LMS/DUP/S08054

Verification Monitoring Report for the Durango, Colorado, Processing Site

November 2011

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Contents

Figures

Tables

Appendixes

Abbreviations

ACL	alternate concentration limit
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DWEL	drinking water equivalent level
EPA	U.S. Environmental Protection Agency
ft	feet
ft^3/day	cubic feet per day
GCAP	Ground Water Compliance Action Plan
MCL	maximum concentration limit
mg/L	milligrams per liter
POC	point-of-compliance
UMTRCA	Uranium Mill Tailings Radiation Control Act

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1.0 Introduction

The Durango processing site is located in La Plata County, Colorado, approximately 0.25 mile southwest of the central business district of Durango, Colorado (Figure 1). The site consists of two separate areas: (1) the mill tailings area, which is the setting of former uranium-ore milling and storage of residual solid wastes (mill tailings), as well as a lead smelter plant which operated previous to the uranium mill, and (2) a raffinate ponds area where liquid process-wastes were impounded during milling operations. The former mill tailings area encompasses about 40 acres on a bedrock-supported river terrace between Smelter Mountain to the west, the Animas River to the east, and Lightner Creek to the north (Figure 2). The raffinate ponds area occupies about 20 acres on a separate river terrace located 1,500 feet (ft) south (downstream) of the mill tailings area (Figure 3).

1.1 Compliance Strategy

The compliance strategy for groundwater cleanup at the former mill tailings area of the Durango site is natural flushing, institutional controls to prevent exposure to contaminated groundwater, water quality monitoring, and an alternate concentration limit (ACL) for selenium (DOE 2003). This strategy was based in part on groundwater flow and solute transport modeling that predicted acceptable cleanup times for each contaminant, except possibly cadmium, by natural flushing of groundwater after the mill tailings (contaminant source) was removed in 1991. Baseline conditions of contaminant concentration in the model correspond to results of the June 2002 groundwater sampling. The groundwater model is fully documented in the Site Observational Work Plan (DOE 2002).

The compliance strategy for the raffinate ponds area consists of no further action, in conjunction with supplemental standards based on limited use (poor quality) groundwater. Groundwater monitoring is conducted as a best management practice. Monitoring results for the raffinate ponds area are also presented in this report.

1.2 Purpose

The primary purpose of this verification monitoring report is to evaluate the observed progress of passive groundwater restoration at the Durango mill tailings area. The evaluation involves comparing observed constituent concentrations through June 2011 with model-predicted concentrations for the same time period. The goal is to evaluate if natural flushing is progressing as predicted and if it remains a viable compliance strategy for the site.

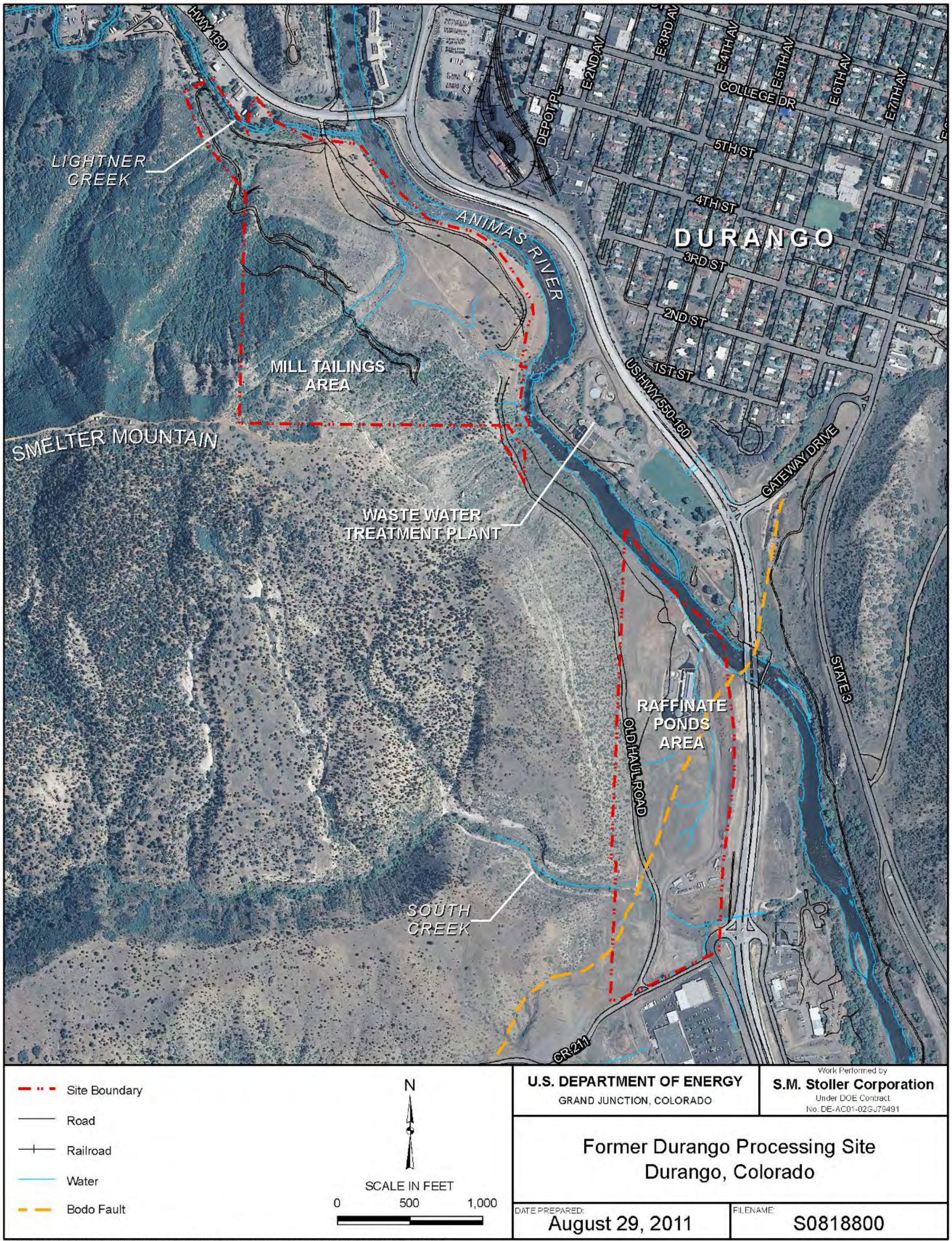

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Figure 1. Durango Processing Site

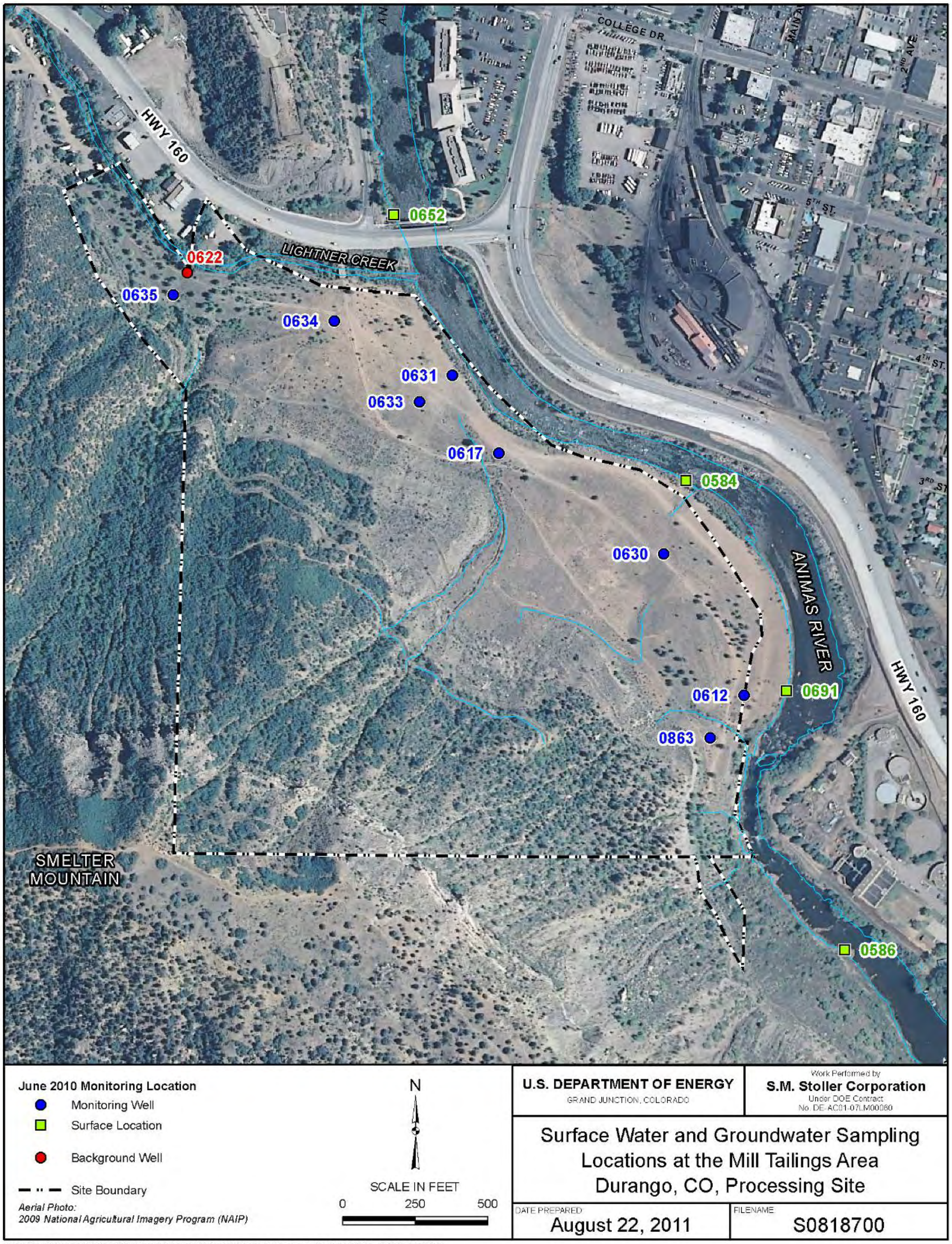

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Figure 2. Monitoring Network in the Mill Tailings Area at the Durango Site

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Figure 3. Monitoring Locations for the Raffinate Ponds Area

1.3 Summary

Evaluation of monitoring data through June 2011 and trend analysis of contaminant levels at site wells indicate that natural flushing remains a viable compliance strategy for the Durango processing site. The constituent concentration trends at several wells also appear to generally match model predictions. Cadmium concentrations are below the compliance goal for all locations except well 0612. Trend analysis suggests the concentration of this constituent will be below the compliance goal within a 100-year time frame. The compliance goal for manganese is also only exceeded at well 0612, and trend analysis indicates that the concentration of this constituent also will meet the compliance goal within 100 years. Molybdenum concentrations are below the compliance goal at all wells except well 0612, which is equal to the compliance goal. Exceedances at well 0612 could be attributed to the lead slag and a small lens of uranium ore that was left in place at the mill tailings area below the layers of lead slag along the river bank. Selenium concentrations are below the compliance goal for all locations except well 0633, which could be attributed to natural selenium in groundwater due to the leaching of shale bedrock underlying the site. Sulfate and uranium concentrations are above the compliance goals at all locations except at wells 0863, 0631, and 0635 for sulfate and wells 0863 and 0635 for uranium. Despite these exceedances, trend analysis of existing concentration data and model predictions suggests that it is still possible for sulfate and uranium to meet the compliance goals within 100 years.

2.0 Site Conditions

2.1 Hydrogeology

2.1.1 Mill Tailings Area

The uppermost aquifer at the mill tailings area is shallow and consists mostly of poorly sorted colluvium derived from Smelter Mountain, which rises steeply to the southwest. Alluvial deposits associated with the Animas River and Lightner Creek also comprise a portion of the shallow aquifer. The colluvium and alluvium are underlain by the low-permeability Mancos Shale bedrock, which essentially acts a hydraulic barrier downward from the shallow groundwater system. Approximately 70 ft of colluvium overlies bedrock along the base of Smelter Mountain. These deposits thin eastward and transition to deposits close to the Animas River that are about 15 ft thick. Depth to groundwater increases from about 5 ft on the river terrace to about 60 ft near the mountain-front. The saturated zone is thin (less than 10 ft), unconfined, of limited extent, and has a low yield. Groundwater flow is generally to the southeast, parallel to the Animas River, at an average gradient of approximately 0.02 ft/ft. Hydraulic conductivity of the colluvium and alluvium ranges from 10 to 70 ft/day.

The colluvium is recharged primarily by runoff from Smelter Mountain and infiltrating precipitation, while the river alluvium receives surface water from Lightner Creek and from river loss along the upstream reach of a prominent river meander that defines the middle third of the mill tailings area’s east boundary. Groundwater discharges to the Animas River along the upper and lower thirds of the river reach adjacent to the mill tailings area. Under average conditions, the estimated volume of groundwater discharge from the mill tailings area is 1,480 cubic feet per day (ft^3/day); approximately 840 ft^3/day of this total enters the Animas River near the mouth of Lightner Creek, and the remaining 640 ft^3/day enters the Animas River east and southeast of the footprint of a former tailings pile (DOE 2002). The alluvium and colluvium pinch out against bedrock cliffs near the southeast corner of the site, at which point groundwater discharge to the river is complete (DOE 2002).

2.1.2 Raffinate Ponds Area

Groundwater in the raffinate ponds area occurs in two bedrock units, both members of the Mesaverde Group, that are separated by the northeast trending Bodo Fault (Figure 3). The Point Lookout Sandstone, the basal formation of the Mesaverde Group, lies south of the fault and is divided into two members: a lower transitional member consisting of interbedded lenticular sandstones and shales, and an upper massive sandstone member. The Menefee Formation, north of the fault, consists of massive sandstone and shale along with beds of carbonaceous shale and coal. The Bodo Fault, a normal fault, dips to the southeast at approximately 55 degrees. The Point Lookout Sandstone is downthrown approximately 200 ft along the fault.

Groundwater in the raffinate ponds area is assumed to be unconfined. It is recharged by infiltration of precipitation and runoff from the Smelter Mountain area and the ephemeral South Creek. Eastward-flowing subsurface water also enters the groundwater system near the intersection of Bodo Fault and South Creek (Figure 3). Hydraulic conductivity data indicate that the Point Lookout Sandstone is the least conductive of the various bedrock units underlying the raffinate ponds area. The lower member (predominantly shale and siltstone) of the Point Lookout Sandstone is considered an aquitard. The Menefee Formation consists of mostly low-conductivity sandstone but is relatively permeable where fractures or lenticular coal beds are present. The largest hydraulic conductivities appear to occur in the near-vicinity of Bodo Fault and in the coal beds within the Menefee.

2.2 Water Quality

Groundwater in the alluvial aquifer at the mill tailings area is contaminated as a result of uranium-ore processing and on site tailings piles. Although the primary source of groundwater contamination (mill tailings) was removed from the site by 1991, concentrations of arsenic, cadmium, lead, molybdenum, gross alpha activity (excluding radon and uranium), radium-226+228, selenium, and uranium remaining in the underlying aquifer exceeded maximum concentration limits (MCLs) established in Title 40 *Code of Federal Regulations* Part 192 (40 CFR 192) for sites regulated under the Uranium Mill Tailings Radiation Control Act (UMTRCA). Concentrations of arsenic, lead, and radium have since decreased to levels below the MCLs, and gross alpha activity was detected only sporadically in a few wells. Monitoring for arsenic, lead, radium, and alpha activity was discontinued in 2002 in accordance with provisions of the Ground Water Compliance Action Plan (GCAP) (DOE 2003).

Table 1 compares the maximum concentrations of the remaining site contaminants detected in June 2011 to the corresponding compliance goals for the mill tailings area. The compliance goals for cadmium, molybdenum, and uranium are UMTRCA MCLs. The compliance goal for selenium (0.05 milligram per liter [mg/L]) is adopted from the U.S. Environmental Protection Agency (EPA) Safe Drinking Water Act as an ACL (the UMTRCA MCL is 0.01 mg/L). An ACL was established for selenium because selenium occurs naturally in groundwater beneath the site at levels above the UMTRCA MCL. There are no MCLs for manganese and sulfate. The compliance goal for manganese is the EPA drinking water equivalent level (DWEL). This is a lifetime exposure concentration that is protective of adverse, non-cancer health effects; it assumes that all of the exposure to a contaminant is from drinking water (EPA 2004). The sulfate goal is equivalent to its average background concentration in local groundwater.

Table 1. Current Groundwater Contaminants and Compliance Goals for the Mill Tailings Area

Contaminant of Concern	Compliance Goal (mg/L)	Compliance Goal Source	Maximum Concentration Observed in June 2011 (mg/L)
Cadmium	0.01	UMTRCA MCL	0.039
Manganese	1.6	DWEL (EPA 2004)	5.1
Molybdenum	0.1	UMTRCA MCL	0.1
Selenium	0.05	ACL (DOE 2002)	0.039
Sulfate	1,276	Average Background (DOE 2002)	3300
Uranium	0.044	UMTRCA MCL (activity based)	1.2

Bedrock groundwater at the raffinate ponds area qualifies for supplemental standards on the basis of limited use groundwater. The groundwater in the bedrock is of limited use because of widespread, elevated concentrations of naturally occurring selenium. Selenium concentrations exceed the MCL at background monitoring well 0599 by a factor of nearly nine. Additional evidence of the natural presence of selenium beneath the raffinate ponds area is presented in Section 5.4 of the Site Observational Work Plan (DOE 2002). Because supplemental standards apply to groundwater in the raffinate ponds area, no numerical compliance goals have been established for that portion of the site.

Current monitoring of the Animas River verifies previous findings in the Baseline Risk Assessment (DOE 1995) that past milling operations have negligible effect on surface water quality. Results indicate that constituent concentrations adjacent to and downstream of the mill tailings area are indistinguishable from upstream background river concentrations (Table 2).

Table 2. Current Concentrations in the Animas River

Area	Location #	Cadmium (mg/L)	Molybdenum (mg/L)	Selenium (mg/L)	Uranium (mg/L)
Background	0652	0.00019	0.00034	0.00034	0.0002
Mill Tailings	0584	0.0002	0.00049	0.00049	0.00019
Mill Tailings	0586	0.00034	0.00044	0.00044	0.00022
Mill Tailings	0691	0.00012	0.00026	0.00026	0.00025
Raffinate Ponds	0654	0.00022	0.00037	0.00015	0.00032
Raffinate Ponds	0656	0.0003	0.00026	0.00018	0.00021

2.3 Surface Remediation Activities

The U.S. Department of Energy (DOE) began surface cleanup of the mill tailings and raffinate ponds areas in November 1986 to meet the EPA standards for radium in soil. A total of 2.5 million cubic yards of contaminated material was relocated to the Bodo Canyon disposal cell several miles southwest of the Durango site. Supplemental cleanup standards were applied to steep slopes of Smelter Mountain and two regions bordering the Animas River. In addition, a small lens of uranium ore was left in place at the mill tailings area below layers of slag along portions of the river. The slag deposits, which are 10 to 15 ft thick in some areas (including the location of well 0612), are from a lead smelter that operated on the site from 1880 to 1930. To restore the site, approximately 230,000 cubic yards of uncontaminated soil was backfilled, contoured, and seeded. Riprap was placed in some sensitive areas along the Animas River to prevent erosion. Remedial action was completed in May 1991.

2.4 Water and Land Use

The primary water source for the city of Durango is the Florida River upstream of its confluence with the Animas River. Additional water is withdrawn from the Animas River during high-demand periods (usually during the summer) from a location approximately 2 miles upstream of the mill tailings area. The Animas River bordering the mill tailings area of the Durango site is popular for seasonal boating and fishing. Development plans for both the mill tailings area, and the raffinate ponds area do not include residential use (DOE 2002).

2.5 Institutional Controls

As part of the compliance strategy, public health will be protected at the mill tailings area during the natural flushing period through an environmental covenant between the State of Colorado and the City of Durango (landowner) that restricts access to contaminated alluvial groundwater. Additionally, deed restrictions (which serve as a notice to the public) for the mill tailings area prohibit access to groundwater without written permission from DOE and the Colorado Department of Public Health and Environment. Groundwater use in the raffinate ponds area is restricted in perpetuity through a deed restriction that also requires DOE’s permission before use of groundwater for any purpose. The State of Colorado is currently in the process of trying to obtain a signed environmental covenant agreement for the raffinate ponds area.

3.0 Monitoring Program

The annual groundwater and surface water monitoring of the processing site was established in the GCAP (DOE 2003). The GCAP specifies that monitoring will continue for the first 5 years following U.S. Nuclear Regulatory Commission concurrence with the GCAP. Monitoring for cadmium at the mill tailings area will continue annually for the first 10 years following concurrence because of the greater uncertainty about whether this constituent will naturally flush within the allotted 100-year period established in 40 CFR 192. Monitoring data obtained through the initial 5-year period will measure the progress of natural flushing of the constituents listed in Table 1. The GCAP specifies that after the 5-year annual monitoring period, the scope of subsequent monitoring will be addressed in a Long-Term Management Plan. Although the GCAP has not been approved by the NRC, DOE has adopted the recommended monitoring approach specified in this document. The 5- and 10-year timeframes will begin when concurrence is obtained

At the mill tailings area, monitoring wells 0612, 0617, 0630, 0631, 0633, 0634, 0635, and 0863 have been established as point-of-compliance (POC) wells that will be used to monitor the progress of natural flushing in groundwater in the alluvial aquifer (Figure 2). In accordance with provisions of the GCAP (DOE 2003), natural flushing for a given analyte is complete when its concentration no longer exceeds the compliance goal at all POC wells for three consecutive annual sampling events. Monitoring for that constituent may then be discontinued.

Surface water locations 0652, 0584, 0691, and 0586, located along the Animas River, will be sampled to verify continued protection of the aquatic environment (Figure 2). The rationale and requirements for compliance monitoring in the mill tailings area are summarized in Table 3.

Table 3. Annual Groundwater and Surface Water Compliance Monitoring Requirements for the Mill Tailings Area

Sampling Location	Monitoring Purpose	Analytes	Location
Groundwater Monitoring			
0617, 0630, 0631, 0633, 0634, 0635	POC/verify natural flushing	Manganese Molybdenum Selenium Sulfate Uranium	On site
0612, 0863	POC/verify natural flushing; verify cadmium flushing	Cadmium Manganese Molybdenum Selenium Sulfate Uranium	On site downgradient
Surface Water Monitoring			
0652	Surface water background	Cadmium Molybdenum Selenium Uranium	Off site upstream
0584, 0691	Verify no site-related increase above background		Off site; site groundwater discharge area
0586	Verify no site-related increase above background		Off site; downstream of site groundwater discharge

Groundwater and surface water monitoring of the raffinate ponds area is being conducted only as a best management practice and no POC wells have been established. Monitoring requirements are summarized in Table 4.

Table 4. Summary of Monitoring Requirements at the Raffinate Ponds Area

Sampling Location	Monitoring Purpose	Analytes	Location
0879, 0594 (replaced 0880)	Monitor concentrations in groundwater in the shallow bedrock.	Selenium Uranium	On site
0598	Monitor concentrations in groundwater in the deep bedrock and Bodo Fault zone.	Selenium Uranium	On site
0607	Monitor concentrations in groundwater entering the site.	Selenium Uranium	On site
0884	Monitor off-site downgradient concentrations and migration.	Selenium Uranium	Off site downgradient
0588	Surface water quality entering the site.	Selenium Uranium	Off site upgradient
0654, 0656	Downgradient surface water concentrations.	Selenium Uranium	Off site downgradient

4.0 Results of 2011 Monitoring

Table 5 summarizes the amount of time the model predicts for natural flushing to achieve the compliance goals for cadmium, manganese, molybdenum, selenium, sulfate, and uranium in groundwater. The progress of each constituent, based on water quality data from August 1992 through June 2011, is addressed separately in the following subsections. June 2002, was established as the groundwater model baseline condition (time zero) for contaminant transport. The predicted compliance times, listed in Table 5, are based on the predicted maximum average contaminant concentrations and the probability that the standard will be exceeded. The compliance times differ because the contaminants initially were not distributed evenly and vary in degree of contamination above the respective compliance goal, and because each contaminant varies in its mobility in groundwater.

Table 5. Model-Predicted Groundwater Restoration Times for the Mill Tailings Area

Analyte	Compliance Goal (mg/L)	Predicted Time to Meet Compliance (years)[a,b]
Cadmium	0.01	>100
Manganese	1.6	70
Molybdenum	0.1	5
Selenium	0.05	60
Sulfate	1,276	100
Uranium	0.044	90

[a] Source: DOE 2002, Appendix G, Table 18.
[b] Model time zero (baseline) is June 2002.

Plots of model-predicted compliance times are based on single steady state deterministic simulations conducted for the GCAP (DOE 2003) and run again for the 2010 VMR at individual wells. These plots continue to show mixed results; some 2011 sampling data show concentrations above those predicted by the model, while others are consistent with model predictions.

4.1 Groundwater

4.1.1 Mill Tailings Area

Groundwater was sampled from the eight POC locations (Figure 2) and analyzed for constituents shown in Table 3. Sampling results for 2011 are provided in Appendix A and are discussed below by constituent.

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Figure 4. Distribution of Cadmium at the Mill Tailings Area in June 2011

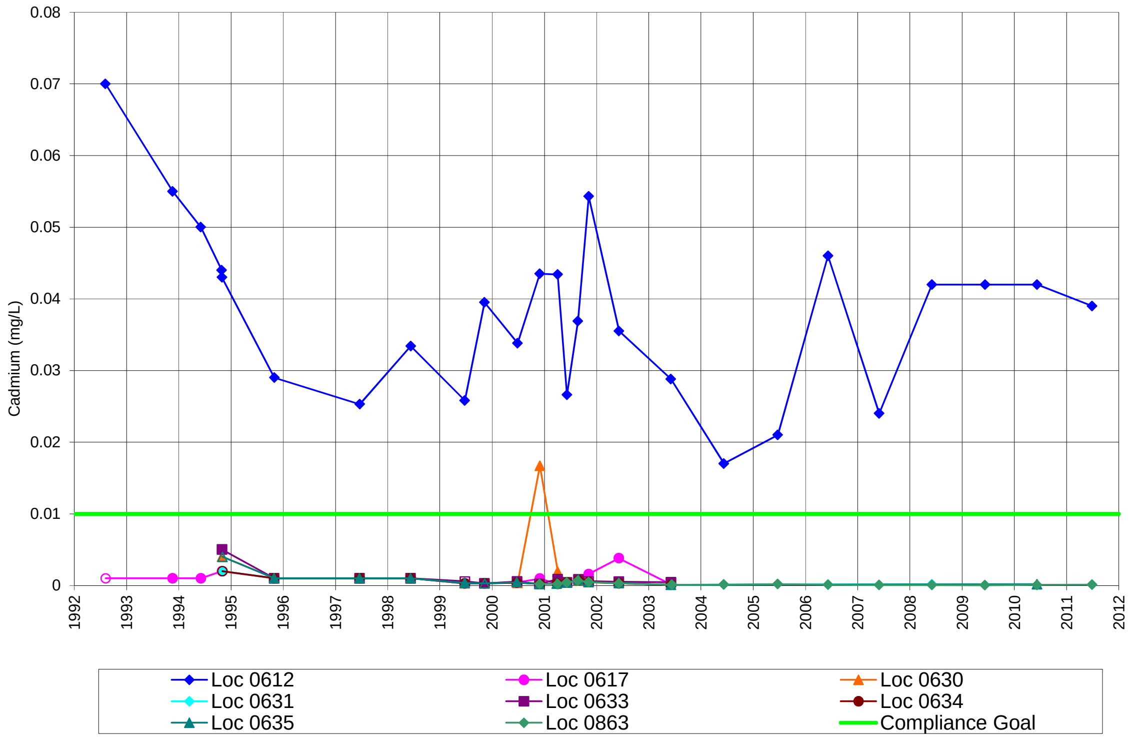

Figure 5. Historical Cadmium Concentrations in Groundwater at the Mill Tailings Area

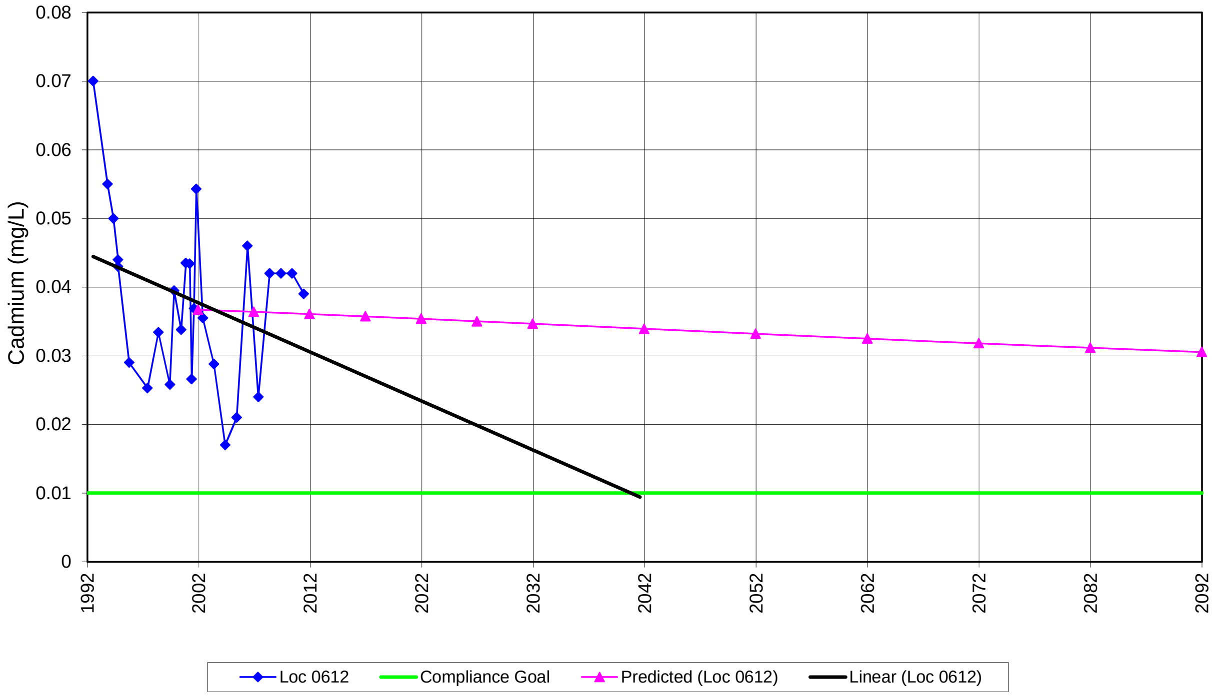

Figure 6. Predicted and Measured Cadmium Concentrations at the Mill Tailings Area

4.1.1.1 Cadmium

Figure 4 is a map view of the site showing the concentration of cadmium in groundwater at the compliance wells in June 2011. Figure 5 shows observed cadmium concentrations versus time at the compliance wells since completion of remedial action in 1991. Cadmium levels exceeded the MCL at well 0612. The remaining monitoring wells contained only trace levels of this constituent. Groundwater modeling predicted a flushing period greater than 100 years for cadmium (Table 5). This result is not consistent with historical trending at well 0612, which if projected linearly from 1992 beyond June 2011 implies compliance for cadmium by about 2040 (Figure 6). Projecting this trend too far into the future might underestimate the actual restoration period because of transport processes that lead to a long tail in the predicted concentrations at the end of the process. This is commonly observed in nature and predicted by the solute transport models. Natural flushing of cadmium, however, remains a potential strategy because of the very limited distribution of cadmium at the site and the observed net decrease in concentration over time. Since it is early in the 100-year natural flushing time frame, DOE will continue to monitor cadmium concentrations in groundwater and will reevaluate the strategy later, if required.

4.1.1.2 Manganese

Figure 7 illustrates the distribution of manganese concentrations in groundwater in June 2011 and Figure 8 shows the historical variations of manganese concentrations at the compliance wells. The June 2011 results are typical for manganese because the compliance goal was exceeded only at well 0612 (Figure 8) Projecting the linear trend of the observed concentration at well 0612 implies that natural flushing will meet the compliance goal at that location in about the year 2086, still within the 100-year time allotment (Figure 9). The net variation in the concentration of manganese observed through the relatively brief period since 2002 is consistent with the model prediction for this location. Well 0612 is very close to the downgradient discharge boundary of the aquifer; therefore contaminant migration from that area will not affect other regions of the aquifer. The flushing period for well 0612 is assumed to represent a sitewide maximum for manganese because the compliance goal is not exceeded at any other location.

4.1.1.3 Molybdenum

Molybdenum concentrations in June 2011 were less than or equal to the compliance goal of 0.1 mg/L at all locations (Figure 10). The concentration at well 0612, which increased slightly in 2011, remain in compliance (Figure 10 and Figure 11). All wells have remained below the standard for 3 sampling rounds, and monitoring for molybdenum can be discontinued. The linear trend of observed concentrations at well 0612 forecasts molybdenum flushing to be complete in 2010 (Figure 12); however, the slight increase in 2011 may warrant further monitoring for molybdenum at well 0612.

Figure 7. Distribution of Manganese at the Mill Tailings Area in June 2011

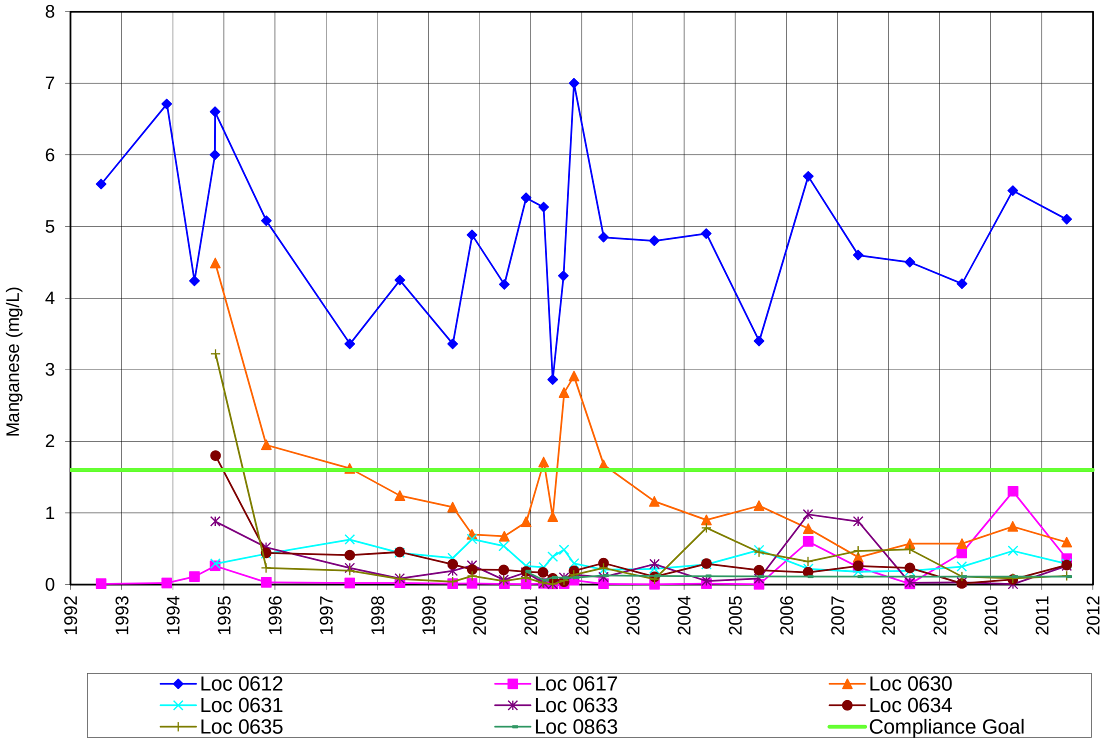

Figure 8. Historical Concentrations of Manganese at the Mill Tailings Area

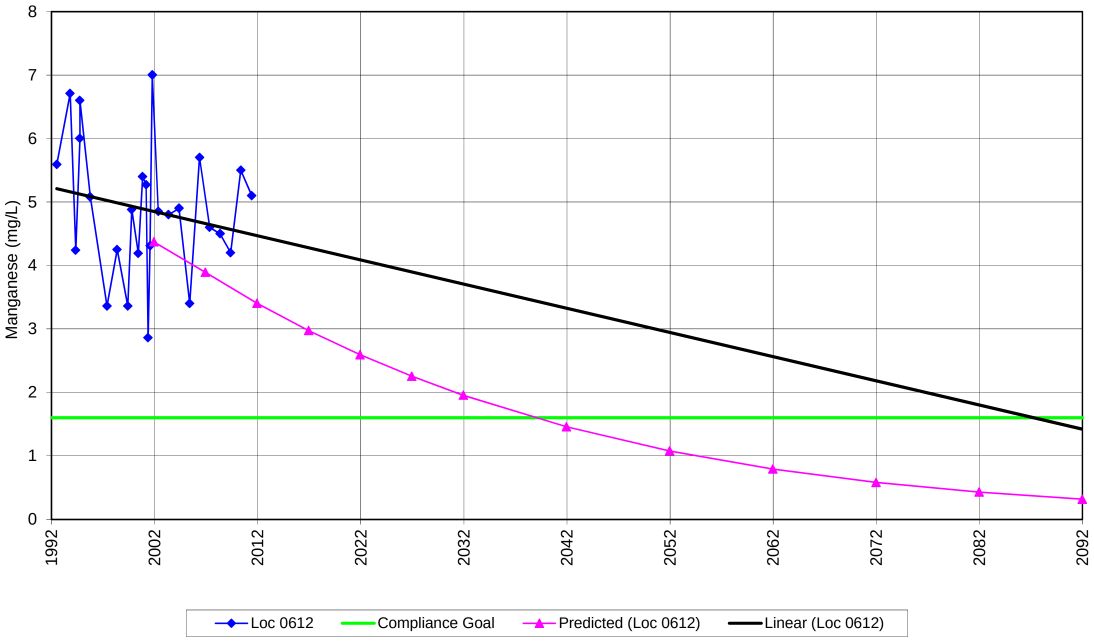

Figure 9. Predicted and Measured Manganese Concentrations at the Mill Tailings Area

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Figure 10. Distribution of Molybdenum at the Mill Tailings Area in June 2011

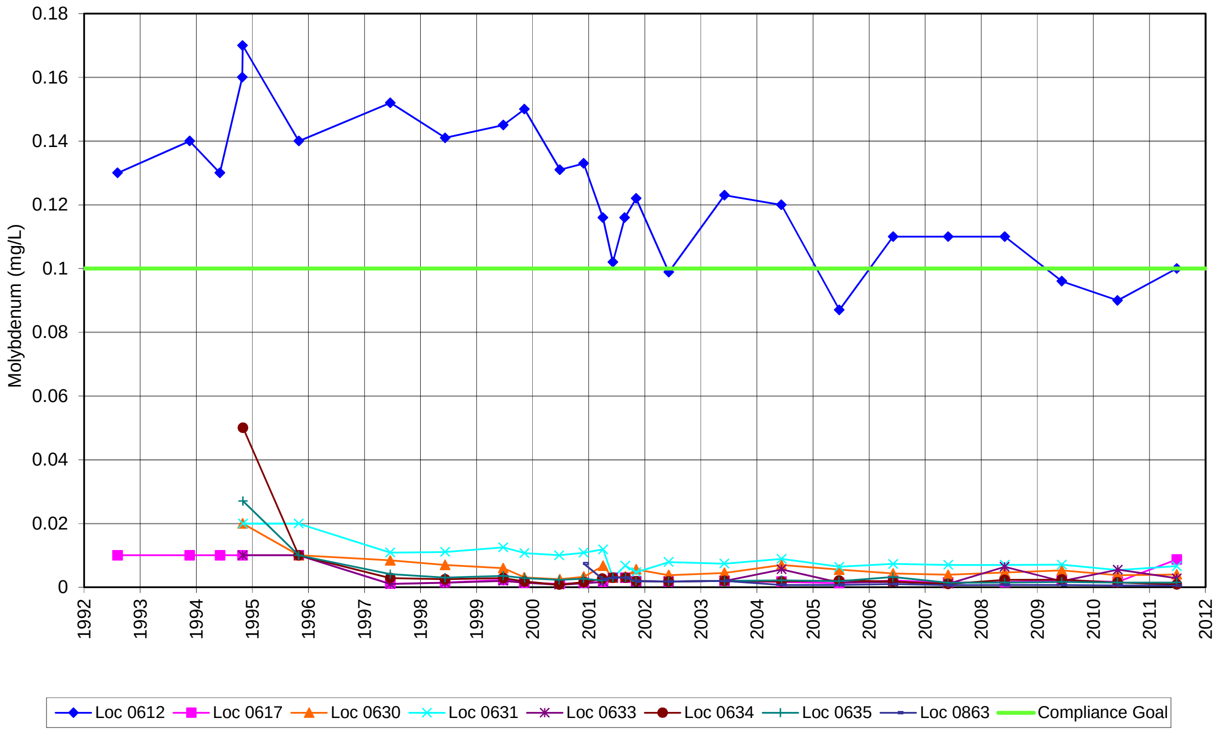

Figure 11. Historical Concentrations of Molybdenum at the Mill Tailings Area

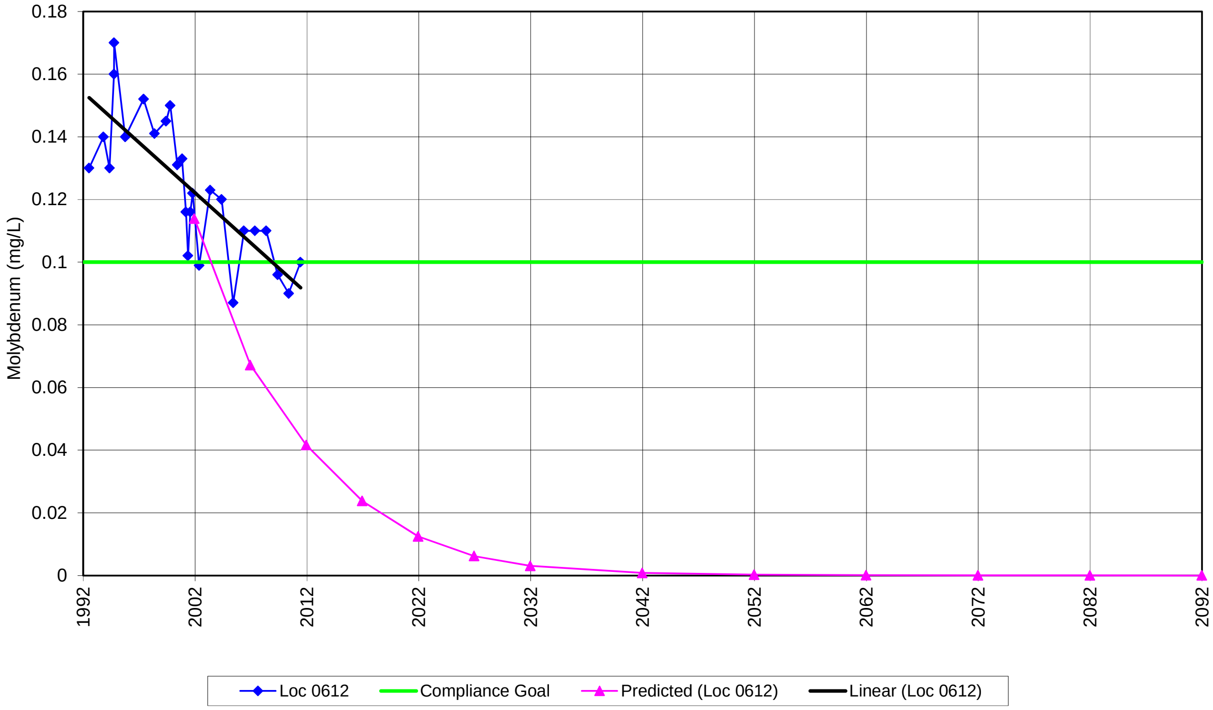

Figure 12. Predicted and Measured Molybdenum Concentrations at the Mill Tailings Area

4.1.1.4 Selenium

Figure 13 shows, in map view, that the compliance goal for selenium (0.05 mg/L) was met at all wells. Selenium levels in well 0633, which had rebounded above the standard in 2010 have decreased below in 2011 (Figure 14). The model predicted that selenium concentrations would drop below the ACL by 2024 (Figure 15).

Concentrations in well 0633 increased from 0.048 mg/L in 2009 to 0.13 mg/L in 2010, and have decreased to 0.015 mg/L in 2011 (Figure 14). The majority of the screened portion of well 0633 is in Mancos Shale, a recognized source of readily mobilized selenium (DOE 2002). The low-level selenium contamination at the site may in part be site-related; however, some contribution from natural sources is likely, as evidenced by concentrations greater than 0.01 mg/L at background well 0622 (Figure 14).

4.1.1.5 Sulfate

Sulfate concentrations that exceed background levels are related to the former use of sulfuric acid in the milling process. In June 2011, sulfate exceeded the average background concentration at all POC wells except wells 0631, 0635, and 0863 (Figure 16 and Figure 17). Observed concentrations since 1992 have fluctuated considerably at most of the POC wells and have generally not shown trending. However, projecting best-fit lines to the data reveals that sulfate flushing will be complete at most locations by about 2092 (Figure 18). Linear trend projections of data from well 0612 and well 0633 indicate that concentrations at these locations will meet the compliance goal. Linear trends at wells 0617 and 0634 are relatively flat or increasing, but the model predictions indicate compliance by 2042.

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Figure 13. Distribution of Selenium at the Mill Tailings Area in June 2011

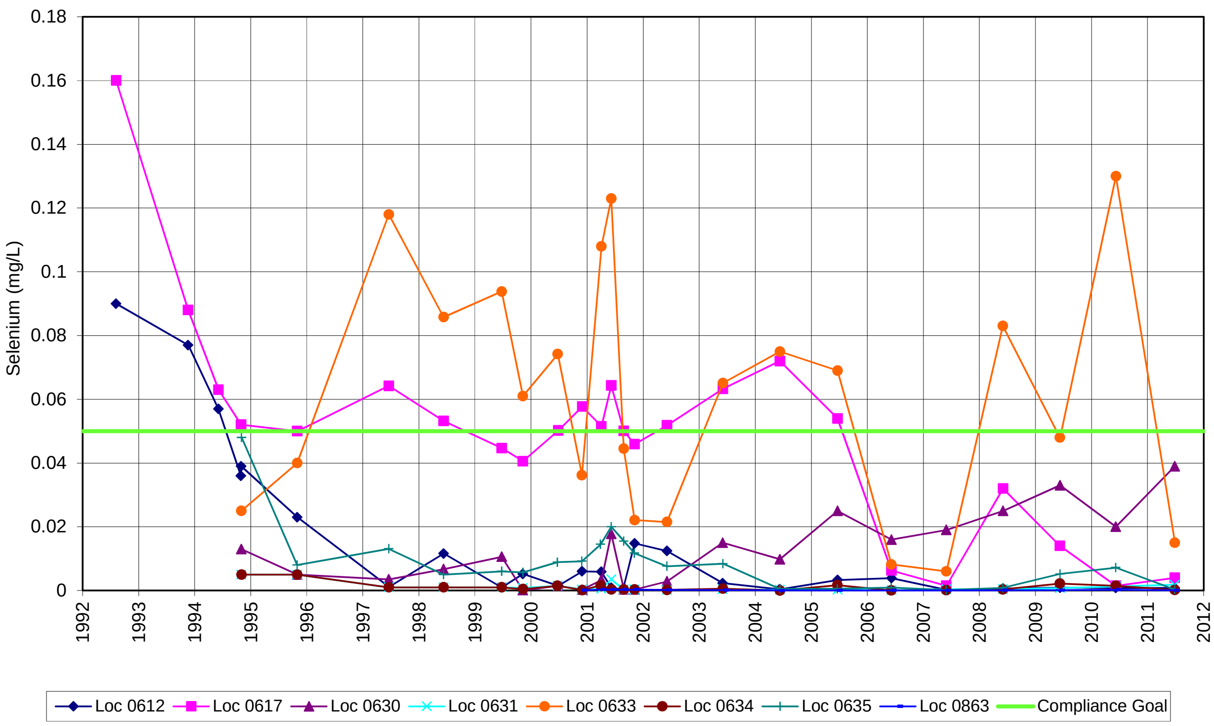

Figure 14. Historical Selenium Concentrations in Groundwater at the Mill Tailings Area

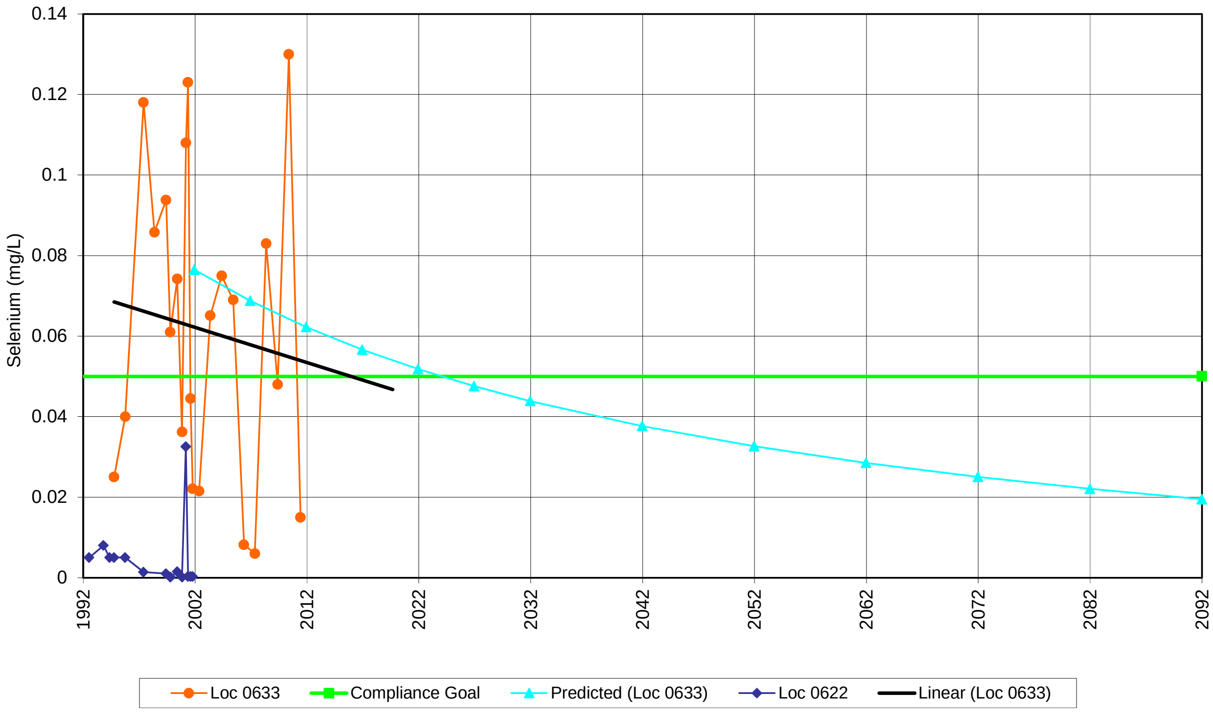

Figure 15. Predicted and Measured Selenium Concentrations at the Mill Tailings Area

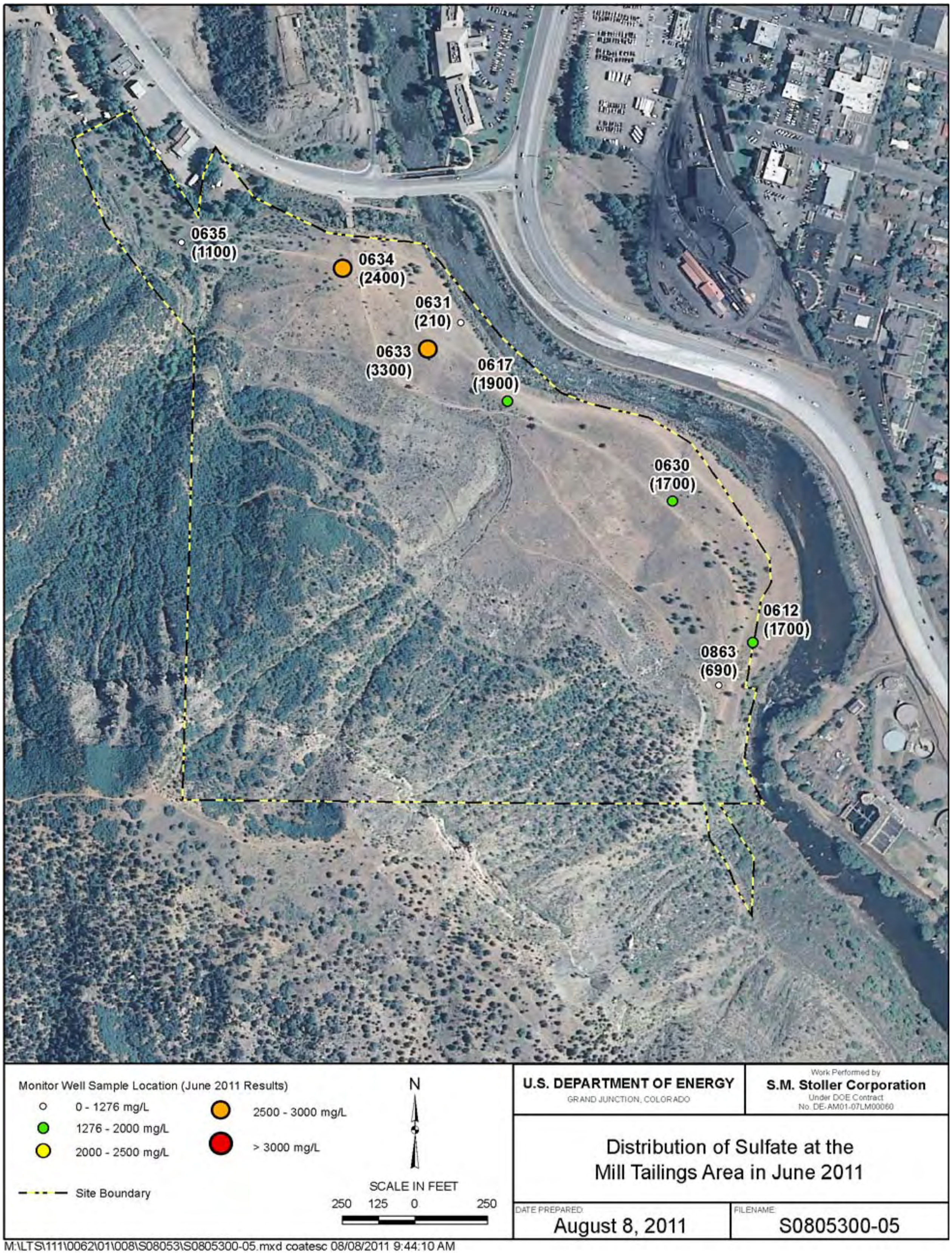

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Figure 16. Distribution of Sulfate at the Mill Tailings Area in June 2011

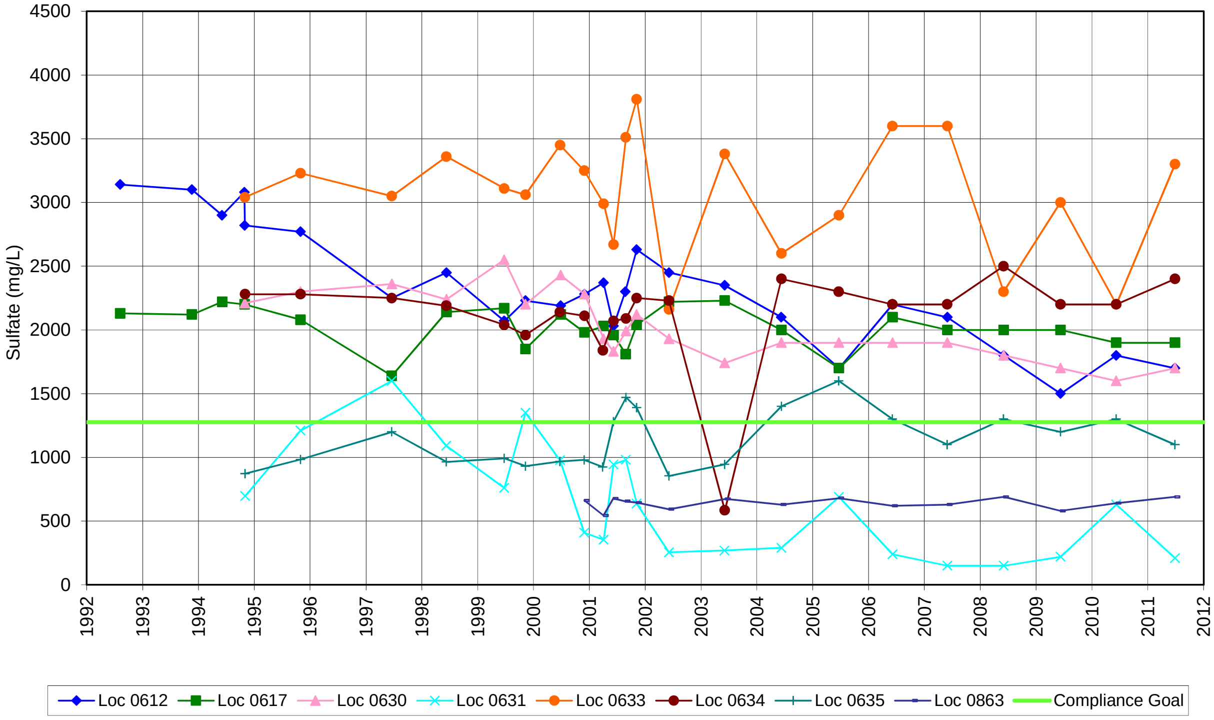

Figure 17. Historical Concentrations of Sulfate at the Mill Tailings Area

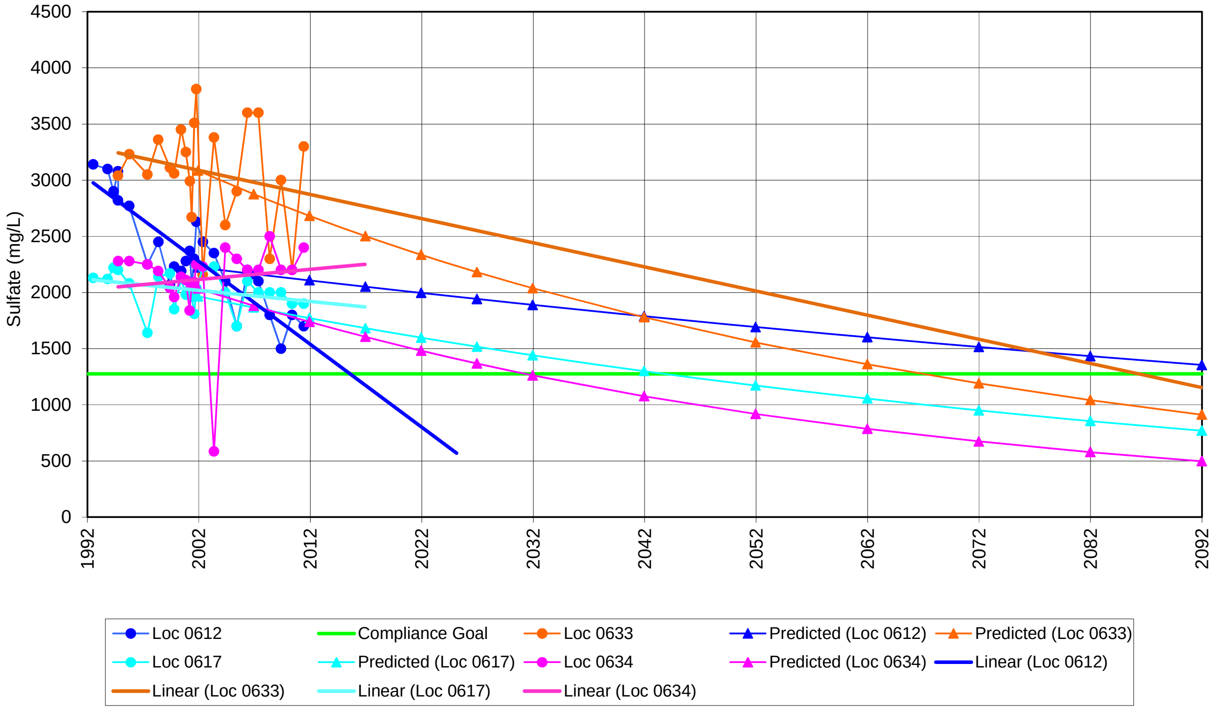

Figure 18. Predicted and Measured Sulfate Concentrations at the Mill Tailings Area

4.1.1.6 Uranium

The uranium compliance goal was exceeded at all locations except wells 0635 and 0863 in June 2011 (Figure 19 and Figure 20). This is consistent with previous monitoring results. The two wells where uranium concentrations have been the greatest (0612 and 0633) have shown a generally decreasing concentration trend since source removal. Groundwater model predictions indicate that sitewide uranium flushing will be complete by about 90 years after June 2002 (Table 5). To date, observed concentrations at the two wells that have the highest uranium concentrations (wells 0612 and 0633) are in general agreement with the model results (Figure 21). These wells are widely separated in the aquifer. The predicted flushing periods for these two wells are less than the predicted sitewide flushing time because the last area to flush according to the site model is south of the downgradient-most monitoring well (well 0612). Linear projection of the observed concentration at well 0633 implies sitewide uranium flushing by about 2030 (Figure 21). The model predicts initial rates of uranium flushing at this well that track observed concentrations, followed by a period of less rapid flushing and marginal levels of contamination (concentration tailing) until the goal is attained. Similar tailing of concentrations is predicted by the model at well 0612. Uranium concentrations may remain slightly above the compliance goal during the period of reduced flushing at these two wells.

4.1.2 Raffinate Ponds Area

Groundwater in the raffinate ponds area is being monitored as a best management practice. Bedrock groundwater at the raffinate ponds area qualifies for supplemental standards on the basis of limited use groundwater due to widespread elevated concentrations of naturally occurring selenium. Because there are naturally occurring sources of both selenium and uranium in the area, groundwater is not expected to naturally flush. Therefore, no modeling was done for the raffinate ponds area.

Groundwater was sampled from five well locations in the monitoring network (Figure 3) in 2011 and analyzed for uranium and selenium. Sampling results for 2011 are provided in Appendix A and are discussed below by constituent.

4.1.2.1 Selenium

Figure 22 shows historical concentrations of selenium since completion of remedial action in 1992. Significant increases and decreases in selenium distribution in groundwater occurred at several wells from 2001 to 2004, and concentrations have since leveled off. It is not clear what caused the past selenium behavior; accordingly, the future disposition of selenium in the area’s groundwater cannot be reliably predicted.

4.1.2.2 Uranium

Historical concentrations of uranium in the raffinate ponds area are shown in Figure 23. Concentrations of uranium in most wells have fluctuated over the last several years, showing neither increasing nor decreasing trends. Supplemental standards were applied to soils in the raffinate ponds area (DOE 2002), and those soils may contain residual uranium contamination that influences groundwater quality. Subpile soil analyses indicate the presence of uranium in soils remaining at the site (DOE 2002).

M:\LTS\111\0062\01\008\S08053\S0805300-06.mxd coatesc 08/08/2011 9:54:12 AM

Figure 19. Distribution of Uranium at the Mill Tailings Area in June 2011

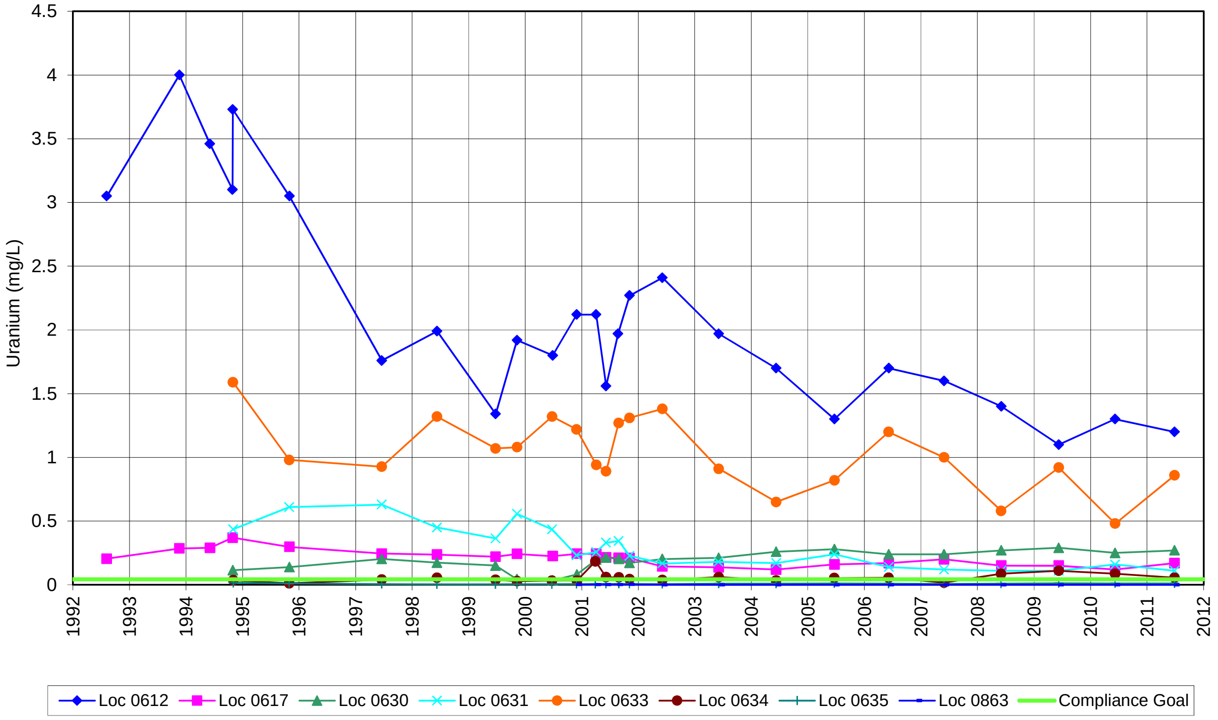

Figure 20. Historical Concentrations of Uranium at the Mill Tailings Area

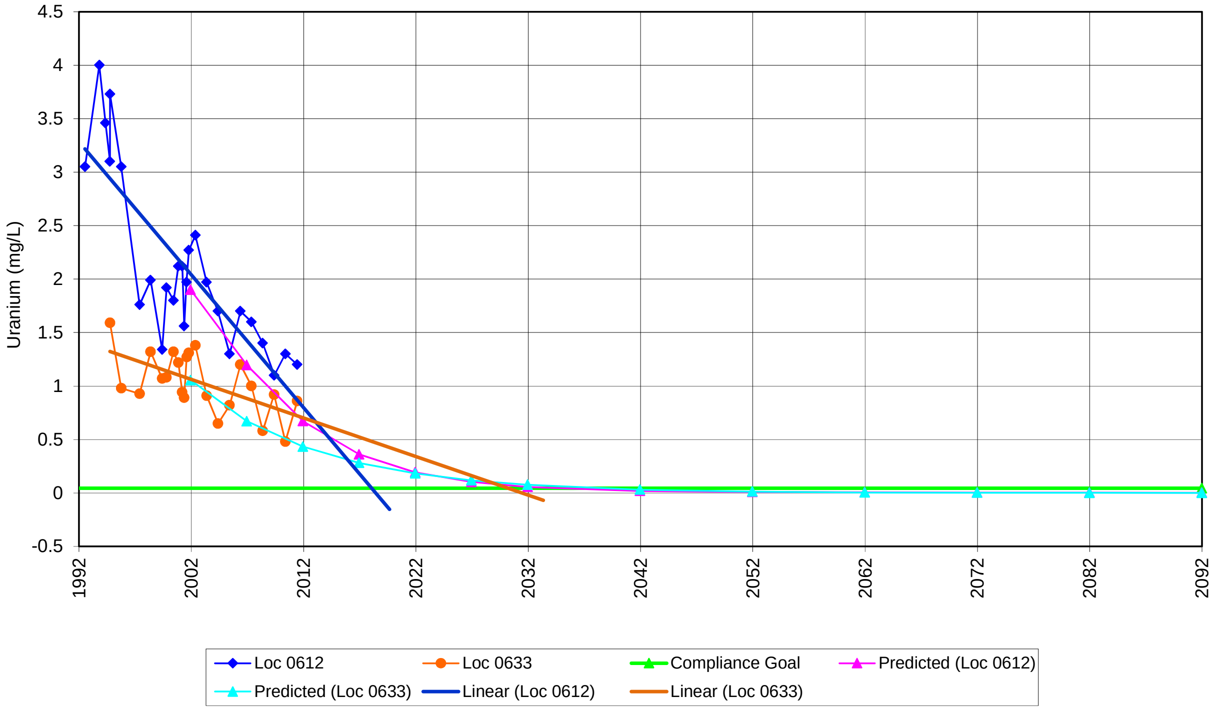

Figure 21. Predicted and Measured Uranium Concentrations at the Mill Tailings Area

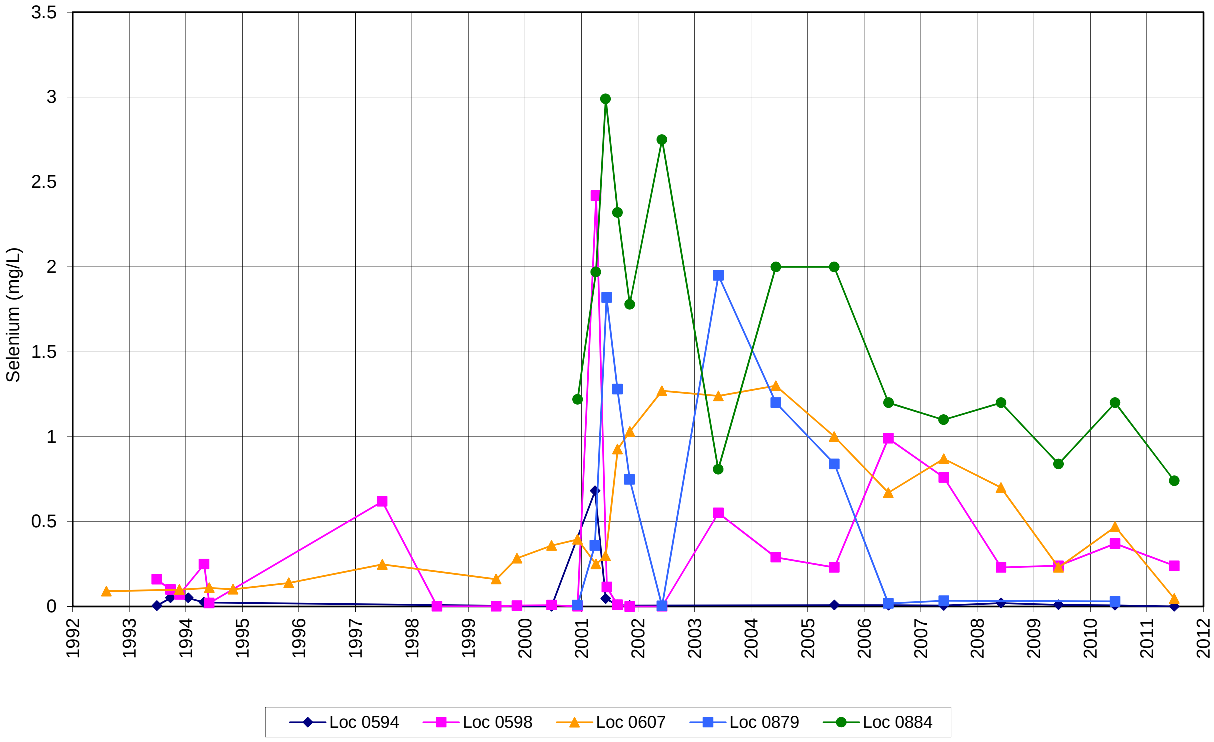

Figure 22. Historical Selenium Concentrations in Groundwater at the Raffinate Ponds Area

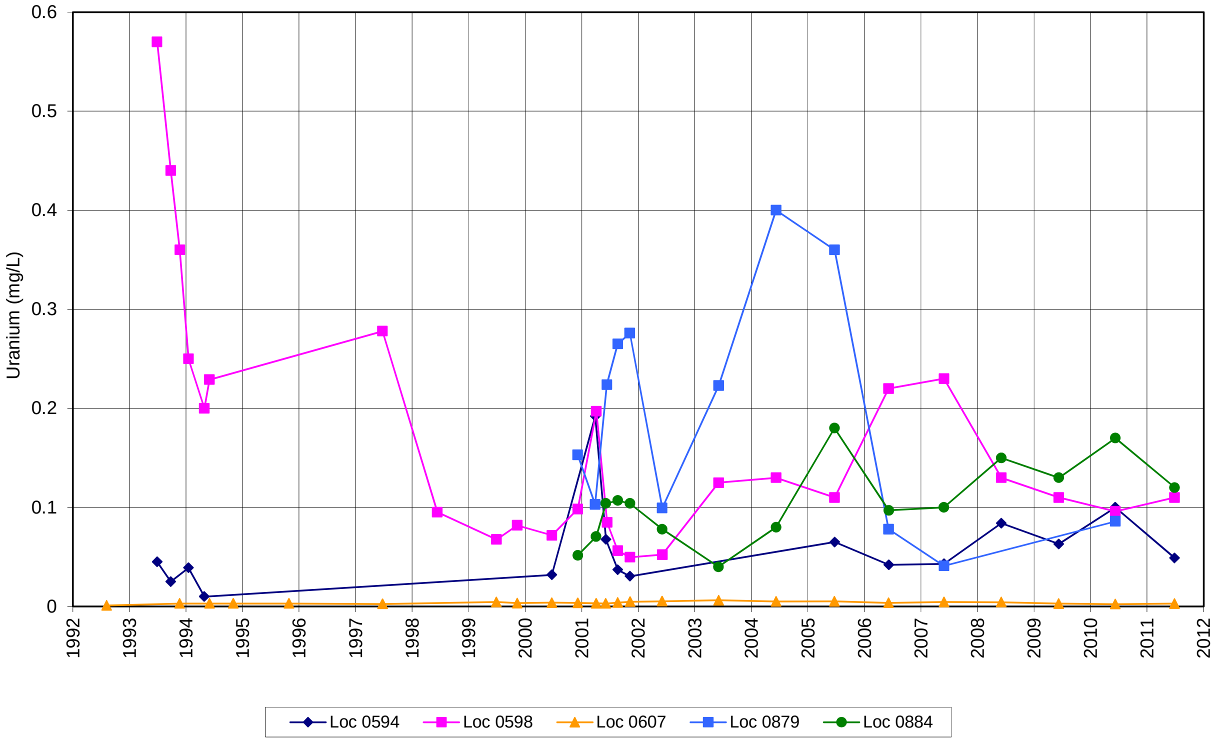

Figure 23. Historical Uranium Concentrations in Groundwater at the Raffinate Ponds Area

4.2 Surface Water

Surface water was sampled from six locations in the Animas River adjacent to both the mill tailings and raffinate ponds areas during June 2011 and analyzed for cadmium, molybdenum, selenium, and uranium (Figure 2 and Figure 3, Table 3 and Table 4). In addition, a sample was collected from South Creek (location 0588), upgradient from the raffinate ponds area, to assess the quality of water entering the raffinate ponds area from the west. The sample from South Creek had levels of selenium (0.00091 mg/L) and uranium (0.022 mg/L) that were higher than those from any other surface location. However, discharge of the creek to the Animas River had no discernible impact on concentrations of selenium and uranium at the river sampling location (0654). Concentrations of constituents at all locations along the river were well below the respective compliance goals and remain indistinguishable from background levels (Table 2 and Appendix A and B).

5.0 Natural Flushing Assessment

As of June 2011, the observed rate of contaminant flushing is generally consistent with groundwater model predictions, given that the validation period to date (June 2002 to June 2011) is short compared to predicted flushing periods (60 to 100 years) for the various contaminants. Only cadmium was identified in the modeling as potentially incapable of flushing to acceptable levels within 100 years. However, at the single location (well 0612) where cadmium is present above the compliance goal of 0.01 mg/L, concentrations have decreased more rapidly than predicted by the model. The linear trend suggests the compliance goal for cadmium will be reached by about 2040. With the possible exception of sulfate and selenium, modeling predictions and concentration trends imply that the compliance goals for remaining constituents will likely be attained within 100 years, suggesting that natural flushing remains a valid compliance strategy for these constituents as well. The impact on surface water quality from site-related contamination remains negligible.

6.0 Conclusions

Assessment of the June 2011 water sampling data and concentration trends at the mill tailings area on the Durango site, particularly since completion of source removal, indicate that natural flushing is leading to reduced contaminant concentrations in groundwater at the site. Note that it is too early in the 100-year natural flushing time frame to draw definitive conclusions.

On the basis of findings presented in this report, the following recommendations are made with regard to monitoring at the mill tailings area:

- Continued monitoring of groundwater and surface water quality at the currently established compliance network locations.
- Discontinue molybdenum and manganese monitoring at all locations except 0612.

It is also recommended that best-management-practice monitoring of the raffinate ponds area continue for the foreseeable future.

7.0 References

DOE (U.S. Department of Energy), 1995. *Baseline Risk Assessment of Ground Water Contamination at the Uranium Mill Tailings Site Near Durango, Colorado,* Rev. 1, DOE/AL/62350–175, UMTRCA Project Office, Albuquerque, New Mexico, September.

DOE (U.S. Department of Energy), 2002. *Site Observational Work Plan for the Durango, Colorado, UMTRCA Project Site*, GJO-2001-272-TAR/MAC-GW DUR 1.1, Grand Junction Office, Grand Junction, Colorado, January.

DOE (U.S. Department of Energy), 2003. *Preliminary Final Ground Water Compliance Action Plan for the Durango, Colorado, UMTRCA Project Site 2003*, GJO–2003-463-TAC/ GWDUR 1.9, Grand Junction Office, Grand Junction, Colorado, July.

EPA (U.S. Environmental Protection Agency), 2004. *2004 Edition of the Drinking Water Standards and Health Advisories*, EPA822-R-04-005, Office of Water, Washington, DC.

Appendix A

Durango Mill Tailings Processing Site (DUR01) Groundwater and Surface Water Quality Data

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR01, Durango Mill Tailings Process Site
LOCATION: 0612 <well>
REPORT DATE: 8/29/2011 1:35 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	37.41 - 57.41	410		F	#	-	-
Cadmium	mg/L	06/28/2011	N001	37.41 - 57.41	0.039		F	#	0.0012	-
	mg/L	06/28/2011	N002	37.41 - 57.41	0.044		F	#	0.0012	-
Manganese	mg/L	06/28/2011	N001	37.41 - 57.41	5.100		F	#	0.00011	-
	mg/L	06/28/2011	N002	37.41 - 57.41	5.300		F	#	0.00011	-
Molybdenum	mg/L	06/28/2011	N001	37.41 - 57.41	0.100	*	FJ	#	0.0032	-
	mg/L	06/28/2011	N002	37.41 - 57.41	0.100		F	#	0.0032	-
Oxidation Reduction Potential	mV	06/28/2011	N001	37.41 - 57.41	-156.3		F	#	-	-
pH	s.u.	06/28/2011	N001	37.41 - 57.41	6.55		F	#	-	-
Selenium	mg/L	06/28/2011	N001	37.41 - 57.41	0.00085		FJ	#	3.2E-05	-
	mg/L	06/28/2011	N002	37.41 - 57.41	0.0014		FJ	#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	37.41 - 57.41	3597		F	#	-	-
Sulfate	mg/L	06/28/2011	N001	37.41 - 57.41	1700		F	#	25	-
	mg/L	06/28/2011	N002	37.41 - 57.41	1800		F	#	25	-
Temperature	C	06/28/2011	N001	37.41 - 57.41	12.67		F	#	-	-
Turbidity	NTU	06/28/2011	N001	37.41 - 57.41	7.88		F	#	-	-
Uranium	mg/L	06/28/2011	N001	37.41 - 57.41	1.200		F	#	0.00029	-
	mg/L	06/28/2011	N002	37.41 - 57.41	1.200		F	#	0.00029	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR01, Durango Mill Tailings Process Site
LOCATION: 0617 <well>
REPORT DATE: 8/29/2011 1:35 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	14.00 - 29.00	409		F	#	-	-
Manganese	mg/L	06/28/2011	N001	14.00 - 29.00	0.360		F	#	0.00011	-
Molybdenum	mg/L	06/28/2011	N001	14.00 - 29.00	0.0087		F	#	0.00032	-
Oxidation Reduction Potential	mV	06/28/2011	N001	14.00 - 29.00	-191.1		F	#	-	-
pH	s.u.	06/28/2011	N001	14.00 - 29.00	6.68		F	#	-	-
Selenium	mg/L	06/28/2011	N001	14.00 - 29.00	0.004		F	#	0.00032	-
Specific Conductance	umhos/c	06/28/2011	N001	14.00 - 29.00	3265		F	#	-	-
Sulfate	mg/L	06/28/2011	N001	14.00 - 29.00	1900		F	#	25	-
Temperature	C	06/28/2011	N001	14.00 - 29.00	12.27		F	#	-	-
Turbidity	NTU	06/28/2011	N001	14.00 - 29.00	2.67		F	#	-	-
Uranium	mg/L	06/28/2011	N001	14.00 - 29.00	0.170		F	#	2.9E-05	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR01, Durango Mill Tailings Process Site
LOCATION: 0630 <well>
REPORT DATE: 8/29/2011 1:35 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	28.30 - 38.30	300		F	#	-	-
Manganese	mg/L	06/28/2011	N001	28.30 - 38.30	0.590		F	#	0.00011	-
Molybdenum	mg/L	06/28/2011	N001	28.30 - 38.30	0.004		F	#	0.00032	-
Oxidation Reduction Potential	mV	06/28/2011	N001	28.30 - 38.30	-148.1		F	#	-	-
pH	s.u.	06/28/2011	N001	28.30 - 38.30	6.73		F	#	-	-
Selenium	mg/L	06/28/2011	N001	28.30 - 38.30	0.039		F	#	0.00032	-
Specific Conductance	umhos/c	06/28/2011	N001	28.30 - 38.30	2985		F	#	-	-
Sulfate	mg/L	06/28/2011	N001	28.30 - 38.30	1700		F	#	25	-
Temperature	C	06/28/2011	N001	28.30 - 38.30	12.33		F	#	-	-
Turbidity	NTU	06/28/2011	N001	28.30 - 38.30	4.54		F	#	-	-
Uranium	mg/L	06/28/2011	N001	28.30 - 38.30	0.270		F	#	2.9E-05	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR01, Durango Mill Tailings Process Site
LOCATION: 0631 <well>
REPORT DATE: 8/29/2011 1:35 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	6.00 - 16.00	370		F	#	-	-
Manganese	mg/L	06/28/2011	N001	6.00 - 16.00	0.290		F	#	0.00011	-
Molybdenum	mg/L	06/28/2011	N001	6.00 - 16.00	0.0066		F	#	0.00032	-
Oxidation Reduction Potential	mV	06/28/2011	N001	6.00 - 16.00	-206.3		F	#	-	-
pH	s.u.	06/28/2011	N001	6.00 - 16.00	6.99		F	#	-	-
Selenium	mg/L	06/28/2011	N001	6.00 - 16.00	0.0018		F	#	0.00032	-
Specific Conductance	umhos/c	06/28/2011	N001	6.00 - 16.00	1122		F	#	-	-
Sulfate	mg/L	06/28/2011	N001	6.00 - 16.00	210		F	#	5	-
Temperature	C	06/28/2011	N001	6.00 - 16.00	13.73		F	#	-	-
Turbidity	NTU	06/28/2011	N001	6.00 - 16.00	0.63		F	#	-	-
Uranium	mg/L	06/28/2011	N001	6.00 - 16.00	0.110		F	#	2.9E-05	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR01, Durango Mill Tailings Process Site
LOCATION: 0633 <well>
REPORT DATE: 8/29/2011 1:35 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	4.00 - 14.00	537		F	#	-	-
Manganese	mg/L	06/28/2011	N001	4.00 - 14.00	0.260		F	#	0.00011	-
Molybdenum	mg/L	06/28/2011	N001	4.00 - 14.00	0.0028		F	#	0.00032	-
Oxidation Reduction Potential	mV	06/28/2011	N001	4.00 - 14.00	-191.8		F	#	-	-
pH	s.u.	06/28/2011	N001	4.00 - 14.00	6.54		F	#	-	-
Selenium	mg/L	06/28/2011	N001	4.00 - 14.00	0.015		F	#	0.0032	-
Specific Conductance	umhos/c	06/28/2011	N001	4.00 - 14.00	5329		F	#	-	-
Sulfate	mg/L	06/28/2011	N001	4.00 - 14.00	3300		F	#	25	-
Temperature	C	06/28/2011	N001	4.00 - 14.00	15.56		F	#	-	-
Turbidity	NTU	06/28/2011	N001	4.00 - 14.00	3.15		F	#	-	-
Uranium	mg/L	06/28/2011	N001	4.00 - 14.00	0.860		F	#	0.00029	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR01, Durango Mill Tailings Process Site
LOCATION: 0634 <well>
REPORT DATE: 8/29/2011 1:35 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	8.00 - 18.00	503		FQ	#	-	-
Manganese	mg/L	06/28/2011	N001	8.00 - 18.00	0.270		FQ	#	0.00011	-
Molybdenum	mg/L	06/28/2011	N001	8.00 - 18.00	0.00089		FQ	#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	8.00 - 18.00	-183.7		FQ	#	-	-
pH	s.u.	06/28/2011	N001	8.00 - 18.00	6.74		FQ	#	-	-
Selenium	mg/L	06/28/2011	N001	8.00 - 18.00	0.00018		FQ	#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	8.00 - 18.00	4289		FQ	#	-	-
Sulfate	mg/L	06/28/2011	N001	8.00 - 18.00	2400		FQ	#	25	-
Temperature	C	06/28/2011	N001	8.00 - 18.00	13.44		FQ	#	-	-
Turbidity	NTU	06/28/2011	N001	8.00 - 18.00	3.28		FQ	#	-	-
Uranium	mg/L	06/28/2011	N001	8.00 - 18.00	0.056		FQ	#	1.5E-05	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR01, Durango Mill Tailings Process Site
LOCATION: 0635 <well>
REPORT DATE: 8/29/2011 1:35 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	5.50 - 15.50	440		F	#	-	-
Manganese	mg/L	06/28/2011	N001	5.50 - 15.50	0.120		F	#	0.00011	-
Molybdenum	mg/L	06/28/2011	N001	5.50 - 15.50	0.0015		F	#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	5.50 - 15.50	-99.5		F	#	-	-
pH	s.u.	06/28/2011	N001	5.50 - 15.50	6.68		F	#	-	-
Selenium	mg/L	06/28/2011	N001	5.50 - 15.50	0.00032		F	#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	5.50 - 15.50	2447		F	#	-	-
Sulfate	mg/L	06/28/2011	N001	5.50 - 15.50	1100		F	#	25	-
Temperature	C	06/28/2011	N001	5.50 - 15.50	10.52		F	#	-	-
Turbidity	NTU	06/28/2011	N001	5.50 - 15.50	4.16		F	#	-	-
Uranium	mg/L	06/28/2011	N001	5.50 - 15.50	0.011		F	#	1.5E-05	-

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	58.00 - 67.50	556		F	#	-	-
Cadmium	mg/L	06/28/2011	N001	58.00 - 67.50	0.00011	B	F	#	5.8E-05	-
Manganese	mg/L	06/28/2011	N001	58.00 - 67.50	0.110		F	#	0.00011	-
Molybdenum	mg/L	06/28/2011	N001	58.00 - 67.50	0.00052		F	#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	58.00 - 67.50	-169.6		F	#	-	-
pH	s.u.	06/28/2011	N001	58.00 - 67.50	6.80		F	#	-	-
Selenium	mg/L	06/28/2011	N001	58.00 - 67.50	0.00009	B	UF	#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	58.00 - 67.50	2179		F	#	-	-
Sulfate	mg/L	06/28/2011	N001	58.00 - 67.50	690		F	#	10	-
Temperature	C	06/28/2011	N001	58.00 - 67.50	12.69		F	#	-	-
Turbidity	NTU	06/28/2011	N001	58.00 - 67.50	3.56		F	#	-	-
Uranium	mg/L	06/28/2011	N001	58.00 - 67.50	0.00008		F	#	1.5E-05	-

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY

RECORDS: SELECTED FROM USEE100 WHERE site_code='DUR01' AND location_code in('0612','0617','0622','0630','0631','0633','0634','0635','0863') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED >= #1/1/2011#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

SURFACE WATER QUALITY DATA BY LOCATION (USEE102) FOR SITE DUR01, Durango Mill Tailings Process Site
LOCATION: 0584
REPORT DATE: 8/29/2011 1:32 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	0001	40			#	-	-
Cadmium	mg/L	06/28/2011	0001	0.0002		J	#	5.8E-05	-
Molybdenum	mg/L	06/28/2011	0001	0.00049	B		#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	-127.9			#	-	-
pH	s.u.	06/28/2011	N001	7.40			#	-	-
Selenium	mg/L	06/28/2011	0001	0.00018			#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	252			#	-	-
Temperature	C	06/28/2011	N001	13.32			#	-	-
Turbidity	NTU	06/28/2011	N001	19.6			#	-	-
Uranium	mg/L	06/28/2011	0001	0.00019			#	1.5E-05	-

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	0001	42			#	-	-
Cadmium	mg/L	06/28/2011	0001	0.00034		J	#	5.8E-05	-
Molybdenum	mg/L	06/28/2011	0001	0.00044	B		#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	-125			#	-	-
pH	s.u.	06/28/2011	N001	7.26			#	-	-
Selenium	mg/L	06/28/2011	0001	0.00018			#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	236			#	-	-
Temperature	C	06/28/2011	N001	19.50			#	-	-
Turbidity	NTU	06/28/2011	N001	22.3			#	-	-
Uranium	mg/L	06/28/2011	0001	0.00022			#	1.5E-05	-

SURFACE WATER QUALITY DATA BY LOCATION (USEE102) FOR SITE DUR01, Durango Mill Tailings Process Site
LOCATION: 0652 SURFACE WATER AND SED.
REPORT DATE: 8/29/2011 1:32 pm

		SAMPLE:			QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	0001	45			#	-	-
Cadmium	mg/L	06/28/2011	0001	0.00019		J	#	5.8E-05	-
Molybdenum	mg/L	06/28/2011	0001	0.00034	B		#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	-115			#	-	-
pH	s.u.	06/28/2011	N001	7.20			#	-	-
Selenium	mg/L	06/28/2011	0001	0.00018			#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	241			#	-	-
Temperature	C	06/28/2011	N001	13.70			#	-	-
Turbidity	NTU	06/28/2011	N001	25.5			#	-	-
Uranium	mg/L	06/28/2011	0001	0.0002			#	1.5E-05	-

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	0001	36			#	-	-
Cadmium	mg/L	06/28/2011	0001	0.00012	B	J	#	5.8E-05	-
Molybdenum	mg/L	06/28/2011	0001	0.00026	B		#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	-146.8			#	-	-
pH	s.u.	06/28/2011	N001	7.24			#	-	-
Selenium	mg/L	06/28/2011	0001	0.00022			#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	253			#	-	-
Temperature	C	06/28/2011	N001	13.71			#	-	-
Turbidity	NTU	06/28/2011	N001	23.1			#	-	-
Uranium	mg/L	06/28/2011	0001	0.00025			#	1.5E-05	-

		SAMPLE:			QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY

RECORDS: SELECTED FROM USEE102 WHERE site_code='DUR01' AND location_code in('0584','0586','0652','0691') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED >= #1/1/2011#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.
J	Estimated value.	L	Less than 3 bore volumes purged prior to sampling.
N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.
X	Location is undefined.		

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

Appendix B

Durango Raffinate Pond Processing Site (DUR02)
Groundwater and Surface Water Quality Data

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR02, Durango Raffinate Pond Process Site
LOCATION: 0594 <well> Original location DH-116.
REPORT DATE: 8/29/2011 1:38 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	8.50 - 38.50	420		FQ	#	-	-
Oxidation Reduction Potential	mV	06/28/2011	N001	8.50 - 38.50	-155.6		FQ	#	-	-
pH	s.u.	06/28/2011	N001	8.50 - 38.50	6.59		FQ	#	-	-
Selenium	mg/L	06/28/2011	N001	8.50 - 38.50	0.00074		FQ	#	0.00016	-
Specific Conductance	umhos/c	06/28/2011	N001	8.50 - 38.50	3741		FQ	#	-	-
Temperature	C	06/28/2011	N001	8.50 - 38.50	15.96		FQ	#	-	-
Turbidity	NTU	06/28/2011	N001	8.50 - 38.50	3.17		FQ	#	-	-
Uranium	mg/L	06/28/2011	N001	8.50 - 38.50	0.049		FQ	#	1.5E-05	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR02, Durango Raffinate Pond Process Site
LOCATION: 0598 <well> Original location Bureau of Rec well DH-110.
REPORT DATE: 8/29/2011 1:38 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/29/2011	N001	66.20 - 96.20	399		F	#	-	-
Oxidation Reduction Potential	mV	06/29/2011	N001	66.20 - 96.20	-107.6		F	#	-	-
pH	s.u.	06/29/2011	N001	66.20 - 96.20	6.73		F	#	-	-
Selenium	mg/L	06/29/2011	N001	66.20 - 96.20	0.240		F	#	0.00032	-
Specific Conductance	umhos/c	06/29/2011	N001	66.20 - 96.20	7459		F	#	-	-
Temperature	C	06/29/2011	N001	66.20 - 96.20	13.89		F	#	-	-
Turbidity	NTU	06/29/2011	N001	66.20 - 96.20	8.94		F	#	-	-
Uranium	mg/L	06/29/2011	N001	66.20 - 96.20	0.110		F	#	2.9E-05	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR02, Durango Raffinate Pond Process Site
LOCATION: 0607 <well>
REPORT DATE: 8/29/2011 1:38 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/29/2011	N001	35.00 - 55.00	310		FQ	#	-	-
Oxidation Reduction Potential	mV	06/29/2011	N001	35.00 - 55.00	142		FQ	#	-	-
pH	s.u.	06/29/2011	N001	35.00 - 55.00	6.88		FQ	#	-	-
Selenium	mg/L	06/29/2011	N001	35.00 - 55.00	0.460		FQ	#	0.00032	-
Specific Conductance	umhos/c	06/29/2011	N001	35.00 - 55.00	2944		FQ	#	-	-
Temperature	C	06/29/2011	N001	35.00 - 55.00	14.74		FQ	#	-	-
Turbidity	NTU	06/29/2011	N001	35.00 - 55.00	4.86		FQ	#	-	-
Uranium	mg/L	06/29/2011	N001	35.00 - 55.00	0.0029		FQ	#	2.9E-05	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR02, Durango Raffinate Pond Process Site
LOCATION: 0884 <well>
REPORT DATE: 8/29/2011 1:38 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH. RANGE	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	36.50 - 46.50	404		F	#	-	-
Oxidation Reduction Potential	mV	06/28/2011	N001	36.50 - 46.50	-105.7		F	#	-	-
pH	s.u.	06/28/2011	N001	36.50 - 46.50	6.74		F	#	-	-
Selenium	mg/L	06/28/2011	N001	36.50 - 46.50	0.740		F	#	0.00032	-
	mg/L	06/28/2011	N002	36.50 - 46.50	0.770		F	#	0.00032	-
Specific Conductance	umhos/c	06/28/2011	N001	36.50 - 46.50	3923		F	#	-	-
Temperature	C	06/28/2011	N001	36.50 - 46.50	15.05		F	#	-	-
Turbidity	NTU	06/28/2011	N001	36.50 - 46.50	2.02		F	#	-	-
Uranium	mg/L	06/28/2011	N001	36.50 - 46.50	0.120		F	#	2.9E-05	-
	mg/L	06/28/2011	N002	36.50 - 46.50	0.130		F	#	2.9E-05	-

GROUNDWATER QUALITY DATA BY LOCATION (USEE100) FOR SITE DUR02, Durango Raffinate Pond Process Site
LOCATION: 0884 <well>
REPORT DATE: 8/29/2011 1:38 pm

		SAMPLE:		DEPTH.		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	RANGE	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY

RECORDS: SELECTED FROM USEE100 WHERE site_code='DUR02' AND location_code in('0594','0598','0599','0607','0879','0884') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED >= #1/1/2011#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

SURFACE WATER QUALITY DATA BY LOCATION (USEE102) FOR SITE DUR02, Durango Raffinate Pond Process Site
LOCATION: 0588
REPORT DATE: 8/29/2011 1:26 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	N001	275			#	-	-
Cadmium	mg/L	06/28/2011	N001	0.0002		J	#	5.8E-05	-
Molybdenum	mg/L	06/28/2011	N001	0.00094			#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	-90.5			#	-	-
pH	s.u.	06/28/2011	N001	8.01			#	-	-
Selenium	mg/L	06/28/2011	N001	0.00091			#	0.00016	-
Specific Conductance	umhos/c	06/28/2011	N001	1635			#	-	-
Temperature	C	06/28/2011	N001	25.68			#	-	-
Turbidity	NTU	06/28/2011	N001	5.80			#	-	-
Uranium	mg/L	06/28/2011	N001	0.022			#	1.5E-05	-

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	0001	39			#	-	-
Cadmium	mg/L	06/28/2011	0001	0.00022		J	#	5.8E-05	-
Molybdenum	mg/L	06/28/2011	0001	0.00037	B		#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	-103.7			#	-	-
pH	s.u.	06/28/2011	N001	7.34			#	-	-
Selenium	mg/L	06/28/2011	0001	0.00015			#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	260			#	-	-
Temperature	C	06/28/2011	N001	15.77			#	-	-
Turbidity	NTU	06/28/2011	N001	24.9			#	-	-
Uranium	mg/L	06/28/2011	0001	0.00032			#	1.5E-05	-

SURFACE WATER QUALITY DATA BY LOCATION (USEE102) FOR SITE DUR02, Durango Raffinate Pond Process Site
LOCATION: 0656 RESERVED FOR CDAY
REPORT DATE: 8/29/2011 1:26 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	06/28/2011	0001	35			#	-	-
Cadmium	mg/L	06/28/2011	0001	0.0003		J	#	5.8E-05	-
Molybdenum	mg/L	06/28/2011	0001	0.00026	B		#	0.00016	-
Oxidation Reduction Potential	mV	06/28/2011	N001	-141			#	-	-
pH	s.u.	06/28/2011	N001	7.33			#	-	-
Selenium	mg/L	06/28/2011	0001	0.00018			#	3.2E-05	-
Specific Conductance	umhos/c	06/28/2011	N001	245			#	-	-
Temperature	C	06/28/2011	N001	21.44			#	-	-
Turbidity	NTU	06/28/2011	N001	23.5			#	-	-
Uranium	mg/L	06/28/2011	0001	0.00021			#	1.5E-05	-

SURFACE WATER QUALITY DATA BY LOCATION (USEE102) FOR SITE DUR02, Durango Raffinate Pond Process Site
LOCATION: 0656 RESERVED FOR CDAY
REPORT DATE: 8/29/2011 1:26 pm

		SAMPLE:			QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY

RECORDS: SELECTED FROM USEE102 WHERE site_code='DUR02' AND location_code in('0588','0654','0656') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED >= #1/1/2011#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.
J	Estimated value.	L	Less than 3 bore volumes purged prior to sampling.
N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.
X	Location is undefined.		

QA QUALIFIER: # = validated according to Quality Assurance guidelines.