gates—the new main entrance gate at the east corner of the site (near the terrace escarpment), the gate providing terrace access at the north corner of the site; and the old and now abandoned entrance gate at the southwest corner of the site—were in excellent condition. The three entrance signs, E1, E2, and E3, also were in excellent condition.

Sand and gravel operations southeast of the disposal cell complicate access to the new entrance gate at the east corner of the site. Large mounds of dirt have been placed across the access road or track that parallels the southeast fence line, and this precludes the use of this road. The gate is now reached by driving around large stockpiles of gravel while avoiding active sand and gravel operations, pits, and cut banks (SHP PL-1).

The security fence along the site boundary was in good condition. Tumbleweed and windblown trash accumulations along the fence continue to be a problem, particularly on the outside of the west fenceline, inside and outside the fence at the east corner near the new entrance gate, both inside and outside the fence at the southern tip near perimeter sign P16, and on the outside of the fence near the corner at BM-2.

Tumbleweeds and trash were removed from the fence in April to improve the appearance of the site. Tumbleweeds and trash will no doubt have to be removed every 1 to 2 years.

Eighteen pairs of perimeter signs are attached to the security fence. Each pair consists of DOE's standard sign with a pictorial sign mounted below it. All signs are readable and in excellent condition. One sign, P17, with peeling paint was replaced subsequent to the inspection.

Site Markers, Survey Monuments, and Boundary Monuments. The two site markers, SMK-1 just inside the old entrance gate (E1) and SMK-2 on top of the disposal cell, were both in excellent condition. A few hairline cracks in the concrete around base of SMK-1 are not significant.

Three survey monuments, SM-1, SM-2, and SM-3, and seven boundary monuments were undisturbed and in good-to-excellent condition; there are a few hairline cracks in the concrete around SM-2. (Boundary monument BM-8 is at a distant location on the floodplain below the terrace escarpment and is no longer routinely inspected.)

Previously, boundary monuments BM-6 and BM-7 could not be found. During this year's inspection, inspectors located BM-6 and BM-7 by using GPS equipment. BM-6 was buried under a veneer of gravel. It is in an area susceptible to damage by gravel pit operations. Inspectors placed large rocks around the monument to temporarily identify and protect it (SHP PL-2).

Inspectors also used the GPS equipment to navigate to boundary monument BM-7. It was on the steep slope below the terrace escarpment (Figure SHP-1). The slope is very steep, gravelly, and unstable. Because of this, the original surveyors apparently elected not to install the standard boundary monument or set it in concrete. The location for BM-7 was marked only by a wooden stake and a longer piece of lathe. In the future, this monument should only be inspected if appropriate safety equipment is used. Should the need arise, the exact location of the monument can always be reestablished by another land survey.

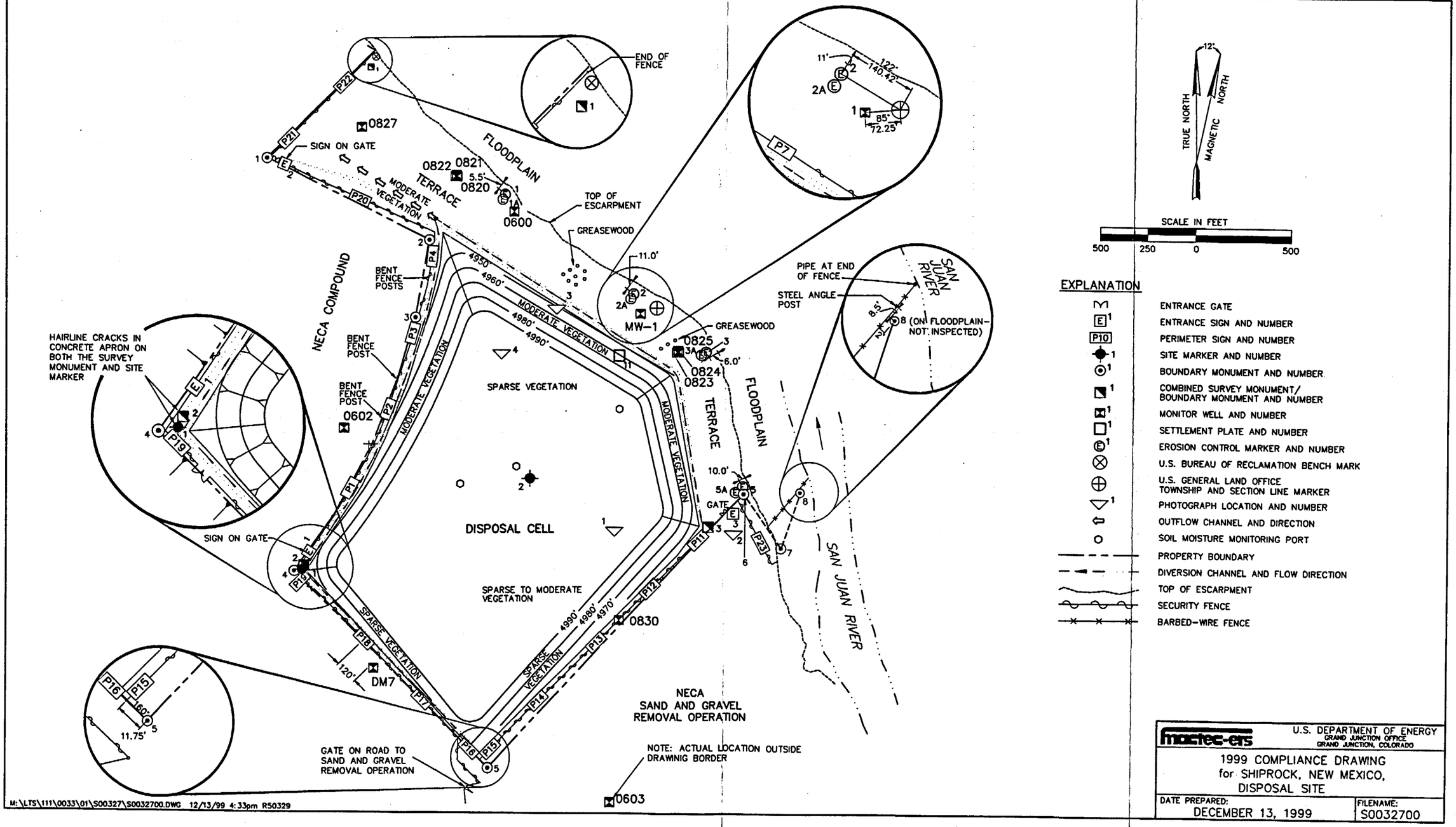


Figure SHP-1. 1999 Compliance Drawings for Shiprock, New Mexico, Disposal Site

Erosion Control Markers. The four sets of erosion control markers along the edge of the terrace, E1/E1A, E2/E2A, E3/E3A, and E5/E5A, were inspected. All were in excellent condition and undisturbed by erosion or mass wasting along the terrace escarpment.

Monitor Wells. Although ground-water activities by the UGW Project continue at this site, ground-water monitoring is not required by the LTSM Program. Inspectors limit their inspection to wells on site and those encountered while inspecting the site perimeter and outlying area transect.

Eight monitor wells on the terrace escarpment, MW-1, MW-600, MW-820 through MW-825, and MW-827, were in excellent condition. The 800-series wells are new and are associated with UGW Project activities. Inspectors used GPS equipment to determine the exact locations of the 800-series wells for the drawing, Figure SHP-1.

Monitor wells MW-602 (located on the NECA facility adjacent to the site), MW-603 (south of the disposal cell and adjacent to the gravel pit operations), MW-830 (along the southeast site boundary, and DM-7 (along the southwest boundary) were also inspected and determined to be in excellent condition.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the disposal cell transect that includes the riprap-covered top and side slopes of the disposal cell and the adjoining diversion channels and outflow channel; (2) the terrace area north and northeast of the disposal cell; and (3) outlying area that includes the fenced borrow-pit area southwest of the disposal cell, the Navajo Engineering and Construction Authority (NECA) yard adjoining the site on the west, and the NECA gravel pit adjoining the site on the southeast.

Within each transect, inspectors examined specific site surveillance features, such as boundary monuments, perimeter (warning) signs, and monitor wells. Inspectors examined each transect for evidence of erosion, settling, slumping, or other disturbance that might affect site integrity or the long-term performance of the site.

Top, Side Slopes, Diversion and Outflow Channels. The top and side slopes of the cell are armored with rock and are in excellent condition. There was no evidence of cracking, settling, slumping, erosion, or animal burrowing.

Significant vegetation has been noted during past inspections on the top and the east, northeast, and northwest side slopes of the disposal cell (SHP PL-3). Plants are primarily Kochia and Russian thistle, but prickly lettuce, Jim Hill mustard, grey horsebrush, western salsify, and rabbitbrush are also observed. Tamarisk is for the time effectively controlled (SHP PL-4). The plants have been sprayed with herbicide for several years to no lasting effect. Plants were sprayed again in July 1999. Plants will continue to establish on the disposal cell because the cover design provides a water source and rooting medium, and the surrounding area an infinite seed supply. DOE will continue to apply herbicide as needed.

The diversion channels and the outflow channel are also rock armored and in excellent condition. Diversion channels surround the disposal cell on all sides except the southeast. Vegetation in the northwest diversion channel, reported previously, is controlled as a result of herbicide spraying.

All site drainage is ultimately directed toward the outflow channel at the north corner of the site. Sparse vegetation, primarily Kochia and Russian thistle, was noted in the outflow channel. Tamarisk in the outflow channel has been a problem in the past but is currently under control. Plant encroachment is not sufficient to impair the function of the outflow channel. However, the channel may have to be sprayed with herbicide from time to time, and dead vegetation removed to keep it clear.

Terrace Area. The terrace within DOE's security fence is little changed from previous years except for the seven new monitor wells (800-series wells) mentioned above. Grease wood discovered in 1998 has not spread. The outer edge of the terrace above the floodplain is susceptible to erosion and mass wasting, but none has occurred on a scale sufficient to disturb the erosion control markers, also mentioned above.

Outlying Areas Adjacent to the Site. A sand and gravel pit operated by NECA is located immediately southeast of the disposal cell. Inspectors noted that activities associated with this sand and gravel operation have made access to the main entrance gate at the east corner of the disposal cell somewhat difficult. The sand and gravel operations do not otherwise seem to interfere with the site. However, a deep pit operation adjacent to the site boundary could be objectionable. No other changes in development or land use were noted.

2.0 Follow-up or Contingency Inspections

No follow-up or contingency inspection in response to new or changed conditions at the site was required in 1999.

3.0 Maintenance

Maintenance in 1999 consisted of herbicide application to control plant encroachment and removal of tumbleweeds and trash from along fence lines. No additional maintenance requirements were identified.

4.0 Ground-Water Monitoring

Ground-water monitoring is not required by the LTSP because of the poor water quality and low yield of the aquifer beneath the disposal cell.

5.0 Corrective Actions

Corrective actions in response to human disturbance or natural events were not required in 1999.

6.0 Photographs

Table SHP-2. Photographs Taken at Shiprock, New Mexico, Disposal Site, 1999

Photograph Location Number	Description
SHP PL-1	NECA gravel pit activities in proximity to southeast perimeter fence of disposal cell.
SHP PL-2	Rocks placed by inspectors denoting location of BM-6.
SHP PL-3	Dead tamarisk on northeast side slope of disposal cell.
SHP PL-4	Vegetation growing on top of disposal cell cover (view is to the east).

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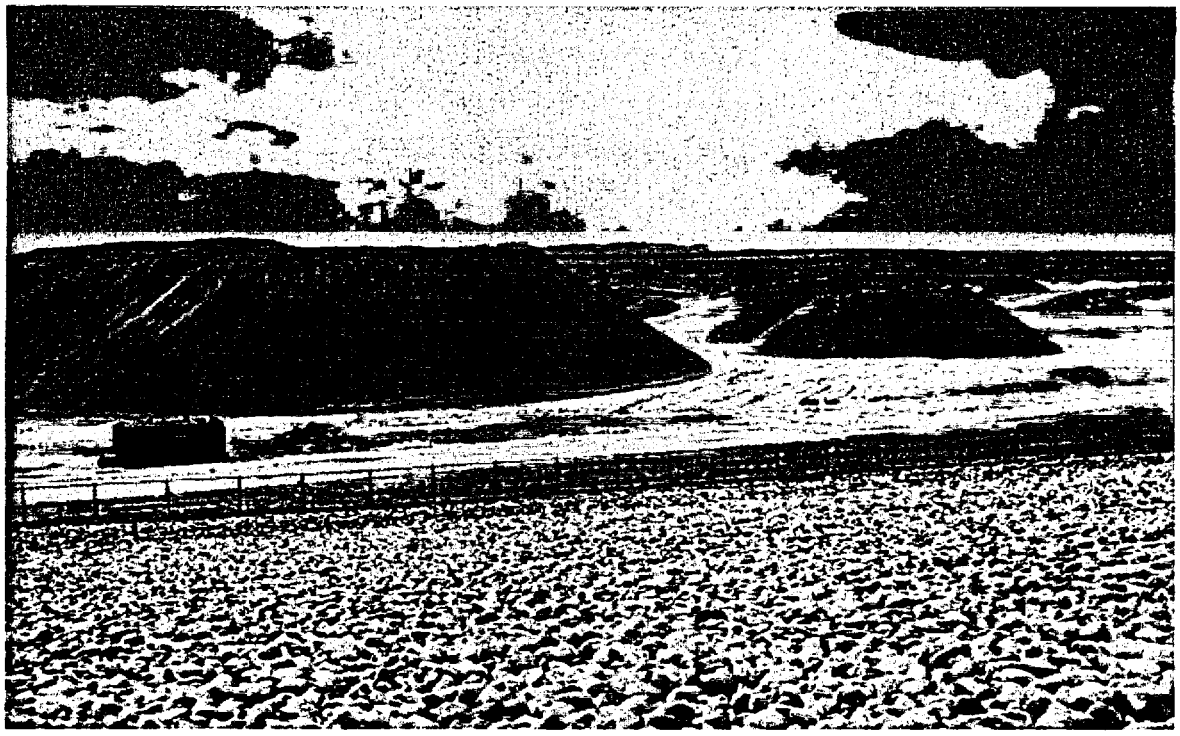
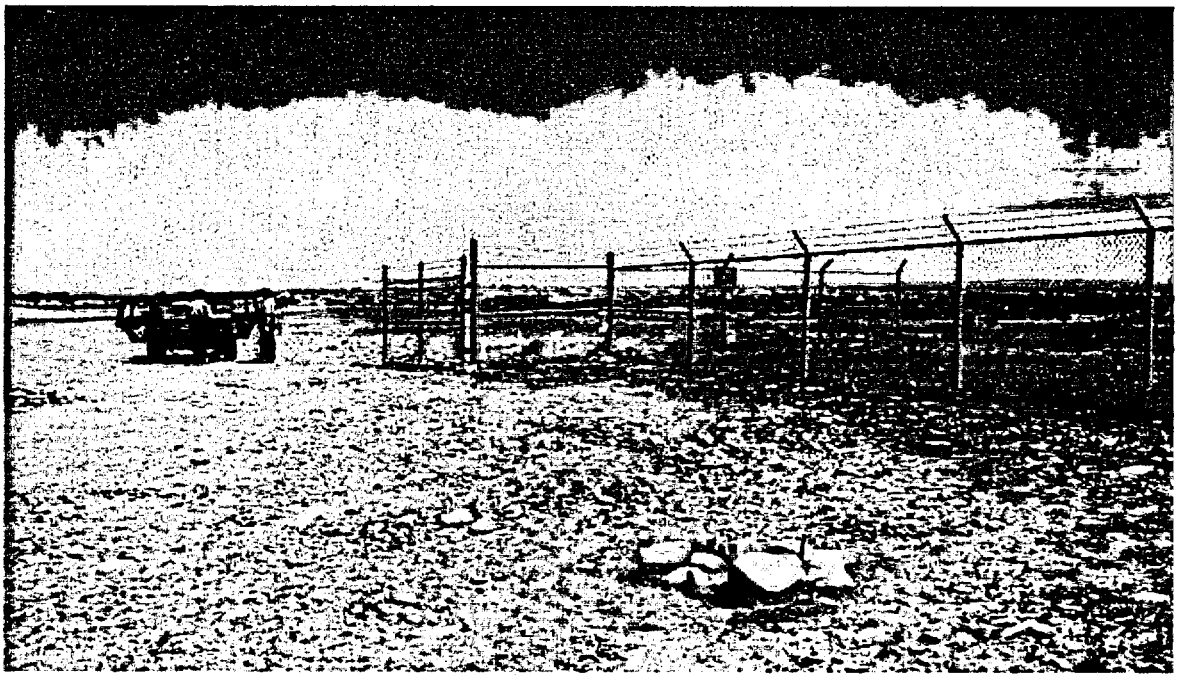
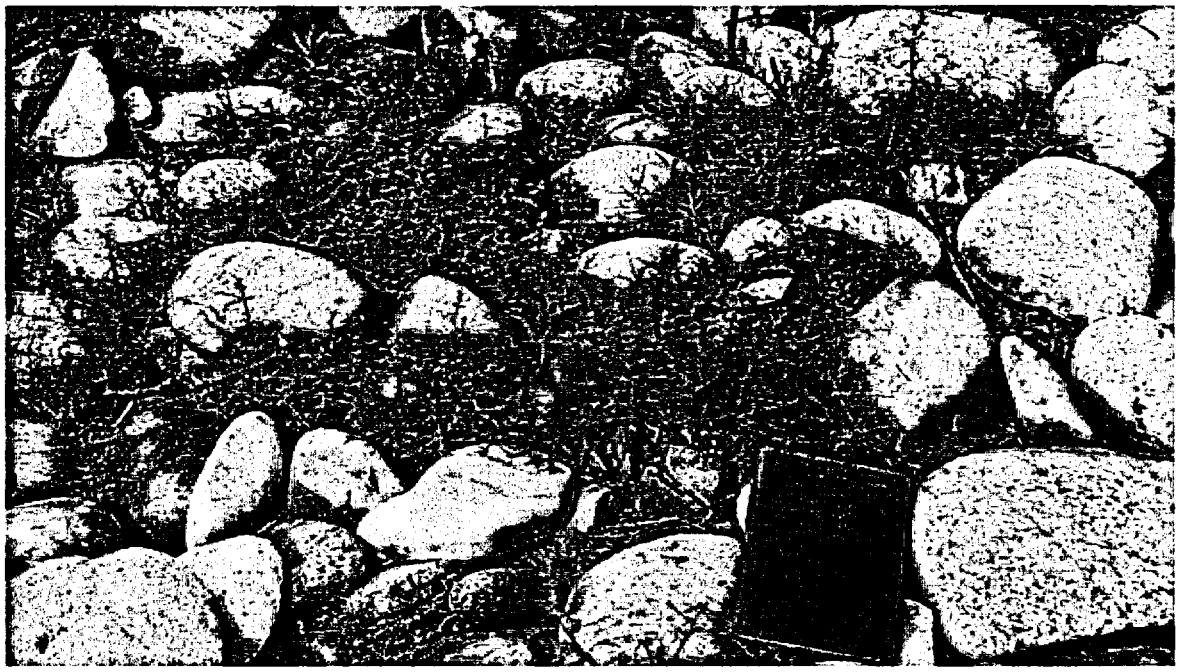


SHP 6/99. PL-1. NECA Gravel Pit Activities in Proximity to Southeast Perimeter Fence of Disposal Cell



SHP 6/99. PL-2. Rocks Placed by Inspectors Denoting Location of BM-6

SHP 6/99. PL-3. Dead Tamarisk on Northeast Side Slope of Disposal Cell



SHP 6/99. PL-4. Spring Crop of Russian Thistle on Northeast Side Slope of Disposal Cell

Annual Compliance Report
Salt Lake (South Clive), Utah, Disposal Site

Compliance Summary

The Salt Lake disposal site, inspected on May 15, 1999, fully complies with licensing requirements. No maintenance is required and no requirement for a follow-up or contingency inspection was identified. Ground-water monitoring is not required.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Salt Lake, Utah, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the South Clive Disposal Site, Clive, Utah* (September 1997, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-228, Rev. 2), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table SLC-1.

Table SLC-1. License Requirements for the Salt Lake (South Clive), Utah, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Sections 3-1 and 3.6.5	Section 1.0
Follow-up or Contingency Inspections	Section 3.4	Section 2.0
Maintenance	Section 5.0	Section 3.0
Ground-Water Monitoring	Section 4.0	Section 4.0
Corrective Actions	Section 6.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. Also during this inspection, site features were located by using GPS equipment to build a geographical information system database and to confirm site maps. This section describes the results of the inspection. Features mentioned in this report are shown on Figure SLC-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

Access Road, Entrance Gate, and Entrance and Perimeter Signs. The Salt Lake disposal site is accessed by following paved and graded roads to the Envirocare of Utah, Inc. (Envirocare) facility and then proceeding another 0.25 mile across Envirocare property along a permanent easement. The roads are in good condition.

The chain link entrance gate at the northwest corner of the site is topped with three strands of barbed wire and is in good condition. The gate is secured by a padlock and chain.

The site entrance sign and perimeter signs are in satisfactory condition. Some of the perimeter signs are of an older design, with red lettering on a yellow background, and the lettering is fading. These should be monitored in future inspections and replaced before they become illegible. Sign spacing should be checked at that time.

Site Markers, Survey Monuments, and Boundary Monuments. Both granite site markers are in excellent condition. Four boundary monuments were in place and are in good condition.

Monitor Wells. Ground-water monitor wells are present within the site security fence, between the site security fence and the Envirocare property boundary fence, and on adjacent Envirocare property. All DOE monitor wells at the Salt Lake site were transferred to Envirocare upon NRC site licensing, when the title to the disposal site was transferred to DOE. This transfer was confirmed in July 1998.

1.2 Transects

To ensure a through and efficient inspection, the site was divided into three areas referred to as transects: (1) the riprap-covered top and side slopes of the disposal cell; (2) the toe drain, maintenance road, perimeter diversion channel, and site security fence; and (3) the site perimeter extending 0.25 mile beyond the security fence. In accordance with the LTSP, the outlying areas were inspected visually from within the fence.

Within each transect, inspectors examined specific site surveillance features, survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or security.

Top Slope and Side Slopes of Disposal Cell. Inspectors walked a series of traverses to inspect the top of the disposal cell. The facets at the corners of the cell were walked, and the entire side slope surface was inspected visually. No evidence of erosion, settling, or slumping was seen. Evidence of minor annual plant encroachment from the previous year was noted on the western side slope.

Toe Drain, Maintenance Road, Perimeter Diversion Channel, and Security Fence. Inspectors examined the area between the toe of the disposal cell and the security fence. No evidence of erosion or other disturbance, intrusion, or significant vegetation encroachment was seen.

Runoff water continues to collect in low spots in the toe drains and the perimeter diversion channels. The site sits on a nearly flat dry lake-bed. No adverse impacts to the cell from the ponding of water in the toe drains or diversion channels are expected because the evaporation rate exceeds the rate of precipitation.

The security fence is situated inside the property boundary by distances of 13 to 114 feet. The two personnel gates and the security fence are in good condition.

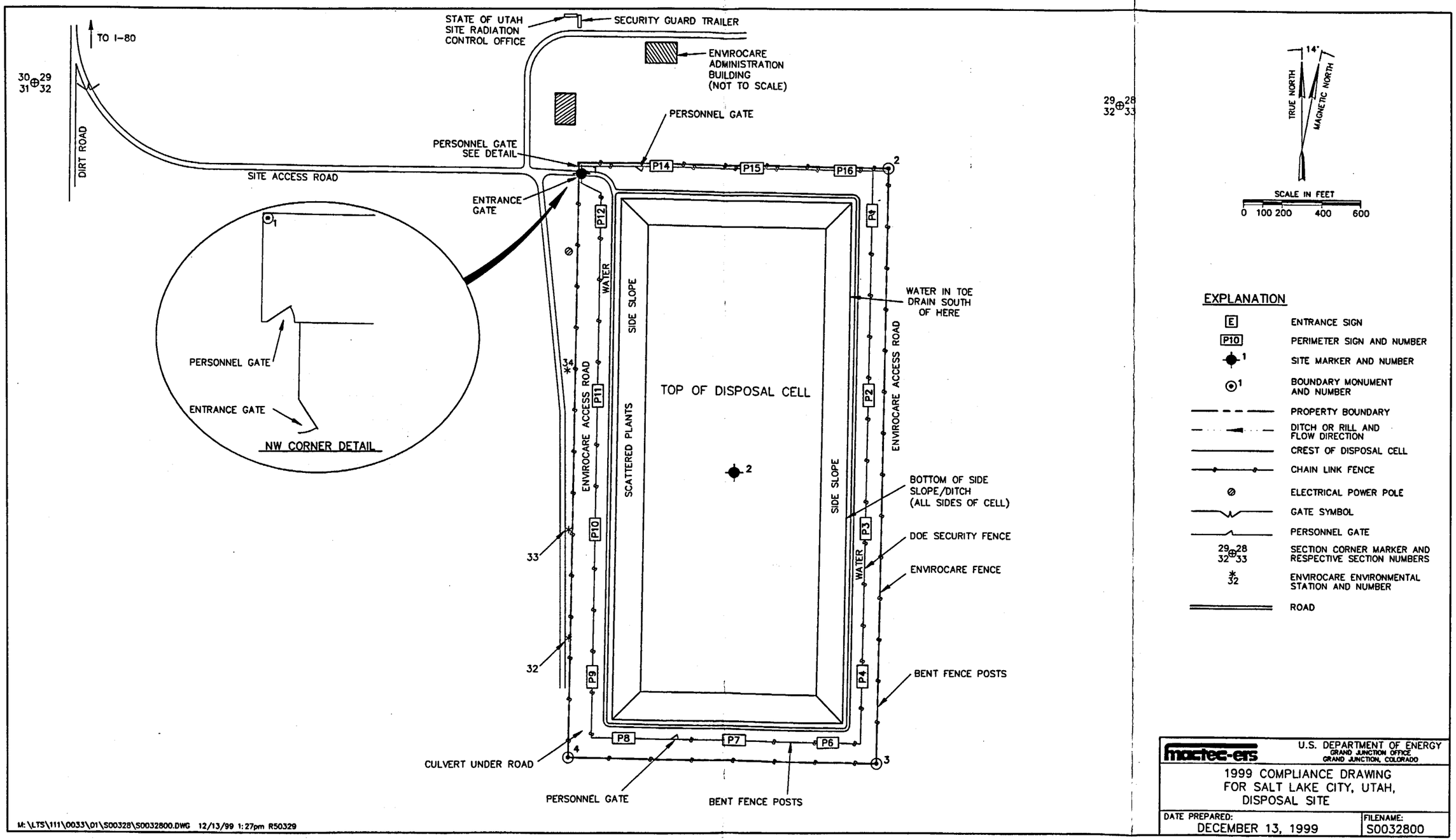


Figure SLC-1. 1999 Compliance Drawings for Salt Lake (South Clive), Utah, Disposal Site

Site Perimeter. The site perimeter transect extends from the security fence to 0.25 mile beyond the site boundary. This transect includes the Envirocare fence, the enclosed area between the two fences, the outflow channel, and monitoring wells. No problems were noted in the site perimeter transect. Envirocare has installed new evaporation ponds east of the site boundary and personnel were working on the disposal cell south of the boundary. Asbestos hazard warning signs have been placed on the Envirocare fence.

2.0 Follow-up or Contingency Inspections

The LTSP stipulates that DOE will conduct follow-up or contingency inspections if evidence exists that the disposal site is threatened. No follow-up or contingency inspections were required at this site in 1999.

3.0 Maintenance

The LTSP stipulates that DOE will conduct maintenance to keep the site in a secure and protective condition. No maintenance was required at this site in 1999.

4.0 Ground-Water Monitoring

As explained in the LTSP, ground-water monitoring is not required at the Salt Lake site. Ground water beneath this site is not a potential present or future source of potable water because the ambient total dissolved solids concentration exceeds 10,000 mg/L. The ground water is, therefore, classified as limited use (40 CFR 192.11(e)). All monitor wells at this location belong to Envirocare.

5.0 Corrective Actions

The LTSP stipulates that DOE will implement corrective action if evidence exists that the disposal cell is not functioning as designed. No corrective action was required at this site in 1999.

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Annual Compliance Report
Spook, Wyoming, Disposal Site

Compliance Summary

The Spook, Wyoming, disposal site was inspected on June 22, 1999 and met all compliance requirements. Noxious weed control at the site is ongoing. The site access road is becoming overgrown with grass due to a lack of use. An abandoned transformer platform should be removed. No other maintenance needs were identified. No cause for follow-up or contingency inspections or corrective action was identified. Ground-water monitoring is not required at this site.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Spook, Wyoming, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Spook Wyoming Disposal Cell Site*, (January 1993, U.S. Department of Energy, Albuquerque, N.M., DOE/AL 350215.0000), and in procedures established by DOE to comply with requirements of 10 CFR 40.27. These requirements are listed in Table SPK-1.

Table SPK-1. License Requirements for the Spook, Wyoming, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 6.1	Section 1.0
Follow-up or Contingency Inspections	Section 7.1	Section 2.0
Maintenance	Section 8.0	Section 3.0
Ground-Water Monitoring	Section 5.2	Section 4.0
Corrective Actions	Section 9.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The Spook, Wyoming, disposal site was inspected on June 22, 1999. The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. Features mentioned in this report are shown on Figure SPK-1.

1.1 Specific Site Surveillance Features

The following section details specific site surveillance features investigated during the inspection.

Access Road, Entrance Gate, and Entrance and Perimeter Signs. The road to the site is graded and hard packed. North of the Dry Fork of the Cheyenne River, the road narrows to an infrequently used dirt track. Rills are forming in the track and may eventually make the road

impassable to low-clearance vehicles. The track is not graveled and may be difficult to use in wet weather.

The ten perimeter signs and one entrance sign are in place and legible.

Site Markers, Survey Monuments, and Boundary Monuments. The two site markers, eight boundary monuments, and three survey monuments are in excellent condition. There is no evidence of erosion threatening monuments, although a minor amount of sheet-wash erosion or deflation may have occurred before vegetation became established.

Monitor Wells. A total of 29 DOE wells are located on or adjacent to the site. The remaining six wells in the inventory could not be located in the field. Additionally, an old water supply well remains in the southeastern corner of the site. All DOE wells are locked and in good condition.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the disposal site; (2) the site perimeter; and (3) outlying areas extending 0.25 mile beyond the site property boundary. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or long-term disposal cell performance.

Disposal Site. The Spook site is unique among Title I sites in that tailings and associated waste were consolidated in an open-pit mine and covered with 40 to 60 feet of clean fill and topsoil. None of the observations and concerns routinely associated with above-grade disposal cells, such as quality of the riprap, instability of side slopes, or biointrusion apply to this site.

The surface of the site is generally in excellent condition. No evidence of settling is present over the disposal pit. Vegetation, consisting of grasses and forbs, is, for the most part, healthy and well established across the site. Except for the lack of sagebrush in the reseeded areas, the vegetation is almost indistinguishable from that growing across the road and on the surrounding hills and valleys. The same species are present and the overall health and density of vegetation are similar.

Populations of two thistle species occur on the surface above the disposal cell—Canada thistle and either Platte thistle or New Mexican thistle. Canada thistle is listed as a noxious weed and is controlled to comply with state of Wyoming weed laws. Neither Platte thistle nor New Mexican thistle is considered noxious and neither requires control. The Converse County weed control agent has sprayed the Canada thistle on the site. Most of the thistle identified in the 1998 inspection appears to have been eradicated; however, a few thistle persist. The largest stand of Canada thistle was observed on the west side slope of the former holding pond located southeast of the site boundary.

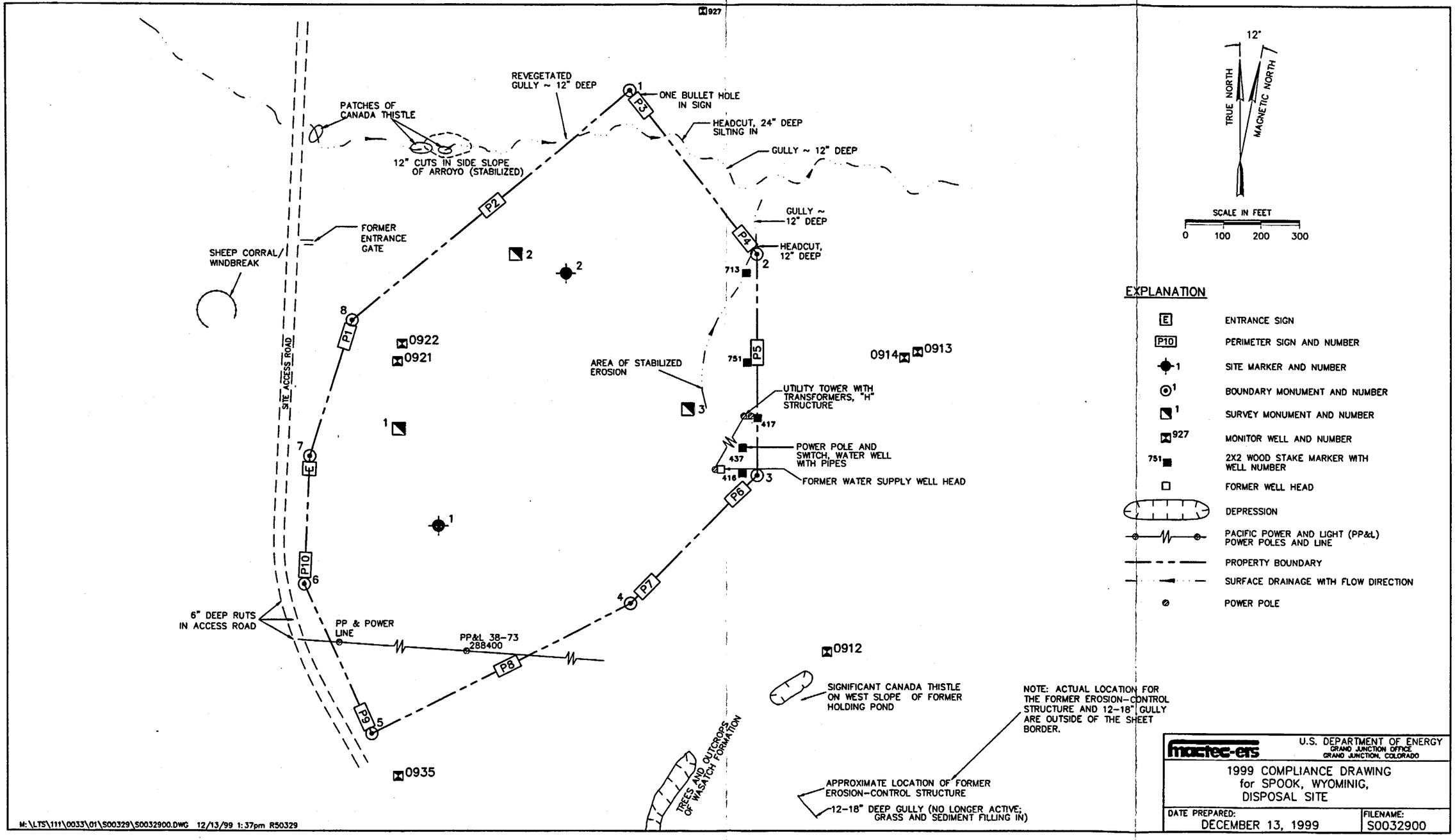


Figure SPK-1. 1999 Compliance Drawings for Spook, Wyoming, Disposal Site

Minor gully erosion has been noted on this site during previous inspections. Gully erosion is not a threat to the site at present because tailings at this site are deeply buried. However, erosion could degrade the contours of the site and displace soil and vegetation.

The most noticeable erosion is confined to two areas associated with the same drainage system. One branch of this drainage system flows across the northern tip of the site from west to east; the other branch starts near a transformer platform and drains the east side of the site, flowing northward to join the first branch. Each branch contains one noticeable headcut as noted during the 1996 and 1997 inspections. Neither headcut has increased in height or migrated upstream from its 1997 position. The gullies appear to be filling with sediment and revegetating naturally.

A transformer platform is still present along the southeast edge of the site. A power line extends from the transformer platform to a power pole by the old water supply well. DOE has requested Pacific Power and Light (PP&L) to remove the derelict transformer platform and the associated power line. PP&L has not replied to the DOE request. PP&L has an easement across the southern end of the site property for another existing power line.

Site Perimeter. Inspectors walked the site perimeter, beginning at the entrance sign, to inspect the site boundary and to examine site surveillance features located along the property line. All site surveillance features were in good to excellent condition, and no erosion or other disturbances were found.

Outlying Areas. The area beyond the site boundary for a distance of 0.25 mile was examined for erosion, disturbance, change in land use, or other feature of possible concern. None was seen.

Southeast of the site, approximately 900 feet south-southeast of BM-3, a formerly active area of erosion appears to be filling in with sediment and revegetating naturally. Immediately upstream of the old headcut, the gradient flattens and vegetation is well established. Erosion at this location is no longer a concern, but the area will continue to be monitored for erosion.

2.0 Follow-up or Contingency Inspections

The LTSP stipulates that DOE will conduct follow-up or contingency inspections if evidence exists that the disposal site is threatened. No cause for follow-up or contingency inspections was identified during the past year.

3.0 Maintenance

The LTSP stipulates that DOE will conduct maintenance to maintain the site in a secure and protective condition. Noxious weeds were sprayed. No additional maintenance was required at this location during 1999.

4.0 Ground-Water Monitoring

The LTSP states that ground-water monitoring is not required at the Spook disposal site for either ground-water compliance or cell performance monitoring. The uppermost aquifer is confirmed as a Class III aquifer of limited use and value. Specifically, (1) this aquifer meets the limited use classification; (2) there is no apparent risk to human health or the environment from

the ground water because of no known exposure pathway to the upper aquifer; (3) there is no discharge of ground water from this aquifer to deeper aquifers or to surface waters; (4) ground water from the uppermost aquifer is not currently used or is projected to be used because it meets the limited use classification; and (5) better quality water is readily available from deeper aquifers that are stratigraphically and hydrologically isolated from the uppermost aquifer. NRC has concurred in the application of supplemental standards to the ground water at this location.

5.0 Corrective Actions

The LTSP stipulates that DOE will implement corrective action if evidence exists that the disposal cell is not functioning as designed. No corrective actions were required at this site in 1999.

Annual Compliance Report
Slick Rock, Colorado, Disposal Site

Compliance Summary

The site, inspected on April 15, 1999, was in excellent condition and met all compliance requirements. Inspectors noted that the stock fence around the site is improved. It is now a four-wire fence with spacers. Vegetation, other than annual weedy species, is not yet established on the spoils pile or in disturbed areas around the disposal cell. Progress of revegetation will be slow because of the arid climate at the site. Rill erosion has occurred on the south slope of the spoils pile and at places downslope from the disposal cell. Erosion has not increased significantly since 1998, nor is it displacing significant quantities of soil or threatening the disposal cell. Stolen perimeter signs have been replaced. No maintenance is required, and no requirement for a follow-up or contingency inspection, or corrective action was identified. The water level in the disposal cell, now after a second year of monitoring, continues to fall; and currently is below the 5,838-foot datum in both stand pipes.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Slick Rock, Colorado, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Burro Canyon Disposal Cell, Slick Rock, Colorado* (May 1998, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-236, Rev. 0), and in procedures established by DOE-GJO to comply with requirements of 10 CFR 40.27. These requirements are listed in Table SRK-1.

Table SRK-1. License Requirements for the Slick Rock, Colorado, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Page 3-1 and 6-1	Section 1.0
Follow-up or Contingency Inspections	Pages 3-3	Section 2.0
Maintenance	Page 4-1	Section 3.0
Ground-Water Monitoring	Pages 2-11	Section 4.0
Corrective Actions	Page 5-1	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The site, near Slick Rock, Colorado, was inspected by DOE-GJO on April 15, 1999. Inspectors determined that the site was in excellent condition.

The purposes of the annual inspection were to confirm the integrity of visible features at the site; to identify changes in conditions that may affect site integrity; and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in this report are shown on the drawing, Figure SRK-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

Access Road, Entrance Gate, and Perimeter Signs. Site access is by an improved gravel and dirt road maintained by the county. The road was in excellent condition.

The entrance gate is a wire gate closed by a wire loop that passes over the top of the adjoining fence post, and a chain and padlock that secures the gate to the adjoining fence post. The gate and the stock fence around the site have been improved, by the former DOE UMTRA Project, since last year's inspection. Now the gate and fence are now strung with four strands of wire with spacers. The top and bottom strands are smooth wire to allow wildlife to pass over and under. The middle two strands are barbed wire. Wires in the fence are taut, and overall the fence and gate are well constructed.

Just east of the entrance gate and inside the stock fence is the entrance sign. Inspectors replaced the entrance sign, which was apparently stolen last year.

Thirty-two perimeter signs are spaced approximately 200 feet apart around the site. The signs are attached to steel posts set in concrete about 5 feet inside the site boundary. Some of the signs have bullet holes, but all are still legible. Inspectors discovered three of the signs had been stolen. The signs were replaced several weeks after the inspection. The stolen signs were all from posts along the access road where vandalism is likely to recur.

Site Markers, Survey and Boundary Monuments. The two granite site markers, SMK-1 near the entrance gate, and SMK-2 on the north-central part of the disposal cell, are in excellent condition. Three survey monuments and six boundary monuments were in place and undisturbed. A non-DOE marker, stamped "U.S. General Land Office Survey, ¼ section, S21/S28," is locked along the east perimeter of the site between perimeter signs P15 and P16.

Monitor Wells. There are seven monitor wells inside the site and two wells just outside the site on the southeast. All wells were locked and in good repair. Monitoring at these wells is not required.

Standpipes. Two standpipes, MW-3 and MW-4, are installed along the downslope edge of the disposal cell at the state's request. These standpipes are used to measure water levels in the lowest part of the disposal cell. Results of water-level measurements are in Section 4.0 (Ground-Water Monitoring) of this report.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the disposal cell transect including the top and side slopes, key trench, and apron; (2) the area between the disposal cell and the site boundary including the stock pond, recontoured and reseeded areas, and the stock fence; and (3) outlying areas including the spoils pile. Each of these transects was inspected by walking a series of traverses.

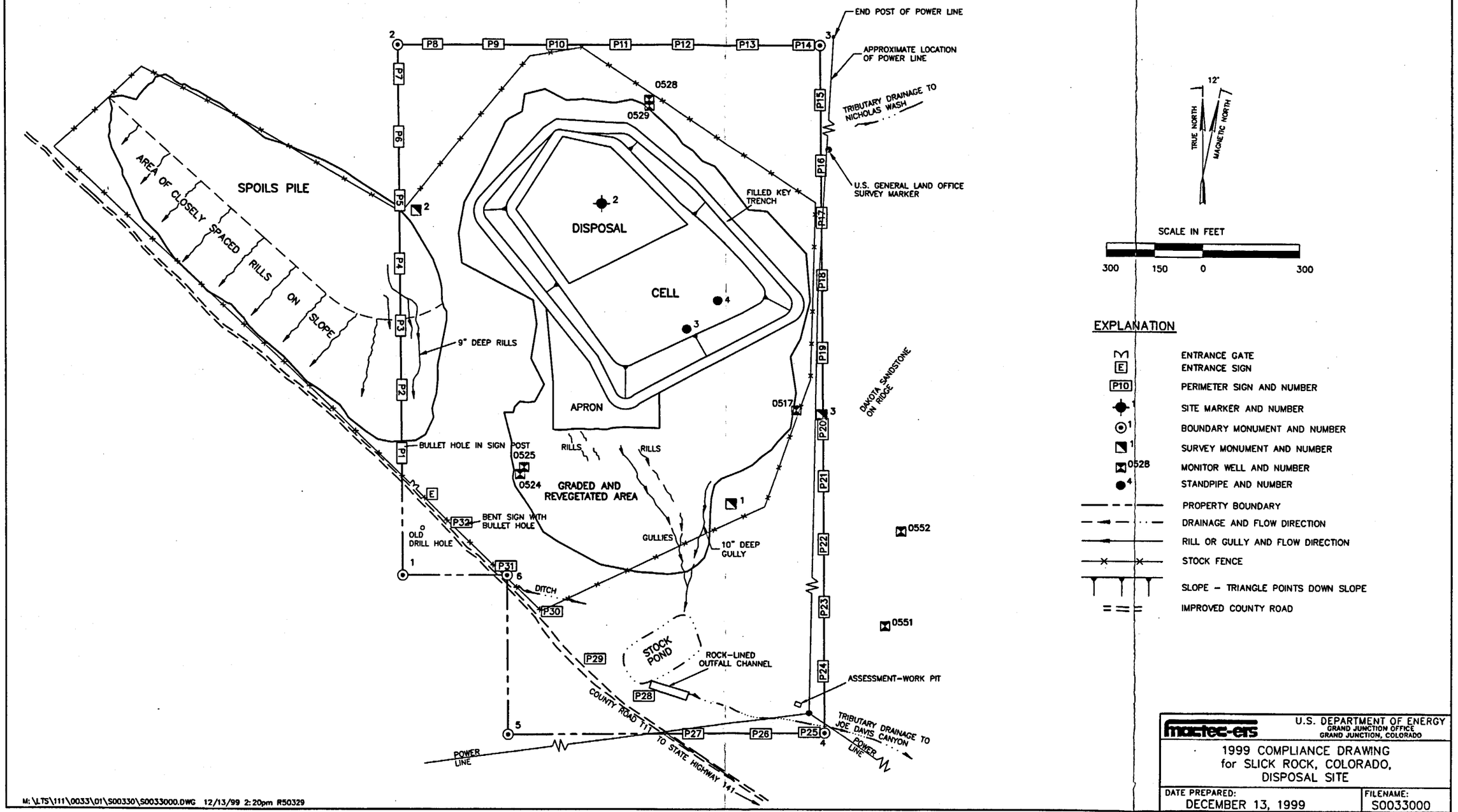


Figure SRK-1. 1999 Compliance Drawings for Slick Rock, Colorado, Disposal Site

Within each transect, inspectors examined specific site surveillance features including monitor wells, survey and boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or the long-term performance of the site.

Disposal Cell (including the Top and Side Slopes, Key Trench, and Apron). The top of the disposal cell is a flat surface that slopes to the southeast. The five side slopes descend from the top of the disposal cell at a maximum grade of 25 percent. The key trench encircles the disposal cell on all sides, and is as much as 5 feet deep and 20 feet wide. South and downslope from the disposal cell, an apron of riprap extends for 50 to 200 feet beyond the key trench. The top and all side slopes, the key trench, and the apron are in excellent condition. Rock covering the disposal cell, key trench, and apron is rounded, cobble-sized material in excellent condition. No evidence of settling, slumping, or erosion was seen on any of the rock-covered surfaces of the disposal cell.

A few scattered Russian thistle were observed on the north end of the disposal cell. They were all less than a few inches tall and appeared to have withered and died, soon after sprouting, from lack of moisture. Plant encroachment is not an issue at this time.

Area Between the Disposal Cell and the Site Property Boundary. This transect includes the stock pond, graded and reseeded areas, and the stock fence.

Runoff from the disposal cell flows southward into the retention pond. The retention pond was originally used during site construction. An outflow channel below the retention pond is lined with rock for a short distance.

Graded and seeded areas are primarily on the western, southern, and northeastern sides of the disposal cell. These areas were seeded in 1996 with a mix of native vegetation, believed to include thickspike wheatgrass, Arizona fescue, Indian ricegrass, tall fescue, four-wing saltbush, and small burnet. The 1996 seeding was not successful. Seeding was repeated in March 1999 by the UMTRA Project. Results of the second seeding were inspected in August. Weedy annuals were abundant, but more desirable vegetation had not yet established. Because the site is in a relatively arid area where evaporation greatly exceeds precipitation, it may take several years for the second seeding to be properly evaluated.

As noted during previous inspections, rills and a few gullies are present where vegetation has not established. Rills and gullies are most noticeable downslope from the apron (between the apron and the retention pond) and on the spoils pile west of the disposal cell. The rills do not appear to be increasing significantly in size or number, and erosion along the rills is not displacing noticeable volumes of soil. The willingness of weedy annuals to grow on the graded slopes is stabilizing the slopes against further erosion.

Outlying Areas Including the Spoils Pile. The area outside the disposal site supports grass and scattered pifion and juniper trees. The land is used for grazing under permit from BLM.

A spoils pile, composed of material excavated during site construction, forms a mound about 50 feet high west of the disposal site. Reseeding of the spoils pile has produced a promising cover on the north side of the spoils pile, where four-wing saltbush and grasses are slowly

establishing. The south side of the spoils pile, however, is mostly bare, as discussed above, except for annual weeds.

2.0 Follow-up or Contingency Inspections

Follow-up or contingency inspections in response to new or changed conditions at the site were not required in 1999.

3.0 Maintenance

Maintenance in 1999 consisted of replacement of stolen perimeter signs and removal of materials left from installation of standpipes, MW-3 and MW-4.

4.0 Ground-Water Monitoring

Two standpipes, MW-3 and MW-4, were installed along the downslope edge of the disposal cell at the state's request. Data loggers installed in these standpipes are downloaded quarterly. These standpipes are used to measure water level in the lowest part of the disposal cell.

The purpose of the water-level monitoring is to evaluate the potential for water to rise in the disposal cell and migrate laterally into the lowest of two sandstone beds exposed in the sidewall of the disposal cell.

Results of water-level monitoring are shown in the attached figures, SRK-2 and SRK-3.. Water-level measurements began in 1998. At that time, water levels in both standpipes stood above the 5,838-foot elevation of the lower sandstone bed. Since then, water levels have dropped below the 5,838-foot datum.

In August 1999, water level in MW-3 was below 5,837.5 feet. The data logger was removed from MW-4 in May 1999 and replaced in August 1999. When the data logger was removed in May 1999, water level was below 5,838.0 feet.

Second order linear trend lines are superimposed on the hydrograph data from each well (Figures SRK-2 and SRK-3). The downward slope of each trend line is, so far, noticeably consistent. (Noise or oscillations in the hydrograph curves are attributed to changes in atmospheric pressure.)

DOE will continue to monitor water levels in the two standpipes until the water level is at or below the 5,838-foot elevation of the lower sandstone bed and a downward trend is observed consistently for three consecutive quarters. At that time, DOE will decommission both standpipes (LTSP, pp. 2-11 and 2-12).

5.0 Corrective Actions

Corrective actions to effect repair to the disposal cell or to comply with 40 CFR 192 were not required in 1999.

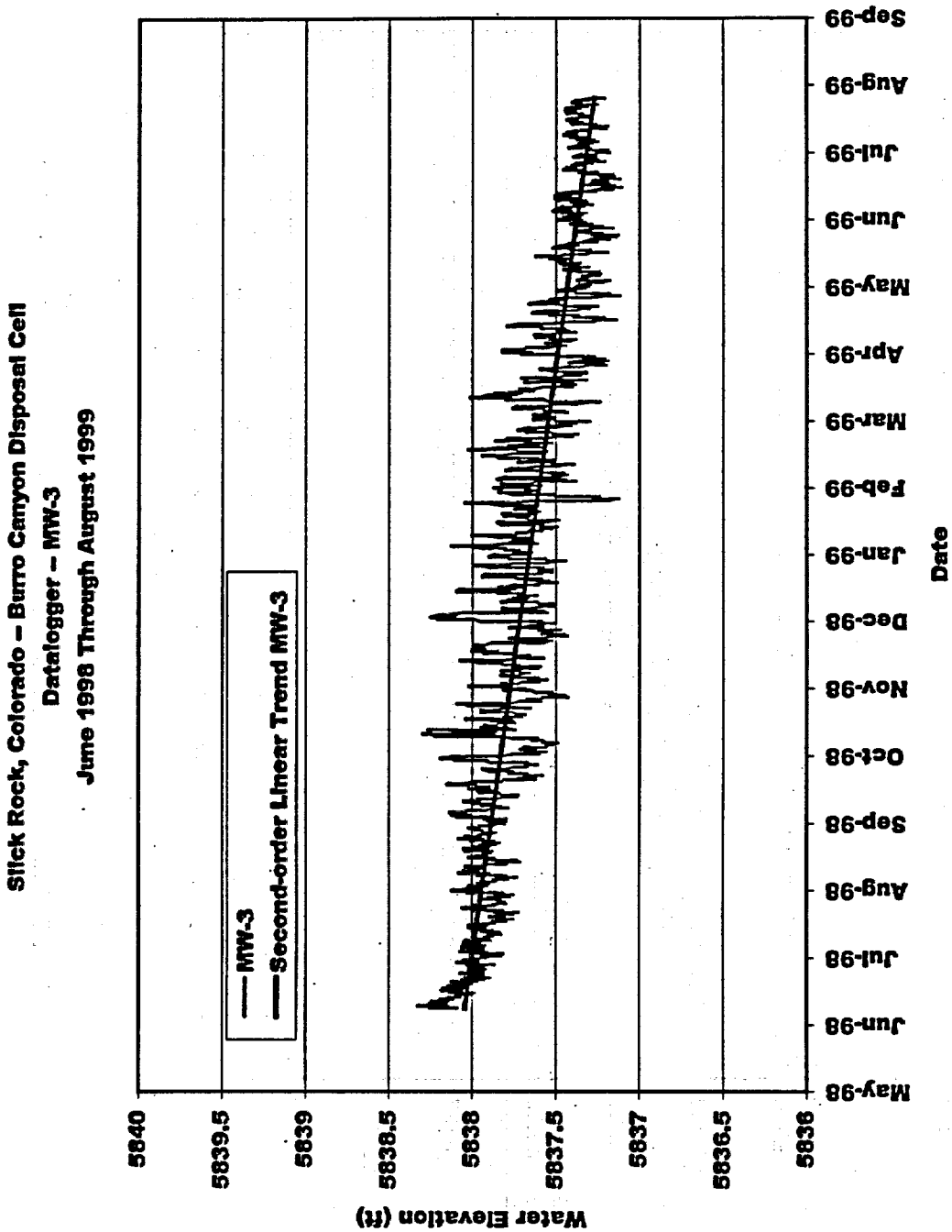
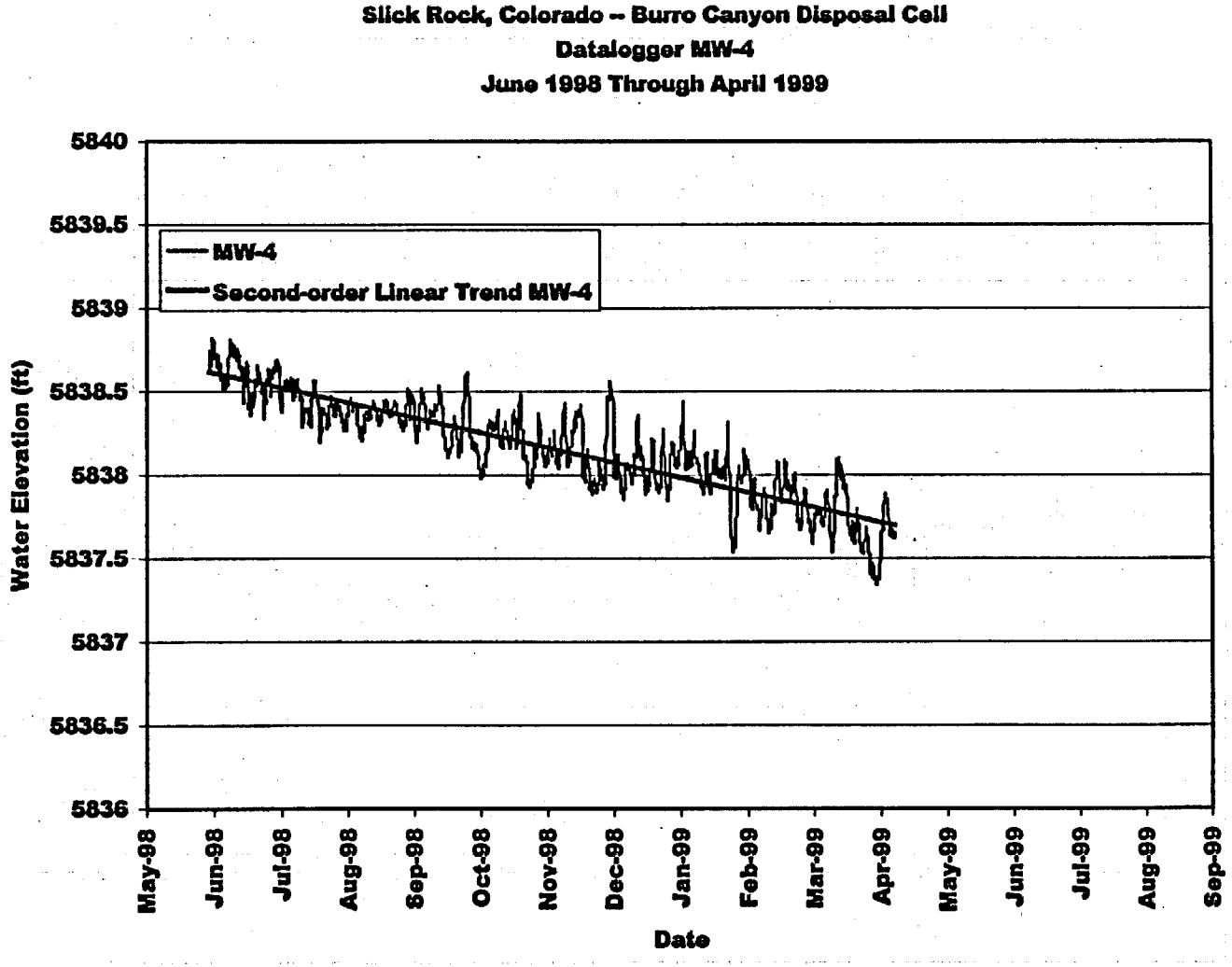


Figure SRK-2. Datalogger Information from MW-3 at Slick Rock, Colorado, Disposal Site



SRK-3. Datalogger Information from MW-4 at Slick Rock, Colorado, Disposal Site

Annual Compliance Report
Tuba City, Arizona, Disposal Site

Compliance Summary

The Tuba City, Arizona, site was inspected on September 27, 1999 and met all compliance requirements. Erosion rills east and west of the access road and on drainage channel embankments are stabilizing. Plant abundance on the cover has not significantly increased since the previous inspection and the revegetated areas are healthy. Construction has begun on an evaporation pond and other structures required for active ground-water remediation, and additional wells were installed since the 1998 inspection. No cause for follow-up or contingency inspections was identified and corrective actions were not required.

Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Tuba City, Arizona, UMTRCA Title I Disposal Site are specified in the *Long-Term Surveillance Plan for the Tuba City, Arizona, Disposal Site*, (October 1996, U.S. Department of Energy, Albuquerque, N.M., DOE/AL/62350-182, Rev. 0), and in procedures established by DOE to comply with requirements of 10 CFR 40.27. These requirements are listed in Table TUB-1.

Table TUB-1. License Requirements for the Tuba City, Arizona, Disposal Site

Requirement	LTSP	This Report
Annual Inspection and Report	Section 6.1	Section 1.0
Follow-up or Contingency Inspections	Section 7.0	Section 2.0
Maintenance	Section 8.0	Section 3.0
Ground-Water Monitoring	Section 5.2	Section 4.0
Corrective Actions	Section 9.0	Section 5.0

Compliance Review

1.0 Annual Inspection and Report

The purposes of the annual inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that may affect site integrity, and to determine the need, if any, for maintenance or additional inspections and monitoring. This section describes the results of the inspection. Features mentioned in this report are shown on Figure TUB-1.

1.1 Specific Site Surveillance Features

This section details specific site surveillance features investigated during the inspection.

Permanent site surveillance features are all present and in good condition. Two Lexan perimeter signs, P9 and P24, had peeled and were no longer legible; these were replaced with aluminum signs. Damage to signs from bullet holes or dents has not significantly increased, and all signs

remain legible. The post for perimeter sign P21 was bent by construction crews and will be straightened.

The security fence remains intact and in good condition. Gaps were noted under the north side of the fence and appear to have been dug by dogs or children. Tumbleweeds and sand accumulation remain along the west fence line. Dead tumbleweeds remain in the northeast corner of the site.

Inspectors documented the condition of the seven wells at the site that comprise the LTSM monitor well network. A GPS unit was used to collect location information for the seven wells and for other site surveillance features.

Sand erosion and redeposition are of particular concern at Tuba City. Unstable coppice dunes in outlying, heavily grazed areas are evidence that sand accumulation along the fence line, in diversion channels, and in the rock cover on the disposal cell may continue. Revegetation of remediated areas surrounding the disposal cell in 1990 and plantings of desert shrubs and grasses inside the security fences upwind of the disposal cell in 1996 were intended to reduce sand movement within the disposal cell. Few features of active sand movement, such as loose sand with ripple marks or coppice dunes, were noted inside the security fence.

New features associated with on-going ground-water remediation activities were added since the 1998 inspection. At the time of the 1999 inspection, a UGW Project contractor was constructing an evaporation pond in the southeast corner of the site. Temporary office trailers were located in the northeast corner of the site, west of the greenhouse. Two vehicle gates and one personnel gate were installed in the south perimeter fence. New wells had been installed south and east of the cell, and other wells were being added south of the site. Roads to the well field outside the site perimeter were graded, and piping is being installed to connect the wells into a treatment network. All features associated with the ground-water remediation activities will be surveyed by UGW when complete and added to site maps.

1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the top and side slopes of the disposal cell; (2) the north drainage channel, rock aprons, trench drains, and other features between the cell toe and the perimeter fence, and (3) the perimeter fence and outlying areas extending 0.25 mile beyond the site property boundary. Each of these transects was inspected by walking a series of traverses.

Within each transect, inspectors examined specific site surveillance features. Inspectors examined each transect for evidence of erosion, settling, slumping, or other phenomena that might affect site integrity or long-term disposal cell performance.

Disposal Cell. Scattered patches of Kochia and Russian thistle persist on the south side slope and top slope of the disposal cell. Plant abundance on the disposal cell is gradually increasing. This growth may be encouraged by soil accretion, which is evident at locations on the top slope of the disposal cell where the rock layer is thin. Sand has accumulated on the south rock apron and filled most of the interstices in the riprap, resulting in more and larger shrubs and grasses establishing in this structure. The Long-Term Performance Project will continue to evaluate

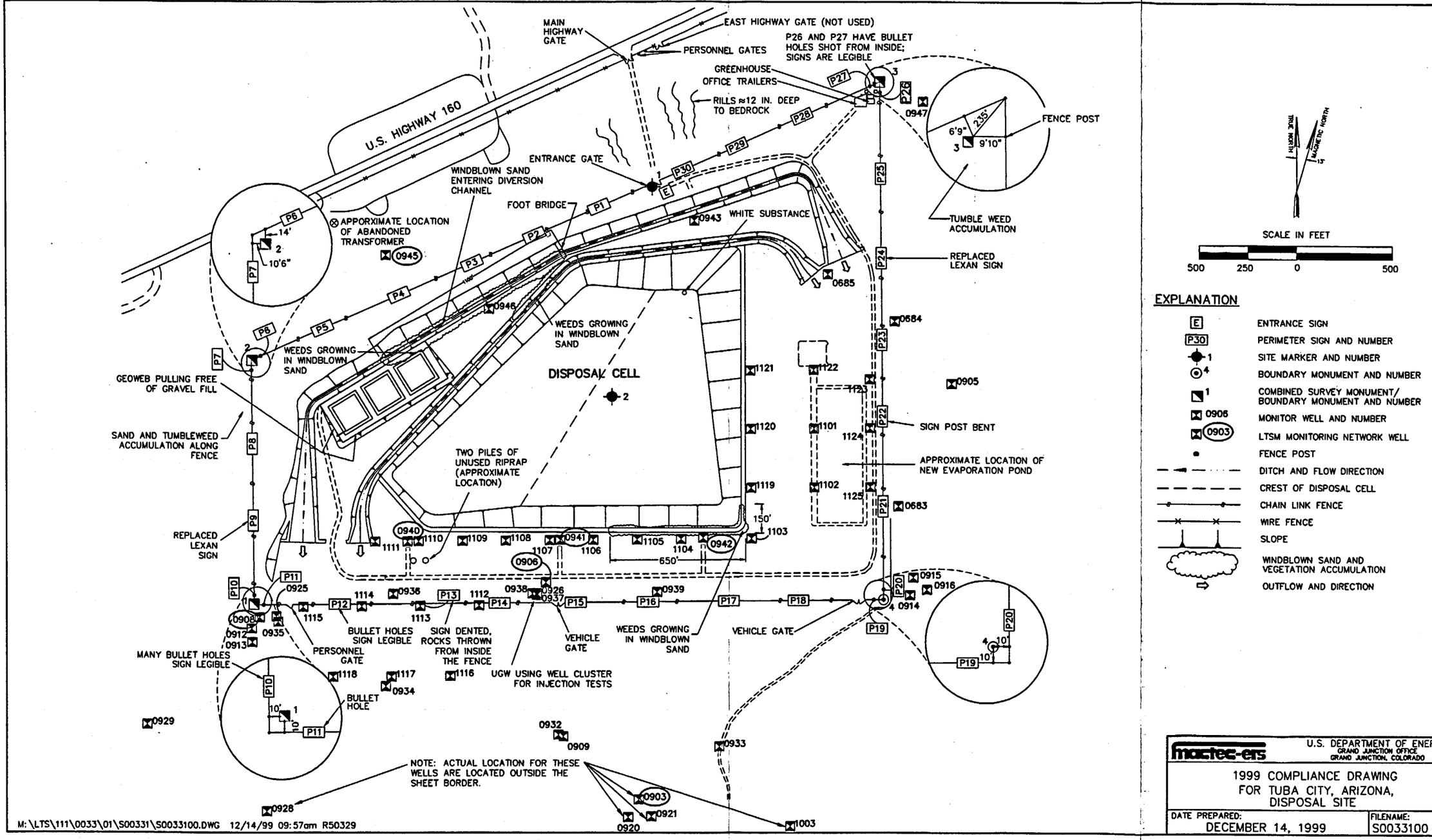


Figure TUB-1. 1999 Compliance Drawings for Tuba City, Arizona, Disposal Site

sand accretion effects and management, the effects of root intrusion on the ability of the cover to limit water infiltration, and possible desiccation of the radon barrier because of heat loading in the basalt riprap. A white evaporite material was noted near the northeast edge of the cell top.

Area Between Cell and Fence. In 1997, UGW armored the embankment slopes on the evaporation ponds with a gravel-filled geoweb to reduce sand transport into the diversion ditches. The geoweb is exposed above the gravel that was placed in the geoweb cells, which will result in premature weathering of the geoweb material. Sand accumulation in the inner diversion channel and in the northwest segment of the outer diversion channel remains unchanged since the 1998 inspection. Erosion rills noted previously on the northern embankments of the inner and outer diversion channels just south of the entrance gate appear to have stabilized. Vegetation inside the fence line appears vibrant and abundant.

Outlying Areas. Erosion rills on either side of the access road between the highway gate and the entrance gate have deepened and widened. The rills expose bedrock 15 to 25 centimeters below the soil surface. The erosion will likely continue until the soil cover has been removed or enough aggregate is exposed to stabilize the slope. The erosion is removing what appears to be a top dressing of soil added during the final site grading, and no structures are threatened by the erosion or deposition of eroded material.

Regraded areas have stabilized as a result of increasing plant abundance and formation of a gravel veneer is a consequence of sand winnowing. However, ground-water remediation activities have disturbed some of these planted areas and may cause the resumption of sand movement.

2.0 Follow-up or Contingency Inspections

The LTSP stipulates that DOE will conduct follow-up or contingency inspections if evidence exists that the disposal site is threatened. No cause for follow-up or contingency inspections was identified during the past year.

3.0 Maintenance

The LTSP stipulates that DOE will conduct maintenance to maintain the site in a secure and protective condition. The experimental Lexan perimeter signs had peeled and were replaced. No other maintenance was required at this location during 1999.

4.0 Ground-Water Monitoring

Evaluative ground-water monitoring is required by the LTSP to monitor baseline water quality. This monitoring may not indicate disposal cell performance because processing-related contamination probably masks any transient drainage or other contamination escaping from the cell. Monitoring to evaluate cell performance will not begin until ground-water remediation (40 CFR 192 Subpart B) activities are complete.

4.1 Monitoring Network

The evaluative monitor well network consists of the seven monitor wells shown in Table TUB-2.

4.2 Frequency of Monitoring

The LTSP stipulates that the wells in the evaluative monitoring network will be sampled semi-annually until October 1998. After that time, the sampling frequency will be re-evaluated. Currently, all these wells are sampled semi-annually except well MW-903, which is sampled annually. All wells were last sampled in February 1999.

Table TUB-2. Evaluative Ground-Water Monitoring Network at the Tube City, Arizona, Disposal Site

Monitor Well	Hydrologic Relationship
903	Downgradient
906	Baseline
908	Baseline
940	Disposal cell boundary
941	Disposal cell boundary
942	Disposal cell boundary
945	Background

4.3 Analytes

Indicator analytes at the Tuba City site are nitrate, molybdenum, selenium, and uranium. These analytes were selected on the basis of their presence in tailings pore water, relatively high mobility in ground water, and low concentration in background water. UGW Project analysis also includes net gross alpha, other standard water quality indicators, and field parameters.

4.4 Results of Ground-Water Monitoring

Results of the 1999 sampling are presented in Table TUB-3. Elevated molybdenum concentrations historically have been detected in Well 906. Molybdenum concentrations are below the MCL in the other wells in the network (Figure TUB-2). Nitrate, selenium, and uranium concentrations are at or below the MCL in MW-903 and MW-945 and exceed the MCL in the remaining wells (Figures TUB-3 through TUB-5). Net gross alpha concentrations have exceeded the MCL.

Table TUB-3. 1999 Ground-Water Sampling Results at the Tuba City, Arizona, Disposal Site

Well Identifier	Molybdenum	Nitrate	Selenium	Uranium
MCL*	0.1	44	0.01	0.044
903	0.001U	50.2	0.002B	0.0021
906	**0.146**	**1970**	**0.139**	**0.894**
908	0.0013B	**673**	**0.0181**	**0.0976**
940	0.0017B	**2050**	**0.0838**	**0.588**
941	**0.0567**	**354**	**0.0318**	**0.22**
942	**0.0242**	**1730**	**0.0318**	**0.291**
945	0.0038B	2.58	0.0013B	0.003

Note: All concentrations are expressed in milligrams per liter.
Maximum Concentration Limit per 40 CFR 192.02, Table 1.
Bold results exceed the MCL.
U = concentration below laboratory reporting limit.

A contamination plume has been characterized that has migrated approximately 1,500 feet off site to the south. The contamination is an artifact of historical uranium milling operations. The tailings pile at the Tuba City site was stabilized in place. Slimes and evaporation ponds on the pile account for the ground-water contamination.

Active ground-water remediation will not begin until 2000. Contaminate concentrations across the evaluative monitoring network do not indicate any clear trends and do not indicate any concerns regarding disposal cell performance.

5.0 Corrective Actions

The LTSP stipulates that DOE will implement corrective action if evidence exists that the disposal cell is not functioning as designed. No corrective actions were required at this site in 1999.

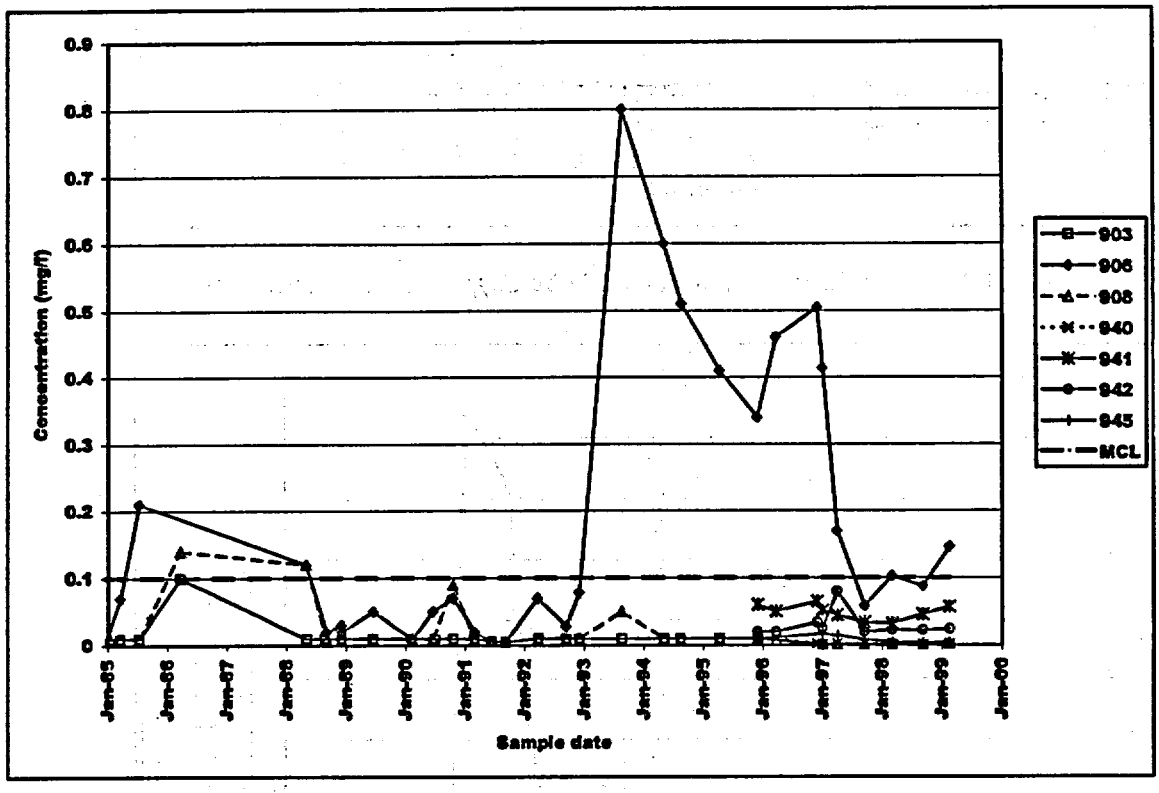


Figure TUB-2. Molybdenum Concentrations at the Tuba City, Arizona, Disposal Site

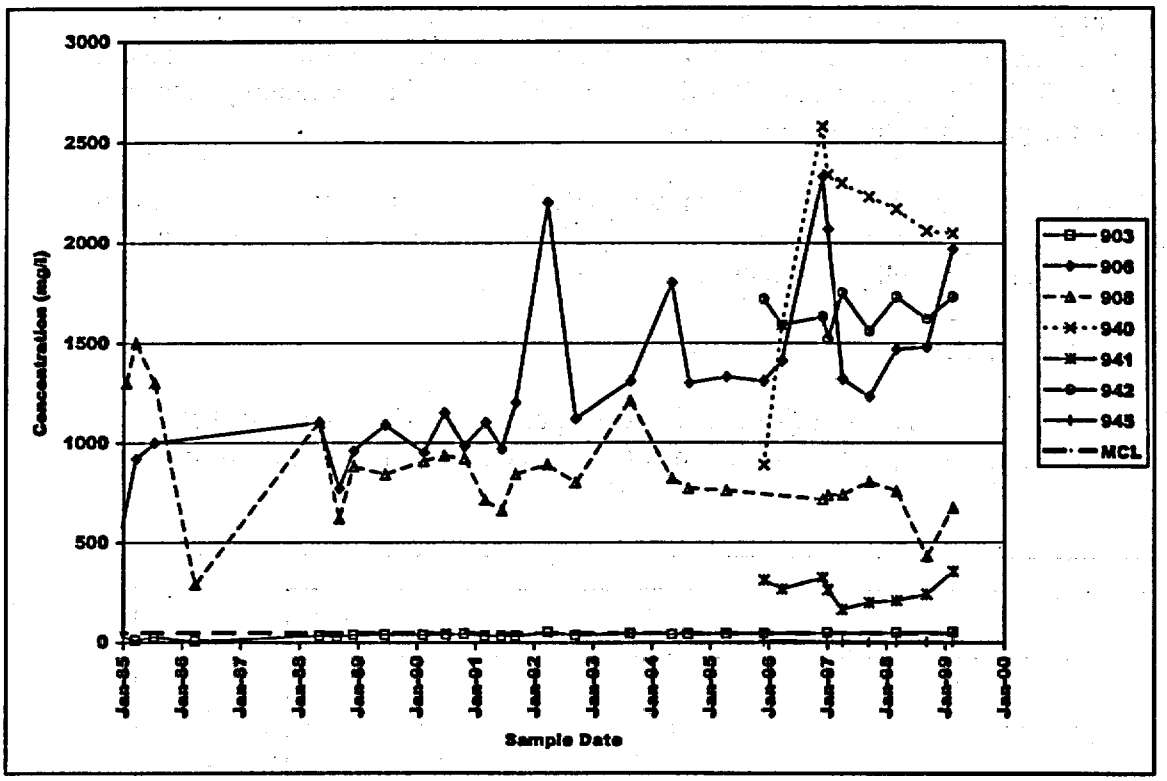


Figure TUB-3. Nitrate Concentrations at the Tuba City, Arizona, Disposal Site

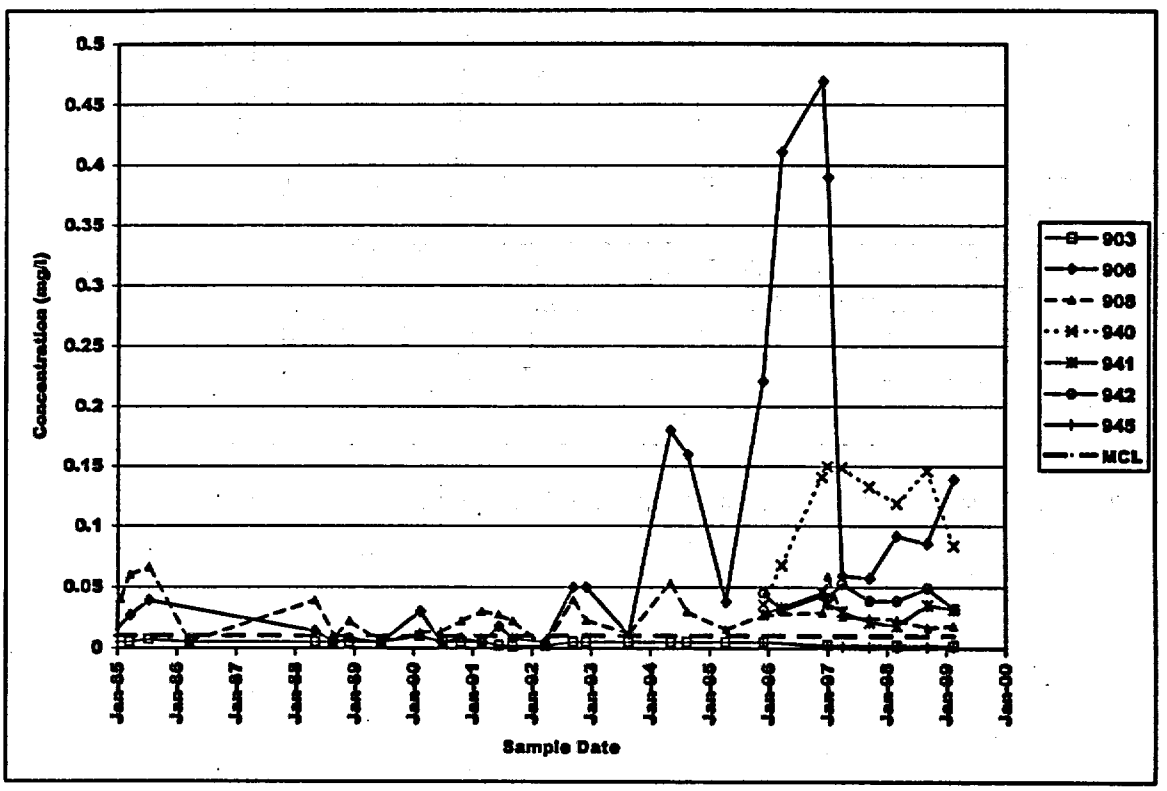


Figure TUB-4. Selenium Concentrations at the Tuba City, Arizona, Disposal Site

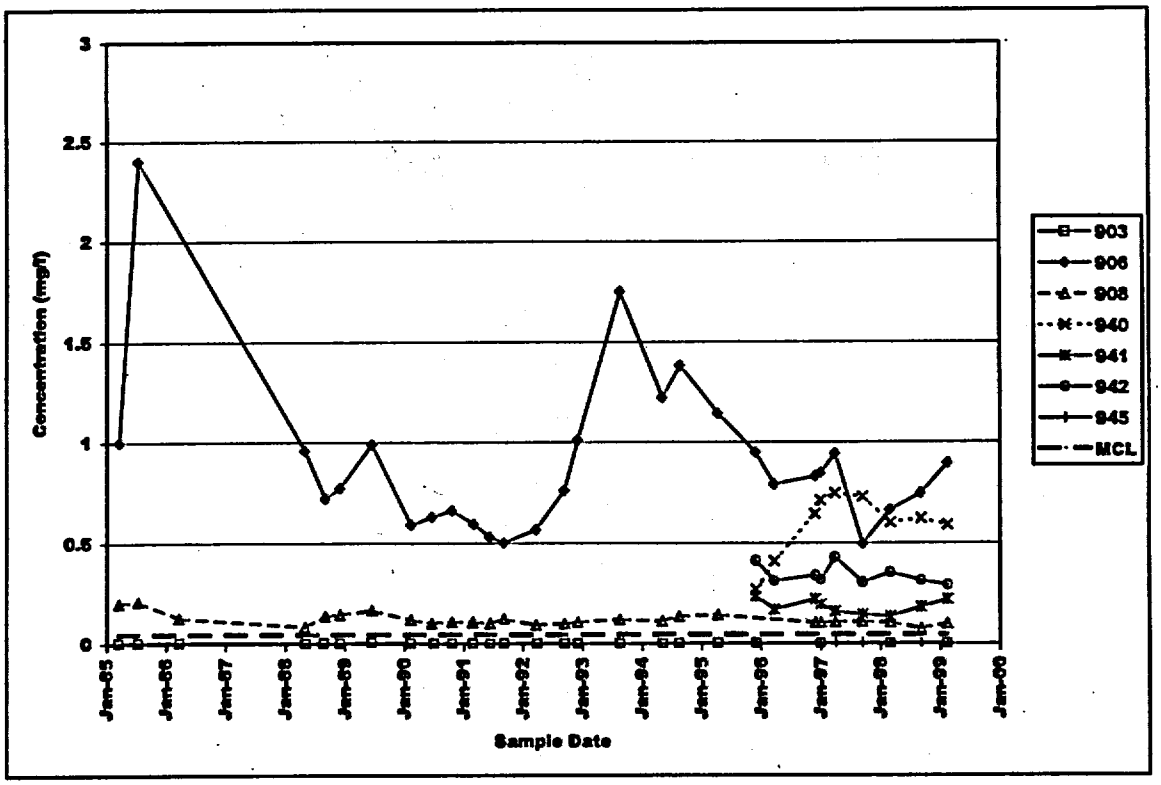


Figure TUB-5. Uranium Concentrations at the Tuba City, Arizona, Disposal Site

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