19.0 Tuba City, Arizona, Disposal Site

19.1 Compliance Summary

The Tuba City, Arizona, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on April 30, 2008. The disposal cell and all associated surface water diversion and drainage structures were in good condition and functioning as designed. Sand accumulation was still present at various locations along the toe of the disposal cell and in the drainage ditch and diversion channel, but is not impacting the function of these features. A gully along the north bank of the diversion channel that deposited sediment into the channel was stabilized. Deep-rooted vegetation found on the disposal cell top and side slopes was treated with herbicide. Three segments of the perimeter fence were repaired, and all 30 perimeter signs were replaced. Results of groundwater monitoring performed in 2008 indicate no significant change in groundwater quality when compared to historical results; groundwater quality downgradient from the former millsite is still degraded due to residual historical (processing-related) contamination. No other maintenance needs or cause for a follow-up or contingency inspection was identified.

19.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Tuba City Disposal Site are specified in the *Long-Term Surveillance Plan* [LTSP] *for the Tuba City, Arizona, Disposal Site* (DOE/AL/62350−182, Rev. 0, U.S. Department of Energy [DOE], Albuquerque Operations Office, October 1996) and in procedures established by DOE to comply with requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). These requirements are listed in Table 19–1.

Table 19–1. License Requirements for the Tuba City Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.1	Section 19.3.1
Follow-Up or Contingency Inspections	Section 7.0	Section 19.3.2
Routine Maintenance and Repairs	Section 8.0	Section 19.3.3
Groundwater Monitoring	Section 5.2	Section 19.3.4
Corrective Action	Section 9.0	Section 19.3.5

Institutional Controls—The United States Bureau of Indian Affairs holds the 145-acre disposal site in trust. The Navajo Nation retains title to the land. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. The U.S. Nuclear Regulatory Commission (NRC) required DOE to enter into Cooperative Agreement DE–FC04–85AL26731 with the Navajo Nation to perform remedial actions at the former processing sites prior to bringing the site under the general license. DOE and the Navajo Nation executed a Custodial Access Agreement (CAA) that conveys to the federal government title to the residual radioactive materials stabilized at the repository site and ensures that DOE has perpetual access to the site. The site was accepted under the NRC general license (10 CFR 40.27) in 1996 for compliance with 40 CFR 192, Subpart A. Institutional controls at the disposal site, as defined by DOE Policy 454.1, consist of federal control of the property, a site perimeter security fence, warning/no-trespassing signs (referred to as *perimeter*

signs) placed along the property boundary, and a locked gate at the entrance to the site. Verification of these institutional controls is part of the annual inspection. Inspectors found no evidence that these institutional controls were ineffective or violated.

19.3 Compliance Review

19.3.1 Annual Inspection and Report

The site, located east of Tuba City, Arizona, was inspected on April 30, 2008. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report are shown on Figure 19–1. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

Many structures and features at the site—including office buildings, evaporation ponds, a water treatment plant, a network of extraction and injection wells, and a treated water infiltration system—are associated with the ongoing active treatment of contaminated groundwater resulting from the former uranium processing that occurred at the site. These groundwater remediation activities are not addressed in the LTSP. As such, associated features are not included in the annual inspection and are only addressed herein as they relate to site integrity or safety concerns.

19.3.1.1 Specific Site-Surveillance Features

Access Road, Fence, Gate, and Signs—The site is accessed directly from U.S. Highway 160. Perpetual access to the site is granted by the CAA. A gate in a fence on the highway right-of-way allows access to the site along a gravel access road; the site entrance gate is located at the perimeter security fence. The access gate, road, and entrance gate to the site were in good condition. The gates were open at the time of the inspection because of ongoing groundwater remediation operations at the site. Entrance signs posted on both gates were in good condition. The two vehicle gates located in the south side of the perimeter fence were locked and in good condition.

The security fence was intact and in good condition. As observed in previous inspections, the top rail of the perimeter fence had been broken near perimeter signs P3 and P4 and was loose near
19A perimeter sign P24. Although, the breaks were minor and did not compromise site security, repairs were made in 2008. Tumbleweeds and trash have accumulated along the outside of the fence on the west side of the site.

Perimeter signs are posted in pairs. Each sign pair, secured to a metal post, consists of a no-
19B trespassing sign with a radioactive-materials tri-foil symbol, and a schematic sign with a diagram of the disposal cell (also identified by the radioactive-materials tri-foil symbol) and the site boundary. All 30 perimeter sign pairs were replaced with new aluminum signs in 2008.

Markers and Monuments—The two granite site markers—one just inside and to the right of the entrance gate, and the other on top of the disposal cell—were in good condition. The survey and boundary monuments were also in good condition.

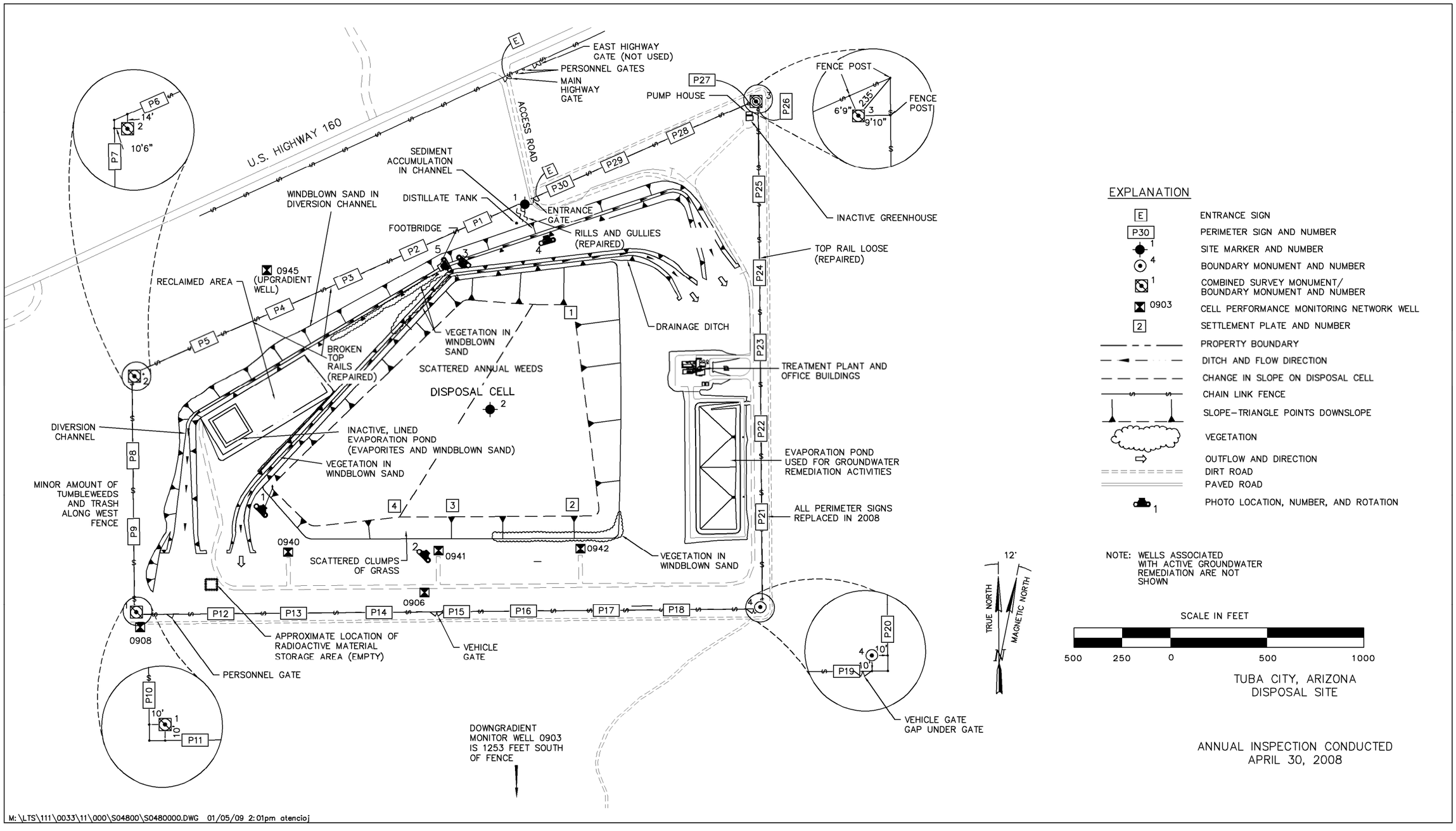

Figure 19–1. 2008 Annual Compliance Drawing for the Tuba City Disposal Site

This page intentionally left blank

Monitor Wells—Seven wells constitute the cell performance monitoring network (MW−0903, MW−0906, MW−0908, MW−0940, MW−0941, MW−0942, and MW−0945). The six wells inside and immediately adjacent to the disposal site were secure and in excellent condition. Monitor well MW–0903, located about one-quarter mile south of the cell, was not inspected but is maintained by personnel performing the sampling and was reported locked and in good condition.

19.3.1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three transects: (1) the disposal cell, (2) the area between the disposal cell and the site boundary, and (3) the outlying area. The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site-surveillance features, drainage structures, vegetation, and other features. Inspectors also examined the site for evidence of settlement, erosion, or other modifying processes.

Disposal Cell—The disposal cell is covered with riprap to control erosion. At the time of the inspection, the rock cover material was in excellent condition and showed no signs of deterioration. No evidence of differential settlement or slumping was observed. All visible components of the disposal cell and cover were in excellent condition (PL–1).

In accordance with the LTSP, deep-rooted vegetation is removed from the disposal cell top periodically to prevent potential penetration of the radon barrier. The most recent removal activity occurred during the fall of 2004. Since then, periodic application of herbicide has been
19C effective in controlling deep-rooted vegetation growth on the cell cover. Herbicide was applied to existing deep-rooted vegetation on the cell top and side slopes in early April 2008, and also during the inspection. Scattered patches of grass and annual weeds also grow on the cell top and side slopes; however, these shallow-rooted plants are not a concern.

Photographs were taken of sand accretion and vegetation encroachment at specific locations on the south side slope (PL–2). Annual photographs are taken at these locations to document change in sand accretion and vegetation conditions at the site. Sand accretion appeared unchanged since 2007, and apart from several dead saltbush shrubs (resulting from the early-April herbicide application), vegetation also appeared unchanged.

Area Between the Disposal Cell and the Site Boundary—The drainage ditch at the base of the disposal cell and the diversion channel, both located along the north and northwest sides of the cell, are in good condition (PL–3). As noted in the 2007 annual inspection, erosion along the north bank of the diversion channel near the distillate tank continues to result in sediment accumulation in the channel (PL–4). Although this erosion has had no apparent adverse impact on the performance of the channel (accumulated sediment would likely flush from the channel
19D during a severe runoff event), the gully in this area was stabilized in November 2008.

Windblown sand deposition continues to be monitored at the site. Unstable dunes in outlying areas are likely sources of sand accumulation along fence lines, in diversion channels, and in the rock cover of the disposal cell. However, revegetation of remediated areas surrounding the disposal cell appears to have been successful in reducing the rate of sand accumulation on site.

Since 2007, no significant increases in sand accretion and vegetation encroachment in the western and northwest segments of the diversion channel and drainage ditch were apparent (PL–5). In fact, there has been very little change at these locations since the monitoring of sand accretion began in 2001. Most important, the sand accumulations and vegetation along the channel and ditch are not adversely affecting the performance of these features.

One inactive evaporation pond is located between the diversion channel and drainage ditch on the west side of the site. This pond serves as a backup pond for the new evaporation pond located on the east side of the site. Two associated inactive evaporation ponds, formerly adjacent to the remaining pond, were removed in 2007, and the reclaimed area was seeded with native species. New vegetation was observed at the time of the inspection.

Outlying Area—The area beyond the site boundary for a distance of about 0.25 mile was examined for erosion, disturbance, change in land use, or other features of possible concern. No concerns were noted. Groundwater remediation activities continue.

19.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition, or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2008.

19.3.3 Routine Maintenance and Repairs

In 2008, all 30 perimeter signs were replaced, deep-rooted vegetation on the disposal cell was treated with herbicide, the fence was repaired, and erosion on the bank of the diversion channel was repaired.

19.3.4 Groundwater Monitoring

In accordance with the LTSP, DOE monitors groundwater to compare current conditions to
19E baseline post-construction (disposal cell) groundwater quality at the site. Groundwater quality beneath and downgradient of the disposal cell has been degraded by contamination from former uranium processing activities. This preexisting (legacy) processing-site-related groundwater contamination might mask any contamination potentially leaching from the disposal cell. Additionally, transient drainage resulting from the presence of wet tailings and slimes placed within the disposal cell may also occur that would not reflect cell performance. These conditions limit the effectiveness of normal point-of-compliance (POC) groundwater monitoring as a reliable indicator of cell performance (typically required under 40 CFR 192, Subpart A).

Given the preexisting processing-site-related contamination described above, long-term groundwater monitoring at POC wells in the uppermost aquifer to demonstrate cell performance is not technically feasible at the Tuba City Site. Therefore, groundwater monitoring is performed in accordance with Section 5.2.2 of the LTSP and is defined as *evaluative monitoring*. According to the LTSP, the purpose of this monitoring is to (1) evaluate trends in groundwater quality in the uppermost aquifer, (2) monitor the downgradient extent of contamination in groundwater, and (3) analyze the impacts of transient drainage and surface runoff. Groundwater quality data will

be evaluated in conjunction with 40 CFR 192, Subpart B (i.e., preexisting processing-site-related contamination) remedy at the site.

In accordance with the LTSP, seven compliance wells (Table 19–2) are monitored for four target analytes: molybdenum, nitrate (nitrate plus nitrite as nitrogen), selenium, and uranium. In Because of the preexisting groundwater contamination, the LTSP provides provisional upper baseline limits (UBLs) as the main criteria for assessing the results of the evaluative monitoring (Table 19–3). As stated in the LTSP, maximum concentration limits (MCLs) are not appropriate for determining the concentration limits needed to evaluate disposal cell performance.

Table 19–2. Groundwater Monitoring Network at the Tuba City Disposal Site

Monitor Well	Hydrologic Relationship	Monitoring Frequency
MW−0903	Downgradient (Off-site)	Annually
MW−0906[a]	Downgradient	Semiannually
MW−0908	Downgradient	Semiannually
MW−0940[b]	Downgradient	Semiannually
MW−0941	Downgradient	Semiannually
MW−0942	Downgradient	Semiannually
MW−0945	Upgradient (Background)	Annually

[a] MW–0906 could not be sampled in August 2008 due to an insufficient volume of water.
[b] MW–0940 has not been sampled since February 2004 due to an insufficient volume of water.

Table 19–3. Provisional Upper Baseline Limits for Groundwater at the Tuba City Disposal Site

Constituent	Provisional UBL (mg/L)[a]
Molybdenum	0.14
Nitrate (as Nitrogen)	311[b]
Selenium	0.05
Uranium	1.171

[a] Provisional UBLs are provided in the LTSP (October 1996).
[b] 311 mg/L is a calculated value based on the nitrate UBL of 1,379 mg/L presented in LTSP.
mg/L = milligrams per liter.
UBL = upper baseline limit.

Evaluative groundwater monitoring in 2008 was conducted in February (for those wells sampled semiannually) and in August (for all wells see Table 19–2). As has been the case since August 2004, it was not possible to obtain a sample from well MW−0940 because of an insufficient volume of water, reflecting the ongoing groundwater remediation pumping being conducted at the site. Until that time, concentrations of nitrate and (in most cases) selenium had been the highest in this well.

Sample results from the 2008 evaluative monitoring indicate that groundwater quality downgradient from the former millsite (in on-site wells MW–0906, MW–0908, MW–0940, MW–0941, and MW–0942) is still degraded with respect to concentrations of the four target analytes in the upgradient well (MW–0945). Time-concentration plots for the four analytes (beginning in 1998) are shown on Figures 19−2 through 19−5. For all four target analytes, concentrations in the off-site (approximately 1,250 feet) downgradient well MW−0903 have been comparable with those detected in the upgradient (background) well MW−0945, significantly lower than the on-site cell performance wells, and well below corresponding MCLs and UBLs.

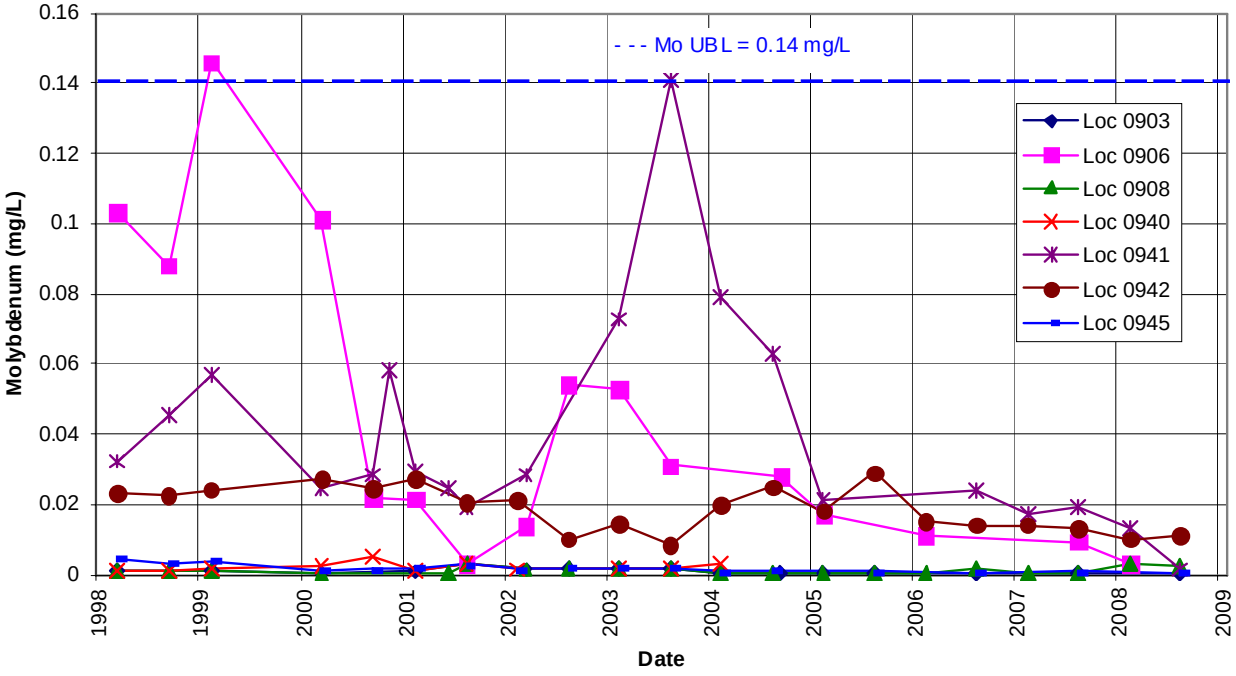

Figure 19–2. Time-Concentration Plots of Molybdenum in Groundwater at the Tuba City Disposal Site

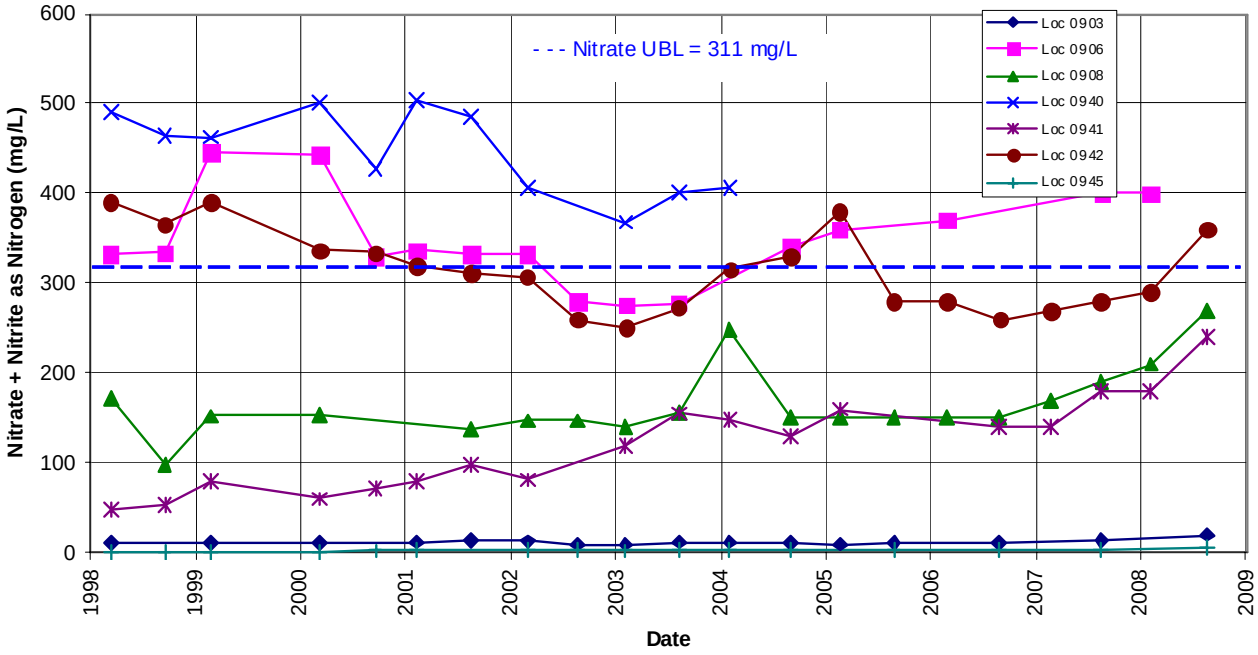

Figure 19–3. Time-Concentration Plots of Nitrate in Groundwater at the Tuba City Disposal Site

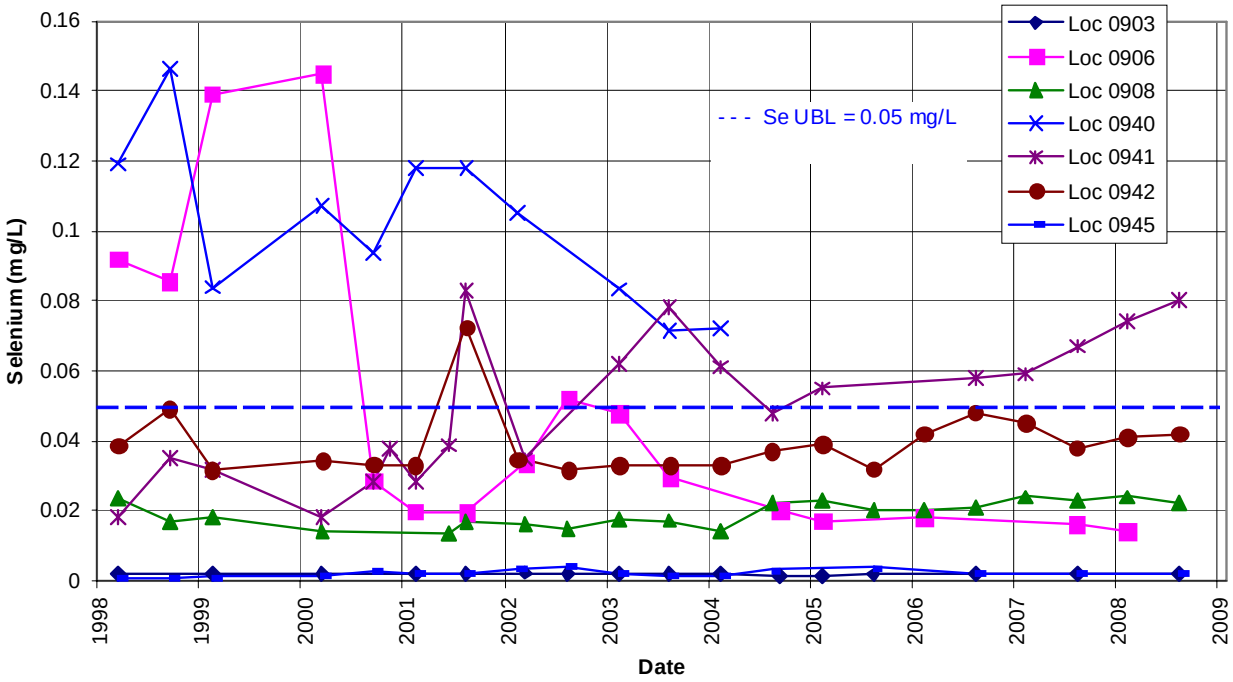

Figure 19–4. Time-Concentration Plots of Selenium in Groundwater at the Tuba City Disposal Site

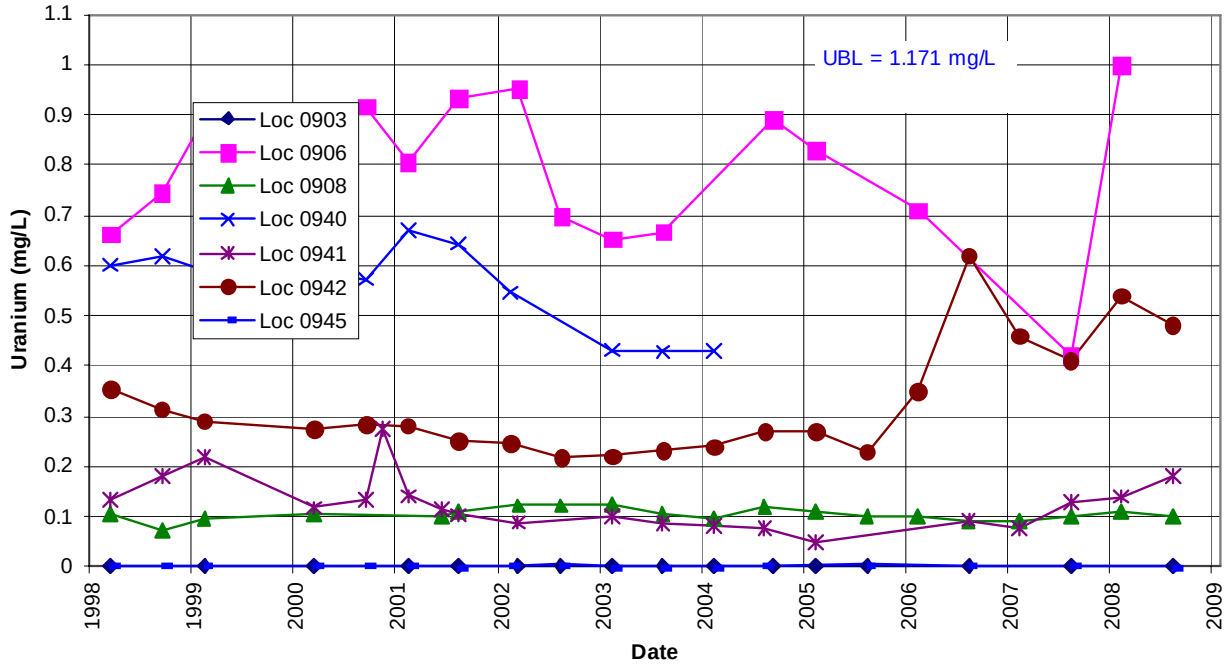

Figure 19–5. Time-Concentration Plots of Uranium in Groundwater at the Tuba City Disposal Site

In 2008, molybdenum concentrations in groundwater were below the 0.1 mg/L MCL and the 0.14 mg/L UBL in all wells (Figure 19–2). This has been the case since 2004, when concentrations began a downward trend in wells MW−0906 and MW−0941. Molybdenum concentrations in remaining wells have consistently been below 0.03 mg/L; results for MW–0908 and MW–0940 (last sampled in 2004) are comparable to background (MW–0945). Concentrations in both the off-site downgradient well MW−0903 and upgradient background well MW−0945 remain at or near the detection limit (0.0001 mg/L).

Since 1998, nitrate concentrations in all on-site downgradient wells—MW–0906, MW−0908, MW−0941, and MW−0942—have exceeded the 10 mg/L MCL by an order of magnitude or more. Nitrate concentrations in these wells have exhibited an upward trend since 2003 (Figure 19–3) and exceeded the 311 mg/L UBL in both MW–0906 (400 mg/L) and MW–0942 (360 mg/L) in 2008. Concentrations in off-site downgradient well MW−0903 remain well below the UBL, but the August 2008 measurement (20 mg/L) exceeded the MCL. Concentrations in the upgradient background well MW−0945 remain below the MCL.

Although selenium concentrations measured in groundwater in 2008 exceeded the 0.01 mg/L MCL in all wells except the upgradient background well MW−0945 and the off-site downgradient well MW−0903, concentrations were below the 0.05 mg/L UBL except for MW–0941 (0.08 mg/L, Figure 19–4). Concentrations in MW–0941 have displayed a recent upward trend since 2004 that fit into an overall upward trend since 1998.

In 2008, uranium concentrations in groundwater exceeded the 0.044 mg/L MCL but remained below the 1.171 mg/L UBL in all on-site downgradient wells (Figure 19–5). Concentrations in the upgradient well MW−0945 and the off-site downgradient well MW−0903 remain below 0.044 mg/L. No significant variations from recent trends occurred, with one exception: the uranium concentration in well MW−0906 essentially doubled since 2007—from 0.42 mg/L to 1.0 mg/L (the maximum concentration measured since LTSP monitoring began in 1998).

Active groundwater remediation is ongoing at the site. The LTSP evaluative monitoring cell performance wells are a subset of the groundwater remediation monitoring well network. The progress of groundwater remediation is evaluated annually, but remediation has not been active long enough to determine if the disposal cell is performing as designed.

19.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2008.

19.3.6 Photographs

Table 19–4. Photographs Taken at the Tuba City Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	45	The cell top and side slope along the northwest side of the disposal cell.
PL–2	45	Vegetation encroachment on the south side slope of the disposal cell (reference photograph taken from extraction well 1107).
PL–3	220	View of drainage ditch along the northwest side of the disposal cell.
PL–4	345	Gully erosion and sediment deposition in the diversion channel near distillate tank.
PL–5	240	Vegetation encroachment in windblown sand accumulating on the south bank of the diversion channel (repeat photograph taken from the footbridge).

TUB 4/2008. PL–1. The cell top and side slope along the northwest side of the disposal cell.

TUB 4/2008. PL–2. Vegetation encroachment on the south side slope of the disposal cell (reference photograph taken from extraction well 1107).

TUB 4/2008. PL–3. View of drainage ditch along the northwest side of the disposal cell.

TUB 4/2008. PL–4. Gully erosion and sediment deposition in the diversion channel near distillate tank.

TUB 4/2008. PL–5. Vegetation encroachment in windblown sand accumulating on the south bank of the diversion channel (repeat photograph taken from the footbridge).