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Mr. John E. Kieling
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Subject: Department of Energy/National Nuclear Security Administration Sandia National Laboratories Environmental Restoration Operations Mixed Waste Landfill Groundwater Monitoring Report -Monitoring Well MWL-MW4 Metals Data -Calendar Year 2013

Dear Mr. Kieling:

The Department of Energy/National Nuclear Security Administration (DOE/NNSA) and Sandia Corporation (Sandia) are submitting the *Mixed Waste Landfill Groundwater Monitoring Report -Monitoring Well MWL-MW4 Metals Data - Calendar Year 2013* as requested by the New Mexico Environment Department (NMED), Hazardous Waste Bureau (HWB) staff on April 16, 2014. The enclosed report presents unfiltered and filtered metals results for groundwater samples collected from monitoring well MWL-MW4 and includes recommendations. The DOE/NNSA and Sandia are requesting NMED HWB input on this report and the proposed recommendations prior to taking any additional actions with regards to monitoring well MWL-MW4. In accordance with the January 8, 2014, NMED approval of the Mixed Waste Landfill (MWL) Long-Term Monitoring and Maintenance Plan, semiannual groundwater monitoring is being conducted at monitoring wells MWL-BW2, MWL-MW7, MWL-MW8, and MWL-MW9.

If you should have any questions, please contact me at (505) 845-6036 or John Weckerle of my staff at (505) 845-6026.

Sincerely,

James W. Todd
Assistant Manager for
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Enclosure

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CERTIFICATION STATEMENT FOR APPROVAL AND FINAL RELEASE OF DOCUMENTS

Document title: **Environmental Restoration Operations Mixed Waste Landfill Groundwater Monitoring Report – Monitoring Well MWL-MW4 Metals Data - Calendar Year 2013**

Document author: **Mike Mitchell, Department 06234**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment for knowing violations.

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James W. Todd
U.S. Department of Energy
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Sandia Site Office
Owner and Co-Operator

Sandia National Laboratories

Sandia National Laboratories, New Mexico

Environmental Restoration Operations

A U.S. Department of Energy Environmental Cleanup Program

MIXED WASTE LANDFILL
GROUNDWATER MONITORING REPORT
MONITORING WELL MWL-MW4 METALS DATA
CALENDAR YEAR 2013

U.S. DEPARTMENT OF ENERGY

United States Department of Energy
Sandia Field Office

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1.0 Introduction

This groundwater monitoring report provides information on metals results for recent samples collected from the Mixed Waste Landfill (MWL) monitoring well MWL-MW4 at Sandia National Laboratories, New Mexico (SNL/NM). Unfiltered and filtered nickel concentrations have increased in groundwater samples from this well since 2011. In 2013 additional metals (chromium, cobalt, copper, and iron) have also shown a significant increase in concentration, but only in the unfiltered samples. This report includes information that will be presented in the SNL/NM Calendar Year (CY) 2013 Annual Groundwater Monitoring Report (anticipated submittal in June 2014), but is being provided in advance to the New Mexico Environment Department (NMED). Recommendations for additional actions and monitoring of MWL-MW4 are also provided in light of the transition to groundwater monitoring at the MWL under the Long-Term Monitoring and Maintenance Plan (LTMMP) (SNL March 2012) that was approved by the NMED in January 2014 (Blaine January 2014).

The MWL is a 2.6-acre site in the north-central portion of Technical Area III at SNL/NM (Figure 1). The MWL consists of two distinct disposal areas: the classified area (occupying 0.6 acres) and the unclassified area (occupying 2.0 acres). Approximately 100,000 cubic feet of low-level radioactive and mixed waste containing approximately 6,300 curies of activity (at the time of disposal) were disposed of in the MWL from March 1959 through December 1988. Classified wastes were buried in cylindrical pits in the classified area and unclassified wastes were buried in shallow trenches in the unclassified area. Construction of the MWL evapotranspirative (ET) Cover was completed in September 2009 and was approved by the NMED in October 2011 (Kieling October 2011).

1.1 Groundwater Monitoring Network and History

Groundwater monitoring has been conducted at the MWL since 1990. The original groundwater monitoring well network at the MWL (monitoring wells MWL-BW1, MWL-MW1, MWL-MW2, and MWL-MW3) was installed in 1988 and 1989. In 1993, monitoring well MWL-MW4 was completed at an angle of 6 degrees from vertical and was screened at two discrete intervals, 20 feet (ft) apart, to evaluate vertical potentiometric gradients and changes in aquifer parameters with depth. The well is constructed with schedule 80 polyvinyl chloride casing and screen intervals. Because of the two screen intervals and orientation, MWL-MW4 is equipped with an inflatable packer (pressurized by nitrogen-gas) separating the two screen intervals and a dedicated sampling system (Bennett™ stainless steel sampling pump, connecting rods, mounting bracket, lifting cable, and tubing). Machined stainless steel pipe connects the bottom of the sampling pump to the packer, and the entire assembly is held in the well by one-inch diameter metal rods and centralizers. MWL-MW4 is the only MWL monitoring well that contains a packer and dedicated stainless steel sampling equipment. Monitoring wells MWL-MW5 and MWL-MW6 were installed in 2000 at a distance of approximately 200 and 500 ft west of the MWL, respectively, with the screened intervals placed below the top of the regional water table in the coarse-grained Ancestral Rio Grande (ARG) deposits.

The MWL groundwater monitoring network was modified in 2008 (SNL May 2009). Due to the declining water table and corrosion of stainless-steel well screens, four monitoring wells were plugged and abandoned (MWL-BW1, MWL-MW1, MWL-MW2, and MWL-MW3) and four new monitoring wells were installed (MWL-BW2, MWL-MW7, MWL-MW8, and MWL-MW9) (SNL April 2008 and September 2008). The four wells installed in 2008 comprise the MWL groundwater monitoring network for the uppermost part of the regional aquifer and were approved by the NMED (Bearzi October 2008 and January 2009). In accordance with the NMED-approved MWL LTMMP that became effective January 8, 2014, sampling and analysis of these four wells is required for all future MWL groundwater monitoring. Sampling and analysis of other MWL monitoring wells, including MWL-MW4, is not required but they will be retained for other information (i.e., groundwater elevation data).

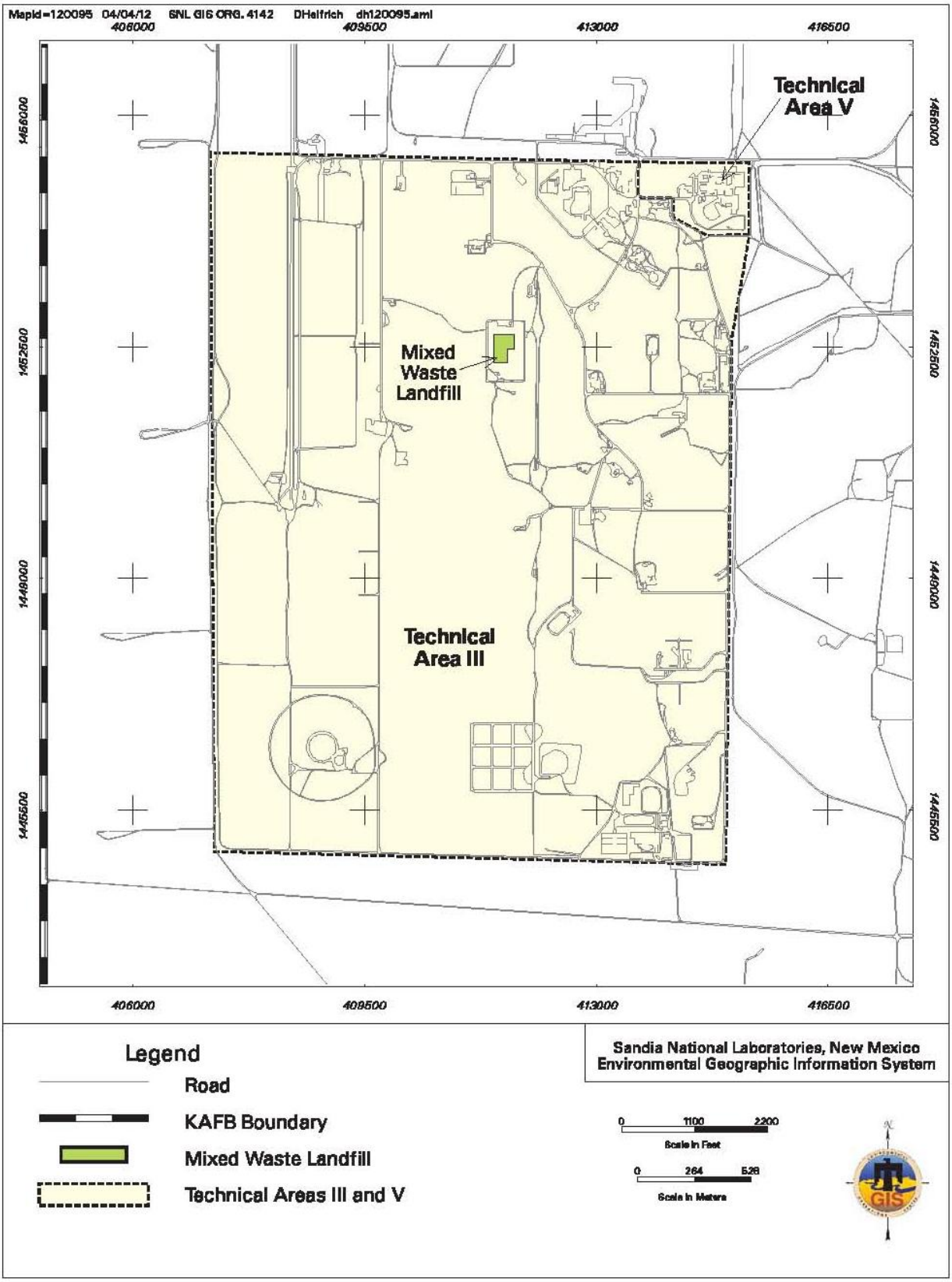

Figure 1. Location of the Mixed Waste Landfill within Technical Area III

Groundwater at the MWL has been extensively characterized and monitored since 1990 for major ion chemistry, volatile organic compounds (VOCs), semivolatile organic compounds, nitrate, metals, radionuclides, and perchlorate. More than twenty years of data indicate that groundwater has not been contaminated by the MWL (Goering et al. 2002; SNL December 2001, January 2002, July 2002, October 2002, June 2003, September 2003, July 2004; Lyon and Goering 2006; SNL November 2006, January 2008, May 2009, June 2010, October 2010, September 2011, June 2012, and June 2013).

1.2 Groundwater Monitoring Well Network

The current groundwater monitoring network at the MWL consists of seven wells, as shown on Figure 2 and listed in Table 1. Of the seven wells, four have screen intervals across the upper surface of the regional aquifer (MWL-BW2, MWL-MW7, MWL-MW8, and MWL-MW9) and are considered compliance wells that monitor the top of the regional water table. Monitoring well MWL-MW4 has two screen intervals separated by an inflatable packer; the upper interval is completed across the regional aquifer water table within the interfingering, fine-grained, Santa Fe Group alluvial-fan deposits. The deeper screen interval is completed within the coarse-grained ARG deposits that underlie the Santa Fe Group alluvial sediments. References in this report to groundwater samples and water levels from monitoring well MWL-MW4 refer to groundwater withdrawn or measured from the upper screened interval, and references made to the bottom of this well refer to the depth to the top of the packer. The lower screen interval of MWL-MW4 is completed within the coarse-grained ARG deposits, but is isolated by an inflatable packer and not monitored in CY 2013 (i.e., not sampled or used for groundwater elevation measurements).

Table 1. MWL Monitoring Well Network and Calendar Year 2013 Compliance Activities

Well ID	Installation Year	WQ [a]	WL [a]	Comment [b]
MWL-BW2	2008	✓	✓	Annual
MWL-MW4 [c]	1993	✓	✓	Annual
MWL-MW5	2000	✓	✓	Annual
MWL-MW6	2000	✓	✓	Annual
MWL-MW7	2008	✓	✓	Annual
MWL-MW8	2008	✓	✓	Annual
MWL-MW9	2008	✓	✓	Annual

NOTES:
[a]Check marks in the WQ and WL columns indicate WQ sampling and WL measurements were completed.
[b]Annual groundwater monitoring of all wells was conducted in January and February.
[c]Upper screen of monitoring well MWL-MW4 is monitored and represents uppermost portion of regional aquifer.
BW = Background Well.
ID = Identification.
MW = Monitoring Well.
MWL = Mixed Waste Landfill.
WL = Water level.
WQ = Water quality.

1.2.1 Conceptual Site Model

A detailed conceptual site model is provided in the *MWL Phase 2 RFI Report* (Peace et al. 2002) and the *Mixed Waste Landfill Groundwater Report, 1990 through 2001, Sandia National Laboratories, Albuquerque, New Mexico* (Goering et al. 2002). An update to the conceptual site model integrating the findings from the four monitoring wells installed in 2008 is presented in the *Mixed Waste Landfill Annual Groundwater Monitoring Report, Calendar Year 2009* (SNL June 2010) and the *Annual Groundwater Monitoring Report, Calendar Year 2012* (SNL June 2013).

Figure 2. Location of Groundwater Monitoring Wells at the Mixed Waste Landfill

The upper surface of the regional aquifer at the MWL is contained within the unconsolidated, fine-grained alluvial-fan deposits of the Santa Fe Group. The depth to water is approximately 500 ft below the ground surface and groundwater flows generally westward away from the Manzanita Mountains and towards the Rio Grande. Several water-supply wells operated by Kirtland Air Force Base (KAFB) and the Albuquerque Bernalillo County Water Utility Authority have significantly modified the natural groundwater flow regime near the MWL by creating a trough in the water table in the western and northern portions of KAFB. As a result, water levels at the MWL have continued to decline since monitoring began in 1990.

Figure 3 shows the October 2013 potentiometric surface of the regional aquifer beneath the MWL. Groundwater flows towards the west and northwest. Based on the contours, the horizontal gradient varies from approximately 0.02 to 0.08 ft per foot. The map is consistent with the conceptual site model and the base-wide potentiometric surface contours, which generally trend north to south beneath Technical Area III with the inferred groundwater flow direction being westward (SNL June 2013).

1.3 Calendar Year 2013 Groundwater Monitoring Activities

Annual groundwater sampling was conducted in January and February 2013 at the MWL as summarized in Table 1. Groundwater samples were collected from the seven monitoring wells (MWL-BW2, MWL-MW4, MWL-MW5, MWL-MW6, MWL-MW7, MWL-MW8, and MWL-MW9) and analyzed for VOCs, Target Analyte List (TAL) metals plus uranium (filtered and unfiltered), anions (as bromide, chloride, fluoride, and sulfate), alkalinity, nitrate plus nitrite, gamma spectroscopy, gross alpha/beta activity, and tritium. Details of the CY 2013 annual groundwater sampling event at the MWL will be provided in the CY 2013 Annual Groundwater Monitoring Report, including field methods, field measurements, field and laboratory quality control (QC) samples, laboratory QC analyses, and data validation results. This report focuses on the 2013 filtered and unfiltered metals results, as well as historic metals results. Attachment A provides summary tables for the CY 2013 metals analytical results.

Groundwater sampling and depth-to-groundwater measurements were conducted in conformance with procedures specified in the *Mixed Waste Landfill Groundwater Monitoring, Mini-Sampling and Analysis Plan for Fiscal Year 2013 Annual Sampling* (SNL January 2013). The minimum purge requirements were not met at monitoring wells MWL-MW4, MWL-MW8, and MWL-MW9. These three monitoring wells were purged to dryness, allowed to recover, and then sampled to collect the most representative groundwater sample possible given the low yield of these wells. Groundwater samples were submitted to the off-site laboratory (GEL) following analysis request/chain-of-custody protocol. All groundwater samples were analyzed by off-site laboratories using U.S. Environmental Protection Agency (EPA)-specified protocols.

1.4 Summary of MWL-MW4 Metals Analytical Results

Metals analysis includes two sets of analyses and results, filtered and unfiltered fractions. Groundwater samples obtained for total metal analyses are collected without filtering. Dissolved metal samples are collected after groundwater is passed through in-line filters of 0.45 micron pore size. The difference in concentrations between the total and dissolved fraction may be attributed to the original metallic ion content of the particles and any sorption of ions to the suspended particles. Samples were analyzed for TAL metals according to EPA Methods 6010, 6020, and 7470 (EPA 1986).

Tables providing CY 2013 metals data for the entire MWL monitoring network are provided in Attachment A at the end of this report. Table A-1 summarizes the CY 2013 unfiltered groundwater metal results and Table A-2 summarizes the CY 2013 filtered metal results. Results are provided for the entire MWL groundwater monitoring network for comparison; however, the following discussion focuses on the sample results for MWL-MW4.

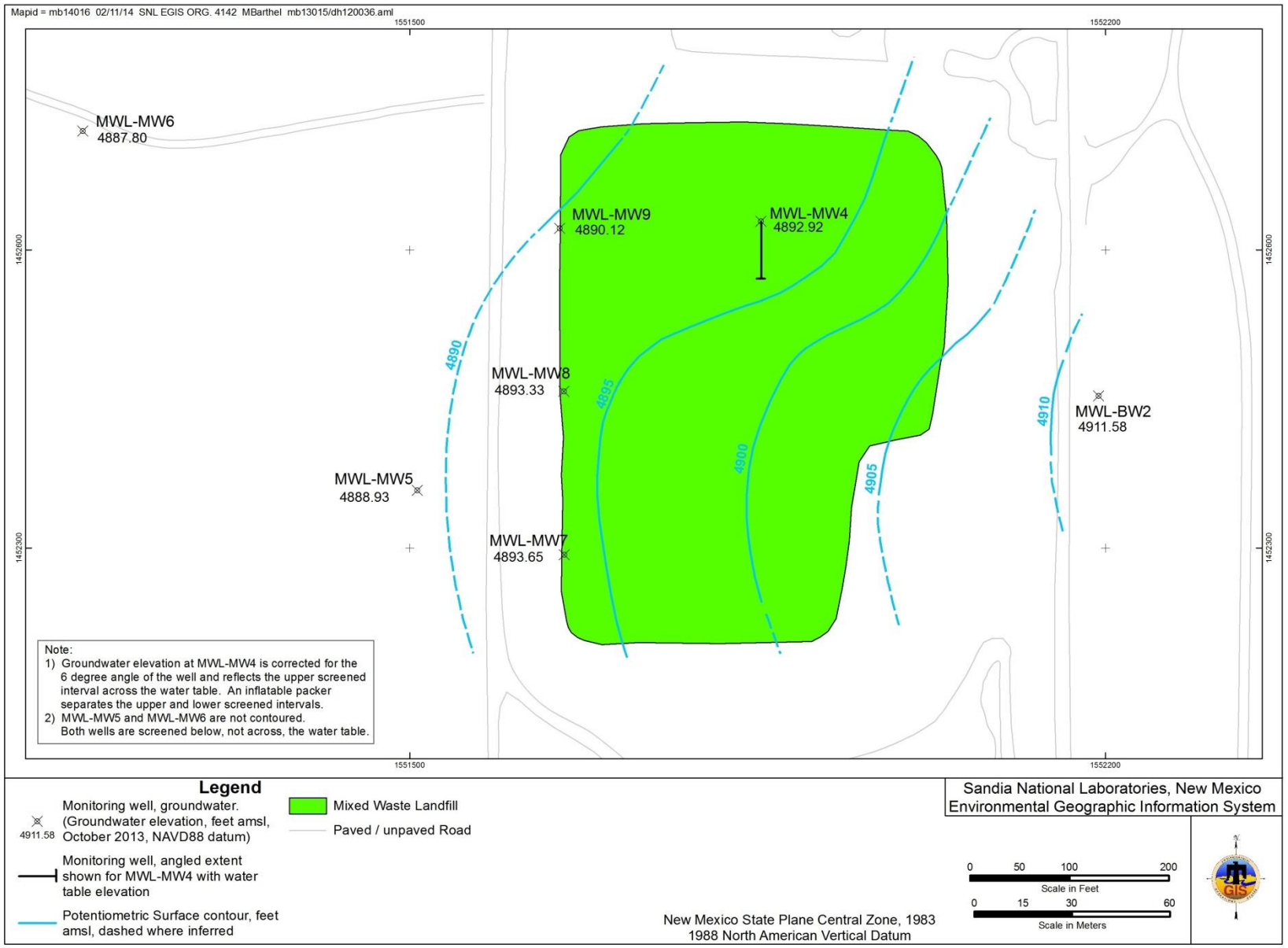

Figure 3. Localized Potentiometric Surface of the Basin Fill Aquifer at the Mixed Waste Landfill, October 2013

Metals results for all MWL monitoring well samples except MWL-MW4 were within the range of historical results and consistent with background concentrations. No metal parameters were detected above established maximum contaminant levels (MCLs) in any groundwater sample, except chromium. Chromium was detected above the MCL of 0.10 mg/L in the unfiltered sample from monitoring well MWL-MW4 at a concentration of 0.112 mg/L, which is the maximum concentration for the MWL-MW4 historic monitoring data set. In the filtered sample from monitoring well MWL-MW4, chromium was not detected above the laboratory method detection limit (MDL) of 0.002 mg/L. Unfiltered MWL-MW4 sample results for chromium, cobalt, copper, iron, and nickel were all significantly elevated relative to historic results. In addition, filtered MWL-MW4 sample results for nickel were elevated above the background concentration of 0.028 mg/L

A trend plot showing unfiltered chromium results for samples from monitoring well MWL-MW4 is provided in Figure 4. This plot includes groundwater elevation data and unfiltered sample results from a total of 19 sampling events conducted from April 1997 through February 2013. The MWL-MW4 unfiltered data set for chromium is dominated by very low detections and non-detections. Prior to CY 2013, the maximum unfiltered chromium concentration was 0.00599 mg/L (April 2001 sample), and from 2008 through 2012 chromium was detected only once in unfiltered samples at a concentration of 0.00259 mg/L (February 2012 sample). The February 2013 unfiltered sample result of 0.112 mg/L represents an unusual increase in chromium concentration (i.e., approximately 2 orders of magnitude), which is 18.7 times higher than the February 2012 result. In contrast, the February 2013 filtered sample result was a non-detection, with a laboratory MDL of 0.002 mg/L.

Other metals results for the February 2013 MWL-MW4 unfiltered sample were reported at concentrations significantly higher than previous maximum concentrations. As summarized in Table 2, cobalt, copper, iron, and nickel were all reported at new maximum concentrations in the February 2013 unfiltered sample. Cobalt, copper, and iron display a similar pattern to the unfiltered chromium results depicted in Figure 4, characterized by a narrow concentration range through 2012, followed by a sharp increase in 2013 concentrations. And similar to the chromium filtered versus unfiltered results, the filtered sample concentrations for cobalt, copper, and iron are much lower and consistent with historical results.

Table 2. MWL-MW4 Unfiltered Metals Results Summary, Calendar Year 2013

Metal	Maximum Concentration 1997 - 2012	February 2013 Concentration
Chromium	0.00559 mg/L (April 2001 sample)	0.112 mg/L
Cobalt	0.000888 mg/L (June 2007 sample)	0.00229 mg/L
Copper	0.00326 mg/L (June 2011 sample)	0.0335 mg/L
Iron	0.569 mg/L (April 2008 sample)	2.92 mg/L
Nickel	0.194 mg/L (February 2013 sample)	0.417 mg/L

mg/L = milligrams per liter. MWL = Mixed Waste Landfill. MW = monitoring well

A trend plot showing unfiltered nickel results for monitoring well MWL-MW4 samples is provided in Figure 5. All unfiltered results through 2010 are below or near the NMED-approved background concentration of 0.028 mg/L. Results from 2011, 2012, and 2013 show an increase in concentration by an order of magnitude, as well as an increasing trend (0.13, 0.194, and 0.417 mg/L, respectively). Although generally similar, there are two differences when comparing the MWL-MW4 nickel results to the MWL-MW4 chromium, cobalt, copper, and iron results. First, the substantial increase in the concentration of nickel occurred two years before the increase was observed for chromium, cobalt, copper, and iron (2011 versus 2013). Second, unfiltered and filtered nickel results are similar and do not show the substantial differences in concentration (i.e., order of magnitude difference) observed in the 2013 results for

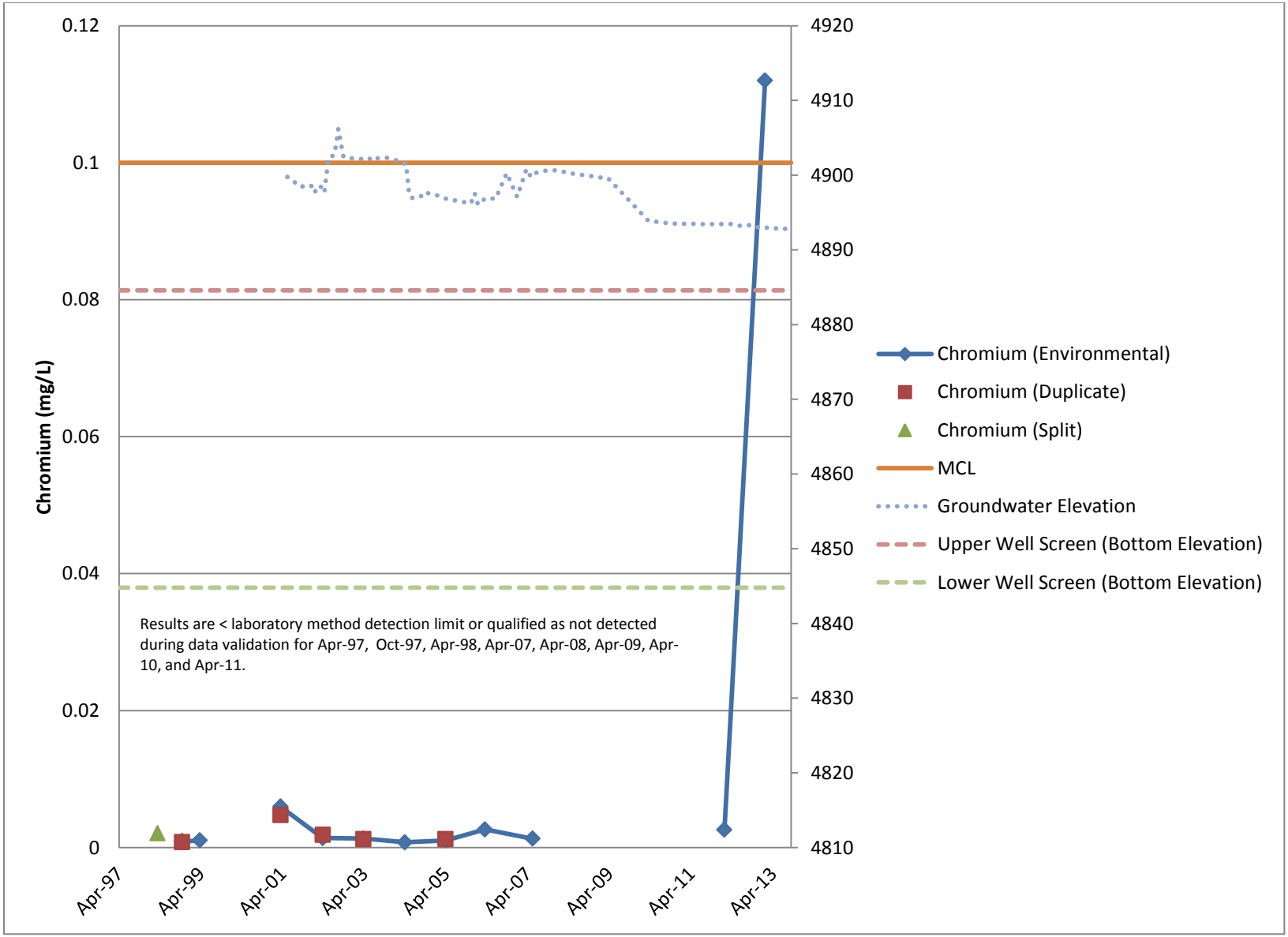

Figure 4. Unfiltered Chromium Concentrations, MWL-MW4 Groundwater Samples

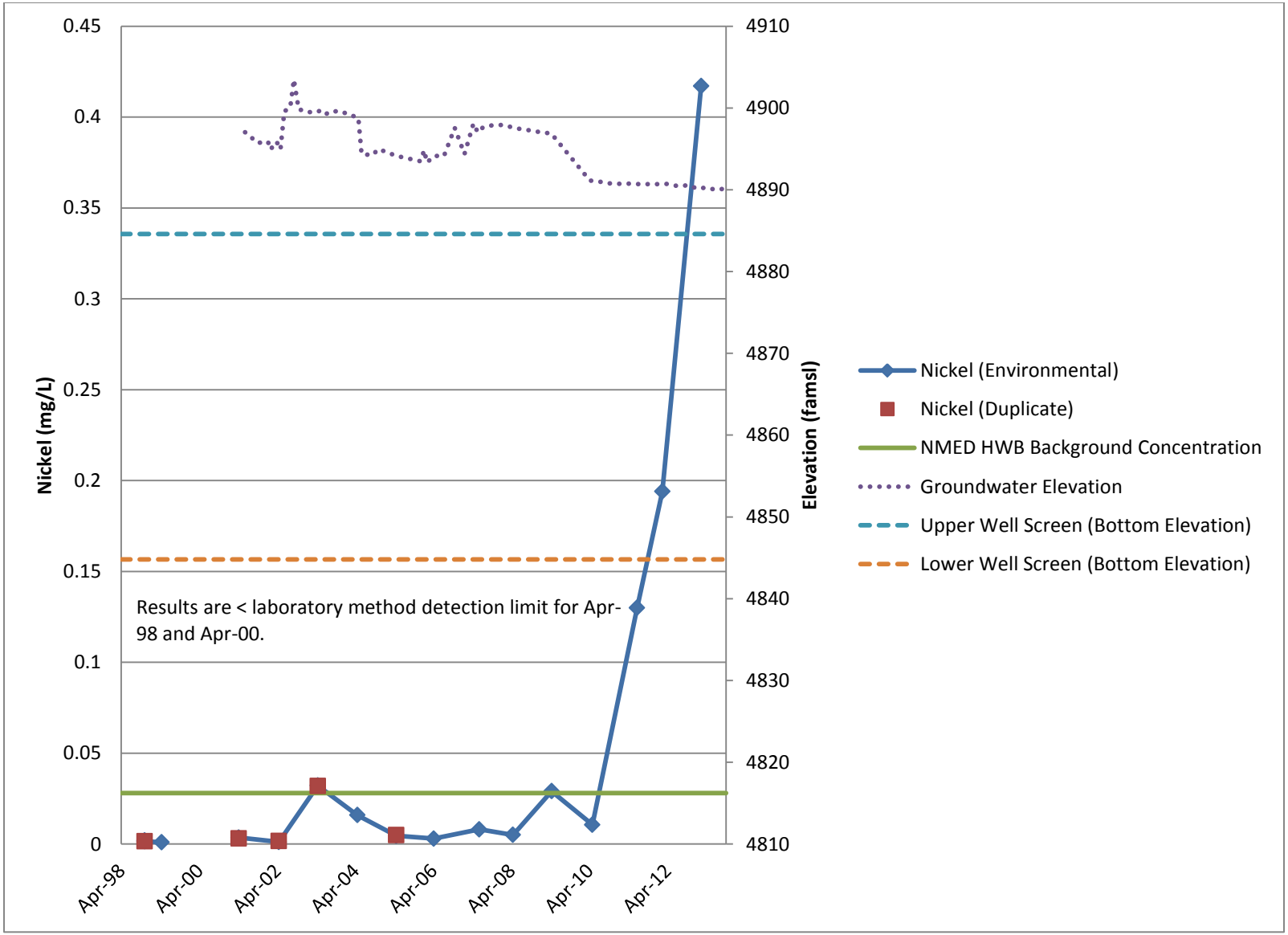

Figure 5. Unfiltered Nickel Concentrations, MWL-MW4 Groundwater Samples

chromium, cobalt, copper, and iron. However, the overall trend for unfiltered nickel results is similar to the trend of unfiltered chromium results, as shown in Figures 4 and 5.

The MWL inventory (Peace et al. September 2002), fate and transport modeling (SNL November 2005), mobility of metals in general, the rapidly increasing trend in concentrations, and the very thick vadose zone beneath the MWL (approximately 500 feet thick) are all factors that support the conclusion that the increased metals concentrations in the recent groundwater samples collected from monitoring well MWL-MW4 are not related to a release from the MWL disposal area. The sharp increases in unfiltered concentrations of chromium, cobalt, copper, iron, and nickel are indicative of a source within the well and are consistent with unfiltered metals results from previous MWL monitoring wells that had stainless steel well screens. The source is most likely corrosion by-products from the dedicated stainless steel sampling pump in monitoring well MWL-MW4. The packer and sampling system were removed in May 2009 prior to construction of the MWL ET Cover to allow the inner and outer well casing to be extended to accommodate the additional height of the ET Cover. Figure 6 is a photograph that was taken in May 2009 after the packer and pump were removed from the well. The stainless steel pump intake (to right of technician's hand) shows visible oxide staining and corrosion. The packer contains less overall metal and based on a visual inspection appeared to be in relatively good shape. The pump and packer were sent to the respective manufacturers for routine maintenance and cleaning prior to the March 2010 re-installation. The packer was refurbished and the pump was replaced. This equipment has not been removed since March 2010.

Figure 6. May 2009 Photograph of the MWL-MW4 Sampling Pump and Inflatable Packer

Table 3 summarizes the maximum filtered and unfiltered metals concentrations from previous MWL groundwater monitoring wells with stainless steel screens, including background monitoring well MWL-BW1. These wells were decommissioned in 2008 due to declining water levels and evidence of stainless steel well screen corrosion (Bearzi March 2007 and July 2007). This table compares unfiltered and filtered maximum concentrations, and demonstrates three relevant points. First, elevated results for chromium, cobalt, copper, iron, and nickel were observed in all four of these wells. Second, maximum unfiltered sample concentrations for chromium, cobalt, copper, iron, and nickel are all similar to (but generally higher) the February 2013 MWL-MW4 sample results (MWL-MW4 results provided at the bottom of Table 3 for comparison). Third, unfiltered samples show maximum concentrations one or more orders of magnitude higher than the filtered results. However, consistent with MWL-MW4 nickel sample results, filtered and unfiltered nickel concentrations are similar (i.e., not substantially different) for samples from MWL-MW1 and MWL-MW3.

Table 3. Summary of Maximum Filtered and Unfiltered Metals Results from Mixed Waste Landfill Monitoring Wells with Stainless Steel Screens[a]

MWL Monitoring Well	Metal	Maximum Filtered Concentration in (mg/L)	Maximum Unfiltered Concentration (mg/L)
MWL-BW1	Chromium	0.002280	0.09420
	Cobalt	0.000220	0.004520
	Copper	0.001940	0.00807
	Iron	0.070900	1.820
	Nickel	0.01280	0.1910
MWL-MW1	Chromium	0.004220	1.1000
	Cobalt	0.000590	0.004040
	Copper	0.003720	0.02440
	Iron	0.2600	6.100
	Nickel	0.4050	0.5380
MWL-MW2	Chromium	0.005530	0.16200
	Cobalt	0.000148	0.000790
	Copper	0.00737	0.01040
	Iron	0.2390	0.3990
	Nickel	0.007110	0.1240
MWL-MW3	Chromium	0.004520	0.1690
	Cobalt	0.000770	0.003310
	Copper	0.00556	0.01360
	Iron	0.1370	4.220
	Nickel	0.1200	0.1570
MWL-MW4	Chromium	0.001620	0.11200
	Cobalt	0.000903	0.002290
	Copper	0.002520	0.03350
	Iron	0.390	2.920
	Nickel	0.1950	0.4170

[a] Monitoring well MWL-MW4 results provided at the bottom of this table for comparison.
BW = Background well.
mg/L = Milligram(s) per liter.
MW = Monitoring well.
MWL = Mixed Waste Landfill

1.4.1 Field and Laboratory Quality Control Sample Results

The QC samples collected during the CY 2013 sampling event that are relevant to the metals sample results include two duplicate samples (collected from monitoring wells MWL-MW5 and MWL-MW8) and two equipment blank (EB) samples (associated with monitoring wells MWL-MW5 and MWL-MW8). Duplicate samples and EB samples were submitted for all analyses.

CY 2013 duplicate environmental sample results show good correlation. Although various constituents were detected in the EB samples at low concentrations, including some metals, for the MWL-MW4 metals sample results only magnesium was qualified as "estimated" based on the EB results.

All environmental sample, field QC sample, and laboratory QC sample results were reviewed and qualified in accordance with AOP 00-03, *Data Validation Procedure for Chemical and Radiochemical Data* (SNL May 2011). Although some analytical results were qualified during the data validation process, no significant data quality problems were noted for any CY 2013 MWL groundwater monitoring samples. The CY 2013 groundwater monitoring data meet data quality objectives and are in compliance with analytical methods and laboratory procedures (i.e., representative and technically defensible).

1.5 Summary and Conclusion

The January-February 2013 unfiltered metals results for chromium, cobalt, copper, iron, and nickel, as well as the 2011 through 2013 unfiltered and filtered nickel results, are anomalous and appear to be related to the corrosion of the stainless steel sampling pump and possibly other metal components associated with the dedicated sampling system in the well (connecting rods, centralizers, etc.). Evidence of corrosion on the sampling pump was observed when the equipment was removed from the well in May 2009 during ET Cover construction. MWL-MW4 is the only groundwater monitoring well at the MWL with dedicated sampling equipment installed in the well, and is the only well showing any indication of elevated metals concentrations. Filtered and unfiltered metals results are consistent with metals results from previous MWL monitoring wells with stainless steel screen sections that were decommissioned in 2008 due to evidence of well screen corrosion and declining water levels.

Previous investigations, fate and transport modeling, and groundwater monitoring results indicated the recent rapid increases in various metal parameters in groundwater samples from monitoring well MWL-MW4 are not related to a release from the MWL.

1.6 Recommendations

In accordance with the NMED-approved MWL LTMMP, groundwater monitoring of MWL-MW4 for metals is no longer required. However, additional information could be acquired to reduce uncertainty about the cause of the rapidly increasing unfiltered metals concentrations in monitoring well MWL-MW4 groundwater samples. The following recommendations are proposed for this purpose.

- Remove the dedicated sampling system from the well; inspect and document the condition of this equipment.
- Return the pump to the manufacturer for maintenance, replace with a new pump or one in good condition. Replace all related tubing.
- Clean the packer in accordance with instructions from the manufacturer, and clean all connecting rods and other components (pressure wash or steam clean). Replace tubing associated with the packer.
- Reinstall the packer, sampling pump, and new tubing to isolate the two screen intervals, and allow for additional sampling.
- Conduct at least one additional MWL-MW4 groundwater sampling event and collect both filtered and unfiltered TAL metals samples.

- Provide NMED with a report that includes the resampling results, and documentation associated with the removal, maintenance-repair-cleaning-replacement of equipment, reinstallation of equipment, and the additional sampling event.
- Continue to use MWL-MW4 for groundwater elevation measurements from the upper screen interval (i.e., maintain the packer in the well) in support of potentiometric surface mapping beneath the MWL.

Prior to taking any additional actions, the Department of Energy/National Nuclear Security Administration/Sandia Field Office and Sandia Corporation are requesting NMED input to this MWL-MW4 Metals Data Report.

1.7 References

Bearzi January 2009 Bearzi, J.P. (New Mexico Environment Department), January 2009. Letter to K. Davis (U.S. Department of Energy) and F. Nimick (Sandia Corporation), *Notice of Approval: Summary Report for the Mixed Waste Landfill Monitoring Well Plug and Abandonment and Installation – Decommissioning of Groundwater Monitoring Wells MWL-MW1, MWL-MW2, and MWL-MW3, Installation of Groundwater Monitoring Wells MWL-MW7, MWL-MW8, and MWL-MW9, September, 2008, Sandia National Laboratories EPA ID#NM5890110518, HWB-SNL-08-020,* January 15, 2009.

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Bearzi March 2007 Bearzi, J. (New Mexico Environment Department Hazardous Waste Bureau), March 2007. Letter to P. Wagner (U.S. Department of Energy) and F. Nimick (Sandia National Laboratories), *Replacement of Mixed Waste Landfill Groundwater Monitoring Well MWL-BW1, Sandia National Laboratories, EPA ID NM5890110518,* March 26, 2007.

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ATTACHMENT A

Mixed Waste Landfill
MWL-MW4 Filtered and Unfiltered Metals Results
Annual Groundwater Monitoring – Calendar Year 2013

Table A-1
Summary of Unfiltered Target Analyte List Metals plus Uranium Results, Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-BW2	Aluminum	0.173	0.015	0.050	NE			093409-009	SW846 6020
29-Jan-13	Antimony	ND	0.001	0.003	0.006	U		093409-009	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093409-009	SW846 6020
	Barium	0.0988	0.0006	0.002	2.00		J-	093409-009	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093409-009	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093409-009	SW846 6020
	Calcium	74.3	1.20	4.00	NE	B		093409-009	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093409-009	SW846 6020
	Cobalt	0.000213	0.0001	0.001	NE	J		093409-009	SW846 6020
	Copper	0.00114	0.00035	0.001	NE			093409-009	SW846 6020
	Iron	0.382	0.033	0.100	NE			093409-009	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093409-009	SW846 6020
	Magnesium	24.7	0.010	0.030	NE			093409-009	SW846 6020
	Manganese	0.0138	0.001	0.005	NE			093409-009	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U		093409-009	SW846 7470
	Nickel	0.00257	0.0005	0.002	NE			093409-009	SW846 6020
	Potassium	4.10	0.080	0.300	NE			093409-009	SW846 6020
	Selenium	0.00256	0.0015	0.005	0.050	J		093409-009	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093409-009	SW846 6020
	Sodium	62.4	1.60	5.00	NE			093409-009	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093409-009	SW846 6020
	Uranium	0.00686	0.000067	0.0002	0.030			093409-009	SW846 6020
	Vanadium	0.00616	0.001	0.005	NE			093409-009	SW846 6010
	Zinc	0.0102	0.0035	0.010	NE			093409-009	SW846 6020

Refer to footnotes on page 36.

Table A-1 *(Continued)*
Summary of Unfiltered Target Analyte List Metals plus Uranium Results, Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW4	Aluminum	0.0284	0.015	0.050	NE	J		093441-009	SW846 6020
11-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093441-009	SW846 6020
	Arsenic	0.00426	0.0017	0.005	0.010	J		093441-009	SW846 6020
	Barium	0.0861	0.0006	0.002	2.00			093441-009	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093441-009	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093441-009	SW846 6020
	Calcium	58.9	0.300	1.00	NE			093441-009	SW846 6020
	Chromium	**0.112**	0.002	0.010	0.100			093441-009	SW846 6020
	Cobalt	0.00229	0.0001	0.001	NE			093441-009	SW846 6020
	Copper	0.0335	0.00035	0.001	NE			093441-009	SW846 6020
	Iron	2.92	0.033	0.100	NE			093441-009	SW846 6020
	Lead	0.00126	0.0005	0.002	NE	J		093441-009	SW846 6020
	Magnesium	18.5	0.010	0.030	NE		J	093441-009	SW846 6020
	Manganese	0.0503	0.001	0.005	NE			093441-009	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U	UJ	093441-009	SW846 7470
	Nickel	0.417	0.0005	0.002	NE			093441-009	SW846 6020
	Potassium	5.10	0.080	0.300	NE		J	093441-009	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093441-009	SW846 6020
	Silver	0.00236	0.0002	0.001	NE			093441-009	SW846 6020
	Sodium	56.7	0.400	1.25	NE			093441-009	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093441-009	SW846 6020
	Uranium	0.00455	0.000067	0.0002	0.030			093441-009	SW846 6020
	Vanadium	0.0105	0.001	0.005	NE			093441-009	SW846 6010
	Zinc	0.144	0.0035	0.010	NE			093441-009	SW846 6020

Refer to footnotes on page 36.

Table A-1 *(Continued)*
Summary of Unfiltered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW5	Aluminum	ND	0.015	0.050	NE	U		093414-009	SW846 6020
30-Jan-13	Antimony	ND	0.001	0.003	0.006	U		093414-009	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093414-009	SW846 6020
	Barium	0.116	0.0006	0.002	2.00		J-	093414-009	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093414-009	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093414-009	SW846 6020
	Calcium	99.9	1.20	4.00	NE	B		093414-009	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093414-009	SW846 6020
	Cobalt	0.000142	0.0001	0.001	NE	J		093414-009	SW846 6020
	Copper	0.000817	0.00035	0.001	NE	J	0.012UJ	093414-009	SW846 6020
	Iron	0.185	0.033	0.100	NE			093414-009	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093414-009	SW846 6020
	Magnesium	33.8	0.010	0.030	NE			093414-009	SW846 6020
	Manganese	0.0085	0.001	0.005	NE			093414-009	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U		093414-009	SW846 7470
	Nickel	0.00201	0.0005	0.002	NE		0.0026U	093414-009	SW846 6020
	Potassium	5.71	0.080	0.300	NE			093414-009	SW846 6020
	Selenium	0.00193	0.0015	0.005	0.050	J		093414-009	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093414-009	SW846 6020
	Sodium	74.9	1.60	5.00	NE			093414-009	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093414-009	SW846 6020
	Uranium	0.00908	0.000067	0.0002	0.030			093414-009	SW846 6020
	Vanadium	0.00548	0.001	0.005	NE			093414-009	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093414-009	SW846 6020

Refer to footnotes on page 36.

Table A-1 *(Continued)*
Summary of Unfiltered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW5 (Duplicate)	Aluminum	ND	0.015	0.050	NE	U		093415-009	SW846 6020
30-Jan-13	Antimony	ND	0.001	0.003	0.006	U		093415-009	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093415-009	SW846 6020
	Barium	0.114	0.0006	0.002	2.00		J-	093415-009	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093415-009	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093415-009	SW846 6020
	Calcium	98.3	1.20	4.00	NE	B		093415-009	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093415-009	SW846 6020
	Cobalt	0.000139	0.0001	0.001	NE	J		093415-009	SW846 6020
	Copper	0.000619	0.00035	0.001	NE	J	0.012UJ	093415-009	SW846 6020
	Iron	0.182	0.033	0.100	NE			093415-009	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093415-009	SW846 6020
	Magnesium	33.9	0.010	0.030	NE			093415-009	SW846 6020
	Manganese	0.0086	0.001	0.005	NE			093415-009	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U		093415-009	SW846 7470
	Nickel	0.00208	0.0005	0.002	NE		0.0026U	093415-009	SW846 6020
	Potassium	5.71	0.080	0.300	NE			093415-009	SW846 6020
	Selenium	0.00201	0.0015	0.005	0.050	J		093415-009	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093415-009	SW846 6020
	Sodium	74.3	1.60	5.00	NE			093415-009	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093415-009	SW846 6020
	Uranium	0.0093	0.000067	0.0002	0.030			093415-009	SW846 6020
	Vanadium	0.00521	0.001	0.005	NE			093415-009	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093415-009	SW846 6020

Refer to footnotes on page 36.

Table A-1 *(Continued)*
Summary of Unfiltered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW6	Aluminum	ND	0.015	0.050	NE	U		093418-009	SW846 6020
31-Jan-13	Antimony	ND	0.001	0.003	0.006	U		093418-009	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093418-009	SW846 6020
	Barium	0.117	0.0006	0.002	2.00			093418-009	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093418-009	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093418-009	SW846 6020
	Calcium	92.4	1.20	4.00	NE			093418-009	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093418-009	SW846 6020
	Cobalt	0.000115	0.0001	0.001	NE	J		093418-009	SW846 6020
	Copper	0.000849	0.00035	0.001	NE	J		093418-009	SW846 6020
	Iron	0.183	0.033	0.100	NE			093418-009	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093418-009	SW846 6020
	Magnesium	30.8	0.010	0.030	NE			093418-009	SW846 6020
	Manganese	ND	0.001	0.005	NE	U		093418-009	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U		093418-009	SW846 7470
	Nickel	0.00228	0.0005	0.002	NE			093418-009	SW846 6020
	Potassium	5.80	0.080	0.300	NE			093418-009	SW846 6020
	Selenium	0.00224	0.0015	0.005	0.050	J		093418-009	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093418-009	SW846 6020
	Sodium	70.8	1.60	5.00	NE			093418-009	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093418-009	SW846 6020
	Uranium	0.0102	0.000067	0.0002	0.030			093418-009	SW846 6020
	Vanadium	0.0064	0.001	0.005	NE			093418-009	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093418-009	SW846 6020

Refer to footnotes on page 36.

Table A-1 *(Continued)*
Summary of Unfiltered Target Analyte List Metals plus Uranium Results, Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW7	Aluminum	ND	0.015	0.050	NE	U		093438-009	SW846 6020
07-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093438-009	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093438-009	SW846 6020
	Barium	0.093	0.0006	0.002	2.00			093438-009	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093438-009	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093438-009	SW846 6020
	Calcium	58.3	0.600	2.00	NE	B		093438-009	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093438-009	SW846 6020
	Cobalt	0.000105	0.0001	0.001	NE	J		093438-009	SW846 6020
	Copper	0.000927	0.00035	0.001	NE	J	J	093438-009	SW846 6020
	Iron	0.115	0.033	0.100	NE			093438-009	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093438-009	SW846 6020
	Magnesium	18.3	0.010	0.030	NE			093438-009	SW846 6020
	Manganese	ND	0.001	0.005	NE	U		093438-009	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U	UJ	093438-009	SW846 7470
	Nickel	0.00152	0.0005	0.002	NE	J		093438-009	SW846 6020
	Potassium	4.66	0.080	0.300	NE			093438-009	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093438-009	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093438-009	SW846 6020
	Sodium	41.0	0.080	0.250	NE			093438-009	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093438-009	SW846 6020
	Uranium	0.00747	0.000067	0.0002	0.030			093438-009	SW846 6020
	Vanadium	0.0076	0.001	0.005	NE			093438-009	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093438-009	SW846 6020

Refer to footnotes on page 36.

Table A-1 *(Continued)*
Summary of Unfiltered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW8	Aluminum	0.0265	0.015	0.050	NE	J		093429-009	SW846 6020
06-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093429-009	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093429-009	SW846 6020
	Barium	0.122	0.006	0.020	2.00			093429-009	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093429-009	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093429-009	SW846 6020
	Calcium	60.8	0.600	2.00	NE	B		093429-009	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093429-009	SW846 6020
	Cobalt	0.000135	0.0001	0.001	NE	J		093429-009	SW846 6020
	Copper	0.00182	0.00035	0.001	NE		0.015UJ	093429-009	SW846 6020
	Iron	0.150	0.033	0.100	NE			093429-009	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093429-009	SW846 6020
	Magnesium	19.1	0.010	0.030	NE			093429-009	SW846 6020
	Manganese	0.0223	0.001	0.005	NE			093429-009	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U	UJ	093429-009	SW846 7470
	Nickel	0.00215	0.0005	0.002	NE			093429-009	SW846 6020
	Potassium	5.06	0.080	0.300	NE			093429-009	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093429-009	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093429-009	SW846 6020
	Sodium	42.3	0.080	0.250	NE			093429-009	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093429-009	SW846 6020
	Uranium	0.00755	0.000067	0.0002	0.030			093429-009	SW846 6020
	Vanadium	0.00242	0.001	0.005	NE	J		093429-009	SW846 6010
	Zinc	0.00515	0.0035	0.010	NE	J		093429-009	SW846 6020

Refer to footnotes on page 36.

Table A-1 *(Continued)*
Summary of Unfiltered Target Analyte List Metals plus Uranium Results, Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW8 (Duplicate)	Aluminum	0.0378	0.015	0.050	NE	J		093430-009	SW846 6020
06-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093430-009	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093430-009	SW846 6020
	Barium	0.120	0.0006	0.002	2.00			093430-009	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093430-009	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093430-009	SW846 6020
	Calcium	59.1	0.600	2.00	NE	B		093430-009	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093430-009	SW846 6020
	Cobalt	0.000144	0.0001	0.001	NE	J		093430-009	SW846 6020
	Copper	0.00195	0.00035	0.001	NE		0.015UJ	093430-009	SW846 6020
	Iron	0.162	0.033	0.100	NE			093430-009	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093430-009	SW846 6020
	Magnesium	19.2	0.010	0.030	NE			093430-009	SW846 6020
	Manganese	0.0227	0.001	0.005	NE			093430-009	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U	UJ	093430-009	SW846 7470
	Nickel	0.00218	0.0005	0.002	NE			093430-009	SW846 6020
	Potassium	5.10	0.080	0.300	NE			093430-009	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093430-009	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093430-009	SW846 6020
	Sodium	43.2	0.080	0.250	NE			093430-009	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093430-009	SW846 6020
	Uranium	0.00726	0.000067	0.0002	0.030			093430-009	SW846 6020
	Vanadium	0.00174	0.001	0.005	NE	J		093430-009	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093430-009	SW846 6020

Refer to footnotes on page 36.

Table A-1 *(Concluded)*
Summary of Unfiltered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW9	Aluminum	0.0358	0.015	0.050	NE	J		093423-009	SW846 6020
04-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093423-009	SW846 6020
	Arsenic	0.00185	0.0017	0.005	0.010	J		093423-009	SW846 6020
	Barium	0.0897	0.0006	0.002	2.00			093423-009	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093423-009	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093423-009	SW846 6020
	Calcium	58.9	0.600	2.00	NE	B		093423-009	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093423-009	SW846 6020
	Cobalt	0.000168	0.0001	0.001	NE	J		093423-009	SW846 6020
	Copper	0.00108	0.00035	0.001	NE		J	093423-009	SW846 6020
	Iron	0.172	0.033	0.100	NE			093423-009	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093423-009	SW846 6020
	Magnesium	18.6	0.010	0.030	NE			093423-009	SW846 6020
	Manganese	0.00862	0.001	0.005	NE			093423-009	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U	UJ	093423-009	SW846 7470
	Nickel	0.00208	0.0005	0.002	NE			093423-009	SW846 6020
	Potassium	4.73	0.080	0.300	NE			093423-009	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093423-009	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093423-009	SW846 6020
	Sodium	40.7	0.080	0.250	NE			093423-009	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093423-009	SW846 6020
	Uranium	0.00923	0.000067	0.0002	0.030			093423-009	SW846 6020
	Vanadium	0.00921	0.001	0.005	NE			093423-009	SW846 6010
	Zinc	0.00376	0.0035	0.010	NE	J		093423-009	SW846 6020

Refer to footnotes on page 36.

Table A-2
Summary of Filtered Target Analyte List Metals plus Uranium Results, Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-BW2	Aluminum	ND	0.015	0.050	NE	U		093409-010	SW846 6020
29-Jan-13	Antimony	ND	0.001	0.003	0.006	U		093409-010	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093409-010	SW846 6020
	Barium	0.0929	0.0006	0.002	2.00		J-	093409-010	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093409-010	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093409-010	SW846 6020
	Calcium	72.7	1.20	4.00	NE	B		093409-010	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093409-010	SW846 6020
	Cobalt	0.000313	0.0001	0.001	NE	J		093409-010	SW846 6020
	Copper	0.000649	0.00035	0.001	NE	J		093409-010	SW846 6020
	Iron	0.135	0.033	0.100	NE			093409-010	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093409-010	SW846 6020
	Magnesium	24.6	0.010	0.030	NE			093409-010	SW846 6020
	Manganese	0.0093	0.001	0.005	NE			093409-010	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U		093409-010	SW846 7470
	Nickel	0.00218	0.0005	0.002	NE			093409-010	SW846 6020
	Potassium	3.98	0.080	0.300	NE			093409-010	SW846 6020
	Selenium	0.00265	0.0015	0.005	0.050	J		093409-010	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093409-010	SW846 6020
	Sodium	61.3	1.60	5.00	NE			093409-010	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093409-010	SW846 6020
	Uranium	0.00679	0.000067	0.0002	0.030			093409-010	SW846 6020
	Vanadium	0.00567	0.001	0.005	NE			093409-010	SW846 6010
	Zinc	0.00979	0.0035	0.010	NE	J		093409-010	SW846 6020

Refer to footnotes on page 36.

Table A-2 *(Continued)*
Summary of Filtered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW4	Aluminum	ND	0.015	0.050	NE	U		093441-010	SW846 6020
11-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093441-010	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093441-010	SW846 6020
	Barium	0.0864	0.0006	0.002	2.00			093441-010	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093441-010	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093441-010	SW846 6020
	Calcium	62.1	0.300	1.00	NE			093441-010	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093441-010	SW846 6020
	Cobalt	0.000296	0.0001	0.001	NE	J		093441-010	SW846 6020
	Copper	0.00213	0.00035	0.001	NE			093441-010	SW846 6020
	Iron	0.137	0.033	0.100	NE			093441-010	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093441-010	SW846 6020
	Magnesium	18.9	0.010	0.030	NE		J	093441-010	SW846 6020
	Manganese	0.00414	0.001	0.005	NE	J		093441-010	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U	UJ	093441-010	SW846 7470
	Nickel	0.179	0.0005	0.002	NE			093441-010	SW846 6020
	Potassium	4.48	0.080	0.300	NE		J	093441-010	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093441-010	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093441-010	SW846 6020
	Sodium	48.6	0.080	0.250	NE			093441-010	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093441-010	SW846 6020
	Uranium	0.00549	0.000067	0.0002	0.030			093441-010	SW846 6020
	Vanadium	0.00821	0.001	0.005	NE			093441-010	SW846 6010
	Zinc	0.0462	0.0035	0.010	NE			093441-010	SW846 6020

Refer to footnotes on page 36.

Table A-2 *(Continued)*
Summary of Filtered Target Analyte List Metals plus Uranium Results, Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW5	Aluminum	ND	0.015	0.050	NE	U		093414-010	SW846 6020
30-Jan-13	Antimony	ND	0.001	0.003	0.006	U		093414-010	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093414-010	SW846 6020
	Barium	0.113	0.0006	0.002	2.00		J-	093414-010	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093414-010	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093414-010	SW846 6020
	Calcium	96.0	1.20	4.00	NE	B		093414-010	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093414-010	SW846 6020
	Cobalt	0.000126	0.0001	0.001	NE	J	0.00064U	093414-010	SW846 6020
	Copper	0.000995	0.00035	0.001	NE	J	0.011UJ	093414-010	SW846 6020
	Iron	0.179	0.033	0.100	NE			093414-010	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093414-010	SW846 6020
	Magnesium	32.5	0.010	0.030	NE			093414-010	SW846 6020
	Manganese	0.00226	0.001	0.005	NE	J		093414-010	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U		093414-010	SW846 7470
	Nickel	0.00199	0.0005	0.002	NE	J		093414-010	SW846 6020
	Potassium	5.47	0.080	0.300	NE			093414-010	SW846 6020
	Selenium	0.00225	0.0015	0.005	0.050	J		093414-010	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093414-010	SW846 6020
	Sodium	72.8	1.60	5.00	NE			093414-010	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093414-010	SW846 6020
	Uranium	0.00914	0.000067	0.0002	0.030			093414-010	SW846 6020
	Vanadium	0.00559	0.001	0.005	NE			093414-010	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093414-010	SW846 6020

Refer to footnotes on page 36.

Table A-2 *(Continued)*
Summary of Filtered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW5 (Duplicate)	Aluminum	ND	0.015	0.050	NE	U		093415-010	SW846 6020
30-Jan-13	Antimony	ND	0.001	0.003	0.006	U		093415-010	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093415-010	SW846 6020
	Barium	0.107	0.0006	0.002	2.00		J-	093415-010	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093415-010	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093415-010	SW846 6020
	Calcium	94.0	1.20	4.00	NE	B		093415-010	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093415-010	SW846 6020
	Cobalt	0.000128	0.0001	0.001	NE	J	0.00064U	093415-010	SW846 6020
	Copper	0.000713	0.00035	0.001	NE	J	0.011UJ	093415-010	SW846 6020
	Iron	0.178	0.033	0.100	NE			093415-010	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093415-010	SW846 6020
	Magnesium	31.9	0.010	0.030	NE			093415-010	SW846 6020
	Manganese	0.00217	0.001	0.005	NE	J		093415-010	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U		093415-010	SW846 7470
	Nickel	0.00199	0.0005	0.002	NE	J		093415-010	SW846 6020
	Potassium	5.25	0.080	0.300	NE			093415-010	SW846 6020
	Selenium	0.00236	0.0015	0.005	0.050	J		093415-010	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093415-010	SW846 6020
	Sodium	70.2	1.60	5.00	NE			093415-010	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093415-010	SW846 6020
	Uranium	0.00876	0.000067	0.0002	0.030			093415-010	SW846 6020
	Vanadium	0.00481	0.001	0.005	NE	J		093415-010	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093415-010	SW846 6020

Refer to footnotes on page 36.

Table A-2 *(Continued)*
Summary of Filtered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW6	Aluminum	ND	0.015	0.050	NE	U		093418-010	SW846 6020
31-Jan-13	Antimony	ND	0.001	0.003	0.006	U		093418-010	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093418-010	SW846 6020
	Barium	0.114	0.0006	0.002	2.00			093418-010	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093418-010	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093418-010	SW846 6020
	Calcium	97.6	1.20	4.00	NE			093418-010	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093418-010	SW846 6020
	Cobalt	0.000124	0.0001	0.001	NE	J		093418-010	SW846 6020
	Copper	0.000678	0.00035	0.001	NE	J		093418-010	SW846 6020
	Iron	0.178	0.033	0.100	NE			093418-010	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093418-010	SW846 6020
	Magnesium	30.8	0.010	0.030	NE			093418-010	SW846 6020
	Manganese	ND	0.001	0.005	NE	U		093418-010	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U		093418-010	SW846 7470
	Nickel	0.00191	0.0005	0.002	NE	J		093418-010	SW846 6020
	Potassium	5.68	0.080	0.300	NE			093418-010	SW846 6020
	Selenium	0.00202	0.0015	0.005	0.050	J		093418-010	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093418-010	SW846 6020
	Sodium	72.6	1.60	5.00	NE			093418-010	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093418-010	SW846 6020
	Uranium	0.0101	0.000067	0.0002	0.030			093418-010	SW846 6020
	Vanadium	0.00713	0.001	0.005	NE			093418-010	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093418-010	SW846 6020

Refer to footnotes on page 36.

Table A-2 *(Continued)*
Summary of Filtered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW7	Aluminum	ND	0.015	0.050	NE	U		093438-010	SW846 6020
07-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093438-010	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093438-010	SW846 6020
	Barium	0.0929	0.0006	0.002	2.00			093438-010	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093438-010	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093438-010	SW846 6020
	Calcium	56.3	0.600	2.00	NE	B		093438-010	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093438-010	SW846 6020
	Cobalt	0.000135	0.0001	0.001	NE	J		093438-010	SW846 6020
	Copper	0.00107	0.00035	0.001	NE		J	093438-010	SW846 6020
	Iron	0.105	0.033	0.100	NE			093438-010	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093438-010	SW846 6020
	Magnesium	18.4	0.010	0.030	NE			093438-010	SW846 6020
	Manganese	ND	0.001	0.005	NE	U		093438-010	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U	UJ	093438-010	SW846 7470
	Nickel	0.00156	0.0005	0.002	NE	J		093438-010	SW846 6020
	Potassium	4.65	0.080	0.300	NE			093438-010	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093438-010	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093438-010	SW846 6020
	Sodium	42.0	0.080	0.250	NE			093438-010	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093438-010	SW846 6020
	Uranium	0.00761	0.000067	0.0002	0.030			093438-010	SW846 6020
	Vanadium	0.00776	0.001	0.005	NE			093438-010	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093438-010	SW846 6020

Refer to footnotes on page 36.

Table A-2 *(Continued)*
Summary of Filtered Target Analyte List Metals plus Uranium Results, Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW8	Aluminum	ND	0.015	0.050	NE	U		093429-010	SW846 6020
06-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093429-010	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093429-010	SW846 6020
	Barium	0.120	0.0006	0.002	2.00			093429-010	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093429-010	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093429-010	SW846 6020
	Calcium	62.4	0.600	2.00	NE	B		093429-010	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093429-010	SW846 6020
	Cobalt	0.000114	0.0001	0.001	NE	J		093429-010	SW846 6020
	Copper	0.00151	0.00035	0.001	NE		0.008UJ	093429-010	SW846 6020
	Iron	0.107	0.033	0.100	NE			093429-010	SW846 6020
	Lead	0.00109	0.0005	0.002	NE	J		093429-010	SW846 6020
	Magnesium	19.3	0.010	0.030	NE			093429-010	SW846 6020
	Manganese	0.0131	0.001	0.005	NE			093429-010	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U	UJ	093429-010	SW846 7470
	Nickel	0.00196	0.0005	0.002	NE	J		093429-010	SW846 6020
	Potassium	5.11	0.080	0.300	NE			093429-010	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093429-010	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093429-010	SW846 6020
	Sodium	43.0	0.080	0.250	NE			093429-010	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093429-010	SW846 6020
	Uranium	0.00742	0.000067	0.0002	0.030			093429-010	SW846 6020
	Vanadium	0.00191	0.001	0.005	NE	J		093429-010	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093429-010	SW846 6020

Refer to footnotes on page 36.

Table A-2 *(Continued)*
Summary of Filtered Target Analyte List Metals plus Uranium Results,
Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW8 (Duplicate)	Aluminum	ND	0.015	0.050	NE	U		093430-010	SW846 6020
06-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093430-010	SW846 6020
	Arsenic	ND	0.0017	0.005	0.010	U		093430-010	SW846 6020
	Barium	0.118	0.0006	0.002	2.00			093430-010	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093430-010	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093430-010	SW846 6020
	Calcium	60.3	0.600	2.00	NE	B		093430-010	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093430-010	SW846 6020
	Cobalt	0.000116	0.0001	0.001	NE	J		093430-010	SW846 6020
	Copper	0.00154	0.00035	0.001	NE		0.008UJ	093430-010	SW846 6020
	Iron	0.109	0.033	0.100	NE			093430-010	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093430-010	SW846 6020
	Magnesium	18.8	0.010	0.030	NE			093430-010	SW846 6020
	Manganese	0.0128	0.001	0.005	NE			093430-010	SW846 6020
	Mercury	ND	0.000067	0.0002	0.002	U	UJ	093430-010	SW846 7470
	Nickel	0.00186	0.0005	0.002	NE	J		093430-010	SW846 6020
	Potassium	4.98	0.080	0.300	NE			093430-010	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093430-010	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093430-010	SW846 6020
	Sodium	42.4	0.080	0.250	NE			093430-010	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093430-010	SW846 6020
	Uranium	0.00737	0.000067	0.0002	0.030			093430-010	SW846 6020
	Vanadium	0.00178	0.001	0.005	NE	J		093430-010	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093430-010	SW846 6020

Refer to footnotes on page 36.

Table A-2 *(Concluded)*
Summary of Filtered Target Analyte List Metals plus Uranium Results, Mixed Waste Landfill Groundwater Monitoring, Sandia National Laboratories/New Mexico

Calendar Year 2013

Well ID	Analyte	Result[a] (mg/L)	MDL (mg/L)	PQL (mg/L)	MCL (mg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.	Analytical Method[c]
MWL-MW9	Aluminum	ND	0.015	0.050	NE	U		093423-010	SW846 6020
04-Feb-13	Antimony	ND	0.001	0.003	0.006	U		093423-010	SW846 6020
	Arsenic	0.00307	0.0017	0.005	0.010	J		093423-010	SW846 6020
	Barium	0.0896	0.0006	0.002	2.00			093423-010	SW846 6020
	Beryllium	ND	0.0002	0.0005	0.004	U		093423-010	SW846 6020
	Cadmium	ND	0.00011	0.001	0.005	U		093423-010	SW846 6020
	Calcium	59.1	0.600	2.00	NE	B		093423-010	SW846 6020
	Chromium	ND	0.002	0.010	0.100	U		093423-010	SW846 6020
	Cobalt	0.00018	0.0001	0.001	NE	J		093423-010	SW846 6020
	Copper	0.00134	0.00035	0.001	NE		J	093423-010	SW846 6020
	Iron	0.108	0.033	0.100	NE			093423-010	SW846 6020
	Lead	ND	0.0005	0.002	NE	U		093423-010	SW846 6020
	Magnesium	18.7	0.010	0.030	NE			093423-010	SW846 6020
	Manganese	0.00225	0.001	0.005	NE	J		093423-010	SW846 6020
	Mercury	0.0003	0.000067	0.0002	0.002		NJ-	093423-010	SW846 7470
	Nickel	0.00174	0.0005	0.002	NE	J		093423-010	SW846 6020
	Potassium	4.73	0.080	0.300	NE			093423-010	SW846 6020
	Selenium	ND	0.0015	0.005	0.050	U		093423-010	SW846 6020
	Silver	ND	0.0002	0.001	NE	U		093423-010	SW846 6020
	Sodium	40.6	0.080	0.250	NE			093423-010	SW846 6020
	Thallium	ND	0.00045	0.002	0.002	U		093423-010	SW846 6020
	Uranium	0.00911	0.000067	0.0002	0.030			093423-010	SW846 6020
	Vanadium	0.00975	0.001	0.005	NE			093423-010	SW846 6010
	Zinc	ND	0.0035	0.010	NE	U		093423-010	SW846 6020

Refer to footnotes on page 36.

Footnotes for Tables A-1 and A-2

Notes

[a]Values in bold exceed the established MCL.

[b]Laboratory/Validation Qualifier – Blank (--) cell = all quality control samples met acceptance criteria. See explanation for "B" "J" "J-" "NJ-" "U" "UJ" qualifiers below.

[c]U.S. Environmental Protection Agency, 1986 (and updates), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd edition.

% = percent.
B = Analyte is detected in associated laboratory method blank.
EPA = U.S. Environmental Protection Agency.
ID = Identifier.
J = Estimated value, the analyte concentration is below the PQL.
J- = The associated numerical value is an estimated quantity with a suspected negative bias.
MCL = Maximum contaminant level. MCLs were established by the EPA Office of Water, National Primary Water Regulations (EPA May 2009).
MDL = Method detection limit. The minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero, analyte is matrix-specific.
mg/L = milligrams per liter.
ND = Not detected (at MDL). Activities of zero or less are considered to be not detected.
NE = Not established.
NJ- = Presumptive evidence of the presence of the material at an estimated quantity with a suspected negative bias.
No. = Number.
PQL = Practical quantitation limit. The lowest concentration of analytes in a sample that can be reliably determined within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions.
U = Analyte is not present or concentration is below the MDL.
UJ = Analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.


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