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MIXED WASTE LANDFILL
ANNUAL GROUNDWATER MONITORING REPORT
APRIL 2006
SAMPLING EVENT
SANDIA NATIONAL LABORATORIES/NEW MEXICO

Prepared for:

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November 2006

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SNL MWL 06

06-030

National Nuclear Security Administration
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DEC 2006
NMED Hazardous Waste Bureau

Mr. James Bearzi
Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Rd. East, Building 1
Santa Fe, New Mexico 87505

Dear Mr. Bearzi:

On behalf of the Department of Energy (DOE) and Sandia Corporation (Sandia), DOE is submitting the Mixed Waste Landfill (MWL) Annual Groundwater Monitoring Report, April 2006. The report presents groundwater monitoring data from the annual sampling event conducted at the MWL in April 2006. The results of the groundwater monitoring showed constituent concentrations within historical ranges for the MWL.

If you have any questions, please contact me at (505) 845-6036, or John Gould of my staff at (505) 845-6089.

Sincerely,

Kimberly A Davis for
Patty Wagner
Manager

Enclosure

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AOP 95-45, 06

CERTIFICATION STATEMENT FOR APPROVAL AND FINAL RELEASE OF DOCUMENTS

Document title: **Mixed Waste Landfill Annual Groundwater Monitoring Report April 2006 Sampling Event, November 2006**

Document authors: **Mark L. Lyon, Shaw**

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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Patty Wagner for
Manager
U.S. Department of Energy
National Nuclear Security Administration
Sandia Site Office
Owner and Co-Operator

Date

Executive Summary

Annual groundwater sampling was conducted at the Sandia National Laboratories Mixed Waste Landfill (MWL) in April 2006. Seven monitoring wells were sampled using a Bennett™ pump in accordance with the April 2006 Mini-Sampling and Analysis Plan for the MWL (SNL/NM 2006). The samples were analyzed off site at General Engineering Laboratories, Inc. for a broad suite of radiochemical and chemical parameters, and the results are presented in this report. The results show constituent concentrations within historical ranges for the site and indicate no evidence of groundwater contamination from the landfill.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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Acronyms and Abbreviations

AOP	Administrative Operating Procedure
EB	equipment blank
E_h	oxidation/reduction potential
EPA	U.S. Environmental Protection Agency
DO	dissolved oxygen
DOE	U. S. Department of Energy
FOP	Field Operating Procedure
GEL	General Engineering Laboratories, Inc.
HWB	Hazardous Waste Bureau
L	liter(s)
MCL	maximum contaminant level
MDA	minimum detectable activity
MDL	method detection limit
µg	microgram(s)
mg	milligram(s)
MWL	Mixed Waste Landfill
NMED	New Mexico Environment Department
pCi	picocurie(s)
pH	potential of hydrogen
PQL	practical quantitation limit
PVC	polyvinyl chloride
QC	quality control
RPD	relative percent difference
SNL/NM	Sandia National Laboratories/New Mexico
SWMU	solid waste management unit
TAL	target analyte list
TB	trip blank
USGS	U.S. Geological Society
VOC	volatile organic compound

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1.0 Introduction

Sandia National Laboratories/New Mexico (SNL/NM), operated for the U.S. Department of Energy (DOE), National Nuclear Security Administration by Sandia Corporation, a division of Lockheed Martin Corporation, is located on Kirtland Air Force Base. The purpose of this report is to document the annual groundwater monitoring activities and results conducted in April 2006 at the Mixed Waste Landfill (MWL). The MWL is located in Technical Area 3 and is shown on Figure 1.

The MWL monitoring well network consists of seven wells that serve as a detection monitoring system for potential contaminant releases to groundwater from the landfill. Five of these wells were installed between 1988 and 1993.

The locations of MWL monitoring wells are shown in Figure 2. Monitoring wells MWL-BW1, MWL-MW1, MWL-MW2, and MWL-MW3 were installed in a one-upgradient, three-downgradient configuration, respectively, based upon regional groundwater flow direction determined in 1988. Monitoring well MWL-MW1 was installed in October 1988 using air rotary casing hammer techniques. Monitoring wells MWL-BW1, MWL-MW2, and MWL-MW3 were installed between June and September 1989 using bentonite-based drilling mud.

Monitoring well MWL-BW1 is located approximately 500 feet southeast of the MWL. MWL-BW1 was established as the background monitoring well. Current groundwater flow direction at the MWL (west) indicates MWL-BW1 is actually cross-gradient to the MWL. However, MWL-BW1 is located far enough away from the landfill to provide background water quality. Monitoring well MWL-MW4 was installed in 1993 directly beneath a disposal trench in which 204,000 gallons of coolant wastewater from the Sandia Engineering Reactor Facility were disposed of in 1967 (Peace et al. September 2002). MWL-MW4 was completed at an angle of 6 degrees from vertical and is screened at two discrete intervals 20 feet apart to evaluate vertical anisotropy, vertical potentiometric gradients, and changes in aquifer parameters with depth. An inflatable packer separates the screened intervals.

Monitoring wells MWL-MW5 and MWL-MW6 were installed in 2000 at a distance of 200 and 500 feet west of the landfill, respectively.

All seven monitoring wells are constructed of 5-inch Schedule 80 polyvinyl chloride (PVC) casing. Wells MWL-BW1, MWL-MW1, MWL-MW2, and MWL-MW3 have screens made of slotted Type 304 stainless steel. Wells MWL-MW4, MWL-MW5, and MWL-MW6 have screens made of slotted Schedule 80 PVC.

Table 2-1 presents well construction information and water levels measured in each MWL monitoring well.

2.0 Regulatory Criteria

Historically, the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) has provided regulatory oversight of the MWL, as solid waste management unit (SWMU) 76 under the Hazardous and Solid Waste Amendments module of the facility Resource Conservation and Recovery Act (RCRA) permit. The NMED confirmed that the MWL is properly designated as a SWMU (Dinwiddie June 1998), and as such, must comply with the corrective action program defined in the 20.4.1.50 New Mexico Administrative Code, incorporating Title 40 Code of Federal Regulations, Section 264.101. Requirements for corrective action at the MWL, including groundwater monitoring requirements, are established through the corrective measures process.

The NMED issued the Compliance Order on Consent (the Order) in April 2004. Regulatory authority for the groundwater sampling at the MWL was transferred to the Order (NMED April 2004). Although this report is not a deliverable under the Order, it has been formatted to address the content criteria set forth in the Order for Periodic Monitoring Reports. The following crosswalk lists the required elements from the Order and the corresponding section(s) in which these elements are addressed in this report.

Required Elements of the Order (NMED April 2004)	MWL Groundwater Monitoring Report April 2006 Sampling Event
1. Title Page and Signature Block (for the name, title and organization of the preparer and the responsible DOE and Sandia representative)	Title Page Signatures for full SNL/NM and DOE chain of command on the transmittal paperwork that travels with the report from SNL/NM to DOE to NMED
2. Executive Summary (Abstract)	Executive Summary and in Chapter 8.0
3. Table of Contents	Table of Contents
4. Introduction	Chapter 1.0 Introduction
5. Scope of Activities	Chapter 3.0 Scope of Activities
6. Regulatory Criteria	Chapter 2.0 Regulatory Criteria
7. Monitoring Results	Chapter 6.0 Summary of Analytical Results
8. Conclusions	Chapter 9.0 Summary and Conclusions
9. Tables	Appear at the end of the report
10. Figures	Appear at the end of the report
11. Appendices	Not applicable

3.0 Scope of Activities

Annual groundwater sampling was conducted at the MWL located in Technical Area 3 at SNL/NM. Sampling was conducted from April 3 through April 18, 2006. All seven monitoring wells at the MWL were sampled, including background monitoring well MWL-BW1, on-site monitoring well MWL-MW4, and downgradient monitoring wells MWL-MW1, MWL-MW2, MWL-MW3, MWL-MW5, and MWL-MW6.

Although monitoring well MWL-MW4 is screened in two discrete intervals (Chapter 1.0), only the upper interval was sampled, as this is the uppermost water-bearing interval beneath the MWL. References in this report to groundwater samples from MWL-MW4 refer to groundwater withdrawn from the upper interval.

Sampling was conducted in accordance with the MWL April 2006 Mini-Sampling and Analysis Plan (SNL/NM 2006). The chemical analytical parameters selected for monitoring included

volatile organic compounds (VOCs), target analyte list (TAL) metals, total uranium, nitrate plus nitrite, bromide, fluoride, chloride, and sulfate. Alkalinity titrations were performed in the field on groundwater collected at each well. Radiochemical analysis performed included gross alpha/beta radioactivity, tritium, isotopic uranium, and gamma-emitting radionuclides.

The MWL groundwater samples were submitted to General Engineering Laboratories, Inc. (GEL) located in Charleston, South Carolina, for chemical and radiochemical analysis. All groundwater samples were collected using a Bennett™ pump.

Field quality control (QC) samples submitted to GEL included one field duplicate sample for the full-suite of analyses, three equipment blank (EB) samples for VOCs, TAL metals, total uranium, and uranium-235 and -238 analyses only, and eight trip blank (TB) samples for VOC analysis.

The remainder of this report is organized as follows: Chapter 3.0 provides a discussion of field methods and measurements used during this sampling activity; Chapter 4.0 discusses analytical methods; Chapter 5.0 provides a summary of the analytical results; Chapter 6.0 presents QC results; and Chapter 7.0 addresses variances from requirements in the MWL April 2006 Mini-Sampling and Analysis Plan (SNL/NM 2006). Summaries of findings for the April 2006 sampling event are presented in Chapter 8.0. References are included in Chapter 9.0.

Tables summarizing field measurements and analytical results are included at the end of this report. Tables 1 and 2 present groundwater elevations and associated information and monitoring well purge indicator parameter measurements, respectively. Table 3 lists analytical parameters, test methods, and quantitation limits. Table 4 presents metals analytical results. Table 5 presents the general chemistry analytical results. Table 6 summarizes the organic compounds. Table 7 summarizes the radiochemical analytical results, and Table 8 compares the duplicate sample analysis results to the associated environmental sample results. Complete field and laboratory documentation are on file at the SNL/NM Customer Funded Records Center.

4.0 Field Methods and Measurements

Field measurements performed during annual groundwater sampling activities included groundwater elevation measurements and water quality measurements. The following sections present a more detailed discussion of field activities and methods.

4.1 Groundwater Elevation

Depth-to-groundwater measurements were obtained using a Solinst™ depth-to-water well sounder prior to purging activities. Depth-to-groundwater measurements were performed in accordance with "Measurement of Ground-Water Level," Field Operating Procedure (FOP) 95-02 (SNL/NM 1995). Measurements were obtained from all monitoring wells. Table 1 presents groundwater elevations, static water heights, and monitoring well completion information.

4.2 Well Purging and Water Quality Measurements

Prior to sample collection, each monitoring well was purged to remove stagnant well casing water. Most MWL monitoring wells recharge slowly, and multiple days were required to purge and sample these wells. The monitoring wells were purged to dryness, allowed to recover, and then sampled to collect the most representative groundwater sample possible, given the low yields of these wells. The recovery period was based on the recharge rate of the well and volume necessary for each sample. Total purge volumes presented in Table 2 are based on measured volumes evacuated from each monitoring well prior to sample collection.

Field analytical measurements were collected in accordance with FOP 94-46, "Field Analytical Measurement of Groundwater" (SNL/NM 1994a). Groundwater temperature, specific conductance, potential of hydrogen (pH), oxidation/reduction potential (E_h), and dissolved oxygen (DO) were measured using a YSI™ Model 6820 flow cell and multi-parameter water quality meter. Turbidity was measured with a Hach™ Model 2100P portable turbidity meter. In addition, a Hach™ field kit was used to perform alkalinity titrations. Water quality measurements were recorded on Field Measurement Log forms. Groundwater pH, temperature,

specific conductance, turbidity, DO, and E_h were measured during purging, before sample collection. Table 2 shows the final three measurements taken before the samples were collected. Water quality parameter field measurements were not taken after sample collection.

4.3 Pump Decontamination

The Bennett™ pump and tubing bundle used to collect groundwater samples were decontaminated prior to installation in MWL monitoring wells according to FOP 94-26, "General Equipment Decontamination" (SNL/NM 1994b). The EB samples were collected after decontamination to verify the effectiveness of the procedure. Three EB samples were collected during the April 2006 annual groundwater sampling event. The EB samples are discussed in Section 5.1.1.

4.4 Sample Collection

All groundwater samples were collected directly from the pump discharge tube into prepared laboratory-provided sample containers. Where appropriate for the requested analysis, chemical preservatives were added to the sample containers at the laboratory prior to shipment.

4.5 Sample Handling and Shipment

Immediately after collection, all sample containers were custody-taped, sealed in plastic bags, and placed on ice in shipping containers. Analysis Request/Chain-of-Custody forms were completed at the time of collection. The samples for chemical and radiochemical analyses were shipped via the SNL/NM Sample Management Office to the contracted analytical laboratory. Sample management activities followed SNL/NM FOP 94-34, "Field Sample Management and Custody" (SNL/NM 1994c).

4.6 Waste Management

All purge and decontamination water was containerized on site pending the results of the analyses. Waste labels were placed on all drums, and the corresponding sample numbers were

marked on the outside of the drum with a permanent marker. The wastes were recorded on a Daily Log of Wastes Generated form and submitted to the SNL/NM Environmental Restoration Project Waste Disposal Coordinator.

5.0 Analytical Methods

Table 3 specifies parameters, appropriate test methods, and target analyte quantitation limits for analytical parameters. A discussion of analytical methods follows.

5.1 Chemical Analytical Methods

All chemical analyses were performed in accordance with the U.S. Environmental Protection Agency (EPA) test methods (EPA 1979, EPA 1986, and EPA 1988). Environmental samples were submitted to GEL and analyzed for VOCs by EPA Test Method 8260B, TAL metals by EPA Test Methods 6020 and 7470A, and total and isotopic uranium by EPA Test Method 6020. General chemistry parameters and methods included nitrate plus nitrite by EPA Method 353.1 and bromide, fluoride, chloride, and sulfate by EPA Method 9056.

5.2 Radiochemical Analytical Methods

Radiochemical parameters and methods included gross alpha and beta radioactivity by EPA Method 900.0, gamma-emitting radionuclides by EPA 901.1, and tritium by EPA 906.0. Radiochemical analytical methods are also summarized in Table 3.

6.0 Summary of Analytical Results

Tables summarizing the groundwater monitoring results are included at the end of this report. Table 4 summarizes the metals analytical results, and Table 5 summarizes the general chemistry analytical results. Table 6 summarizes the organic constituents; Table 7 summarizes the radiochemical analytical results.

The results for chemical and radiological constituents are compared to established EPA Safe Drinking Water Act Regulations Maximum Contaminant Levels (MCL) (EPA 2001), where applicable.

6.1 Metals

Table 4 summarizes the metals parameters from all groundwater samples collected during the annual groundwater sampling at the MWL. Unfiltered samples were analyzed for total TAL metals. Chromium concentrations in the sample and duplicate sample from MWL-MW1 (0.219 and 0.208 milligrams [mg]/liter [L], respectively) and in the sample from MWL-MW3 (0.133 mg/L) exceed the EPA MCL of 0.1 mg/L. The samples were reanalyzed for chromium on June 14, 2006, and the reanalysis results confirmed the original analyses. The analytical results for both the original analyses and the reanalysis are included in Table 4. The chromium concentration in MWL-MW3 represents the first time the MCL has been exceeded in this well. Chromium concentrations exceeding EPA MCL values correlate with nickel results and are attributed to corrosion of Type 304 stainless steel well screens (Oakley and Korte 1996, SNL/NM 2002).

Total uranium results from the April 2006 samples were consistent with data from previous sampling events, and are well within the range of total uranium concentrations established by the U.S. Geological Survey (USGS) for the Middle Rio Grande Basin (USGS 2002).

6.2 General Chemistry Parameters

No general chemistry parameters exceed established MCLs in the groundwater samples. Nitrate plus nitrite (as nitrogen) was detected below the MCL of 10 mg/L at concentrations ranging from 0.877 mg/L at MWL-MW6 to 4.58 mg/L at MWL-BW1. Fluoride was detected below the MCL of 4.0 mg/L at concentrations ranging from 0.766 mg/L at MWL-BW1 to 0.997 mg/L at MWL-MW4. The general chemistry analytical results are presented in Table 5.

6.3 Organic Compounds

Groundwater samples from the MWL monitoring wells showed no detections for VOCs greater than the practical quantitation limits (PQLs) except in one sample. Acetone was detected in the sample from MWL-MW6 (1.89 micrograms [μg]/L) at an estimated concentration less than the PQL but greater than the method detection limit (MDL) due to similar acetone concentrations in one or more QC blank samples. Detections of acetone in MWL-MW1 (but not the field QC duplicate from MWL-MW1), MWL-MW3, MWL-MW4, and MWL-MW5 were qualified as not detected during data validation due to results from the QC samples. Acetone was also detected in the sample from MWL-BW1, but the result was qualified as not detected due to a contamination source introduced at the laboratory from non-SNL samples (see Chapter 8.0). These results are shown in Table 6.

Samples from MWL-MW1 and MWL-MW2 also contained low concentrations of carbon disulfide and toluene. These results were qualified as not detected during data validation because of similar concentrations of the compounds in associated QC samples.

6.4 Radiochemistry

Groundwater samples from the MWL monitoring wells were analyzed for gamma-emitting radionuclides, gross alpha/beta activity, isotopic uranium, and tritium. The results, presented in Table 7 were compared to the established EPA MCLs. No radiological parameters were detected above established MCLs.

Gross alpha and beta activity levels were detected above laboratory reporting limits in all environmental samples. Gross alpha activity levels range from 2.13 ± 0.547 picocuries (pCi)/L in the MWL-BW1 sample to 14.7 ± 2.23 pCi/L in the MWL-MW3 sample. Gross beta activity levels range from 3.11 ± 0.963 pCi/L in the MWL-BW1 sample to 16.1 ± 2.65 pCi/L in the MWL-MW3 sample.

Neither tritium, analyzed by EPA Method 906.0, nor gamma-emitting isotopes, analyzed by EPA Method 901.1, were detected above the minimum detectable activity (MDA) in any of the groundwater samples.

The uranium isotopes uranium-238 and uranium-235 were determined as mass concentrations during metals analysis on the inductively-coupled plasma mass spectrometer using EPA Method 6020. The isotopic mass concentrations, reported in mg/L, were converted to the radioactivity concentrations shown in Tables 7.

7.0 Quality Control Results

QC samples were prepared in the field and in the laboratory in order to assess the quality of the data generated during the annual sampling activities. All data were reviewed in accordance with AOP [Administrative Operating Procedure] 00-03, "Data Validation Procedure for Chemical and Radiochemical Data" (SNL/NM 2003). Results for each QC analysis and the impact on data quality are discussed in the following sections.

7.1 Field Quality Control Samples

The QC samples collected in the field included EB samples, laboratory-prepared TB samples, and field duplicate samples. The following sections discuss each QC sample type.

7.1.1 Equipment Blank Samples

Three EB samples were collected during the annual sampling activities. The first EB sample, MWL-EB1, was collected on April 11, 2006, after sampling at MWL-MW2 on April 10, 2006, and prior to sampling MWL-MW1 on April 12, 2006. The second EB sample, MWL-EB2, was collected on April 12, 2006, after sampling MWL-MW1, and prior to sampling MWL-MW3 on April 13, 2006. The third EB sample, MWL-EB3, was collected after sampling MWL-MW3 on April 13, 2006 and prior to purging and sampling MWL-MW6 on April 14, 2006. The EB samples were analyzed for VOCs, TAL metals, total uranium, and uranium-235 and -238.

The common laboratory contaminant acetone was detected at a concentration greater than the PQL in EB sample MWL-EB2, and at estimated concentrations greater than the MDL and less than the PQL in the MWL-EB1 and MWL-EB3 EB samples. Similar acetone concentrations in associated MWL groundwater samples from MWL-MW1, MWL-MW3, MWL-MW4, and MWL-MW5 were qualified as not detected during data validation based on the EB analytical results.

An estimated concentration, less than relevant PQLs, for carbon disulfide was reported in the MWL-EB3 sample. A concentration of carbon disulfide in a MWL environmental sample was qualified as not detected during data validation due to the presence of the compound in the EB.

In the metals analyses, aluminum, iron, calcium, and copper were detected in MWL-EB1 at concentrations slightly above the relevant PQLs. In MWL-EB2, magnesium, calcium, and zinc were detected above their PQLs. All those elements, plus chromium, lead, nickel, and sodium were also detected in one or more EB samples as estimated concentrations less than the relevant PQLs.

The low levels of VOCs and metals detected in the EB samples indicate the effectiveness of the decontamination procedures. Associated environmental samples with analytical results less than five times the EB concentrations were qualified as not detected or estimated values in accordance with AOP 00-03, "Data Validation Procedure for Chemical and Radiochemical Data" (SNL/NM 2003).

7.1.2 Trip Blank Samples

A laboratory-prepared TB sample was returned to the laboratory with each shipment containing samples for VOC analysis. Eight TB samples that were submitted during annual groundwater sampling were used to assess VOC contamination that might have occurred during sample shipping and storage. Low levels of VOCs were detected in TB samples MWL-TB4 and MWL-TB7 associated with the environmental or EB samples from MWL-MW2 and MWL-MW4, respectively. An estimated concentration of toluene, a common laboratory contaminant, was detected in MWL-TB4 (0.313 μg/L). Acetone was detected in MWL-TB7 at

an estimated concentration of 1.66 μg/L. Similar levels of toluene and acetone in the environmental samples from MWL-MW2 and MWL-MW4, respectively, were qualified as not detected during data validation.

7.1.3 Field Duplicate Samples

Duplicate groundwater samples were collected at MWL-MW1. Relative percent differences (RPD) precision measurements for constituents detected above the PQL in both the environmental and duplicate samples are presented in Table 8. All calculated RPD measurements for chemical analyses are less than 10, indicating acceptable precision.

7.2 Laboratory Quality Control Samples

Internal laboratory QC samples, including method blank samples and duplicate laboratory control samples, were analyzed concurrently with all groundwater samples. Additionally, batch matrix spike and matrix spike duplicate samples were analyzed by GEL. All laboratory data were reviewed and qualified in accordance with AOP 00-03, "Data Validation Procedure for Chemical and Radiochemical Data" (SNL/NM 2003). Data review findings and assigned qualifiers are contained in the data validation memoranda and spreadsheets on file at the SNL/NM Customer Funded Records Center. Data validation qualifiers accompany analytical results in the report tables. While some data qualifiers were assigned based on blank sample results or outlying QC sample results, no data were rejected and all data reported are acceptable for use.

8.0 Variances and Nonconformances

All analytical and field methods met the requirements specified in the MWL Mini-Sampling and Analysis Plan (SNL/NM 2006) and there were no variances from the plan.

During the data validation process there was a nonconformance report issued for the sample from MWL-BW1. The initial concentration of acetone reported did not receive a qualifier in the data

validation process. However, the result was suspect because historically, acetone has not been identified in samples from this well. SNL requested that the laboratory perform a review of the sample results. Based on the review, the laboratory recommended that the low-level detects for acetone be qualified as not detect at 11.3 μg/L. The justification for this determination was identified by the laboratory as contaminated samples from non-SNL samples that contained high levels of acetone that were analyzed on the same day. This affected numerous sample results for that day that the analysis was performed. MWL-BW1 was the only MWL sample affected.

9.0 Summary and Conclusions

Annual groundwater sampling was conducted at the MWL in April 2006. Chromium in the samples from MWL-MW1 and MWL-MW3 exceed the EPA MCL. The chromium concentration in MWL-MW3 represents the first time the MCL has been exceeded in this well. Sample reanalysis of chromium confirmed the original results. No other inorganic or organic parameters were detected above the corresponding MCLs in any samples.

Groundwater samples collected in April 2006 from the MWL monitoring wells showed no organic compounds detected greater than the PQL after data validation and assignment of qualifiers. Estimated concentrations for acetone, less than the PQL but greater than the MDL, are likely inadvertent laboratory-introduced contamination.

Metals analytical results greater than the established MCL were reported for chromium in groundwater samples from MWL-MW1 and MWL-MW3 in April 2006. The chromium concentrations are attributed to corrosion of the stainless steel screens in the monitoring wells (Oakley and Korte 1996, SNL/NM 2002). Total uranium results from the April 2006 samples were consistent with data from previous sampling events, and are well within the range of total uranium concentrations established by the USGS for the Middle Rio Grande Basin (USGS 2002).

No general chemistry parameters exceed established MCLs in any of the groundwater samples. Radioactivity and radionuclides were not detected at levels greater than the corresponding MCL.

10.0 References

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U.S. Geological Survey (USGS), 2002. "Preliminary Summary Statistics—All Ground-Water Sites, Middle Rio Grande Basin," prepared by Laura Bexfield, Water Resources Division, U.S. Geological Survey, Albuquerque, New Mexico.

USGS, see U.S. Geological Survey.

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FIGURES

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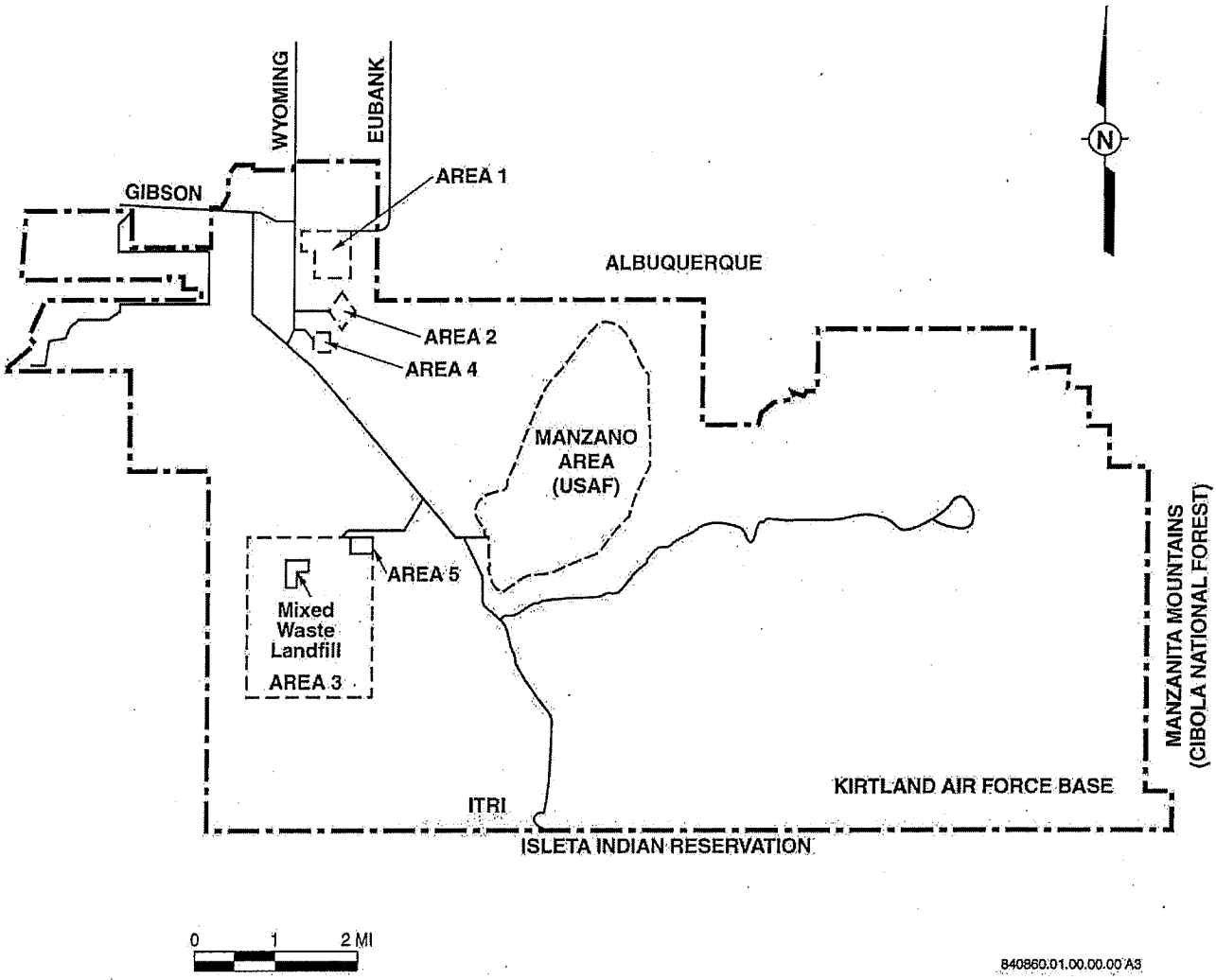

Figure 1 Location of the Mixed Waste Landfill

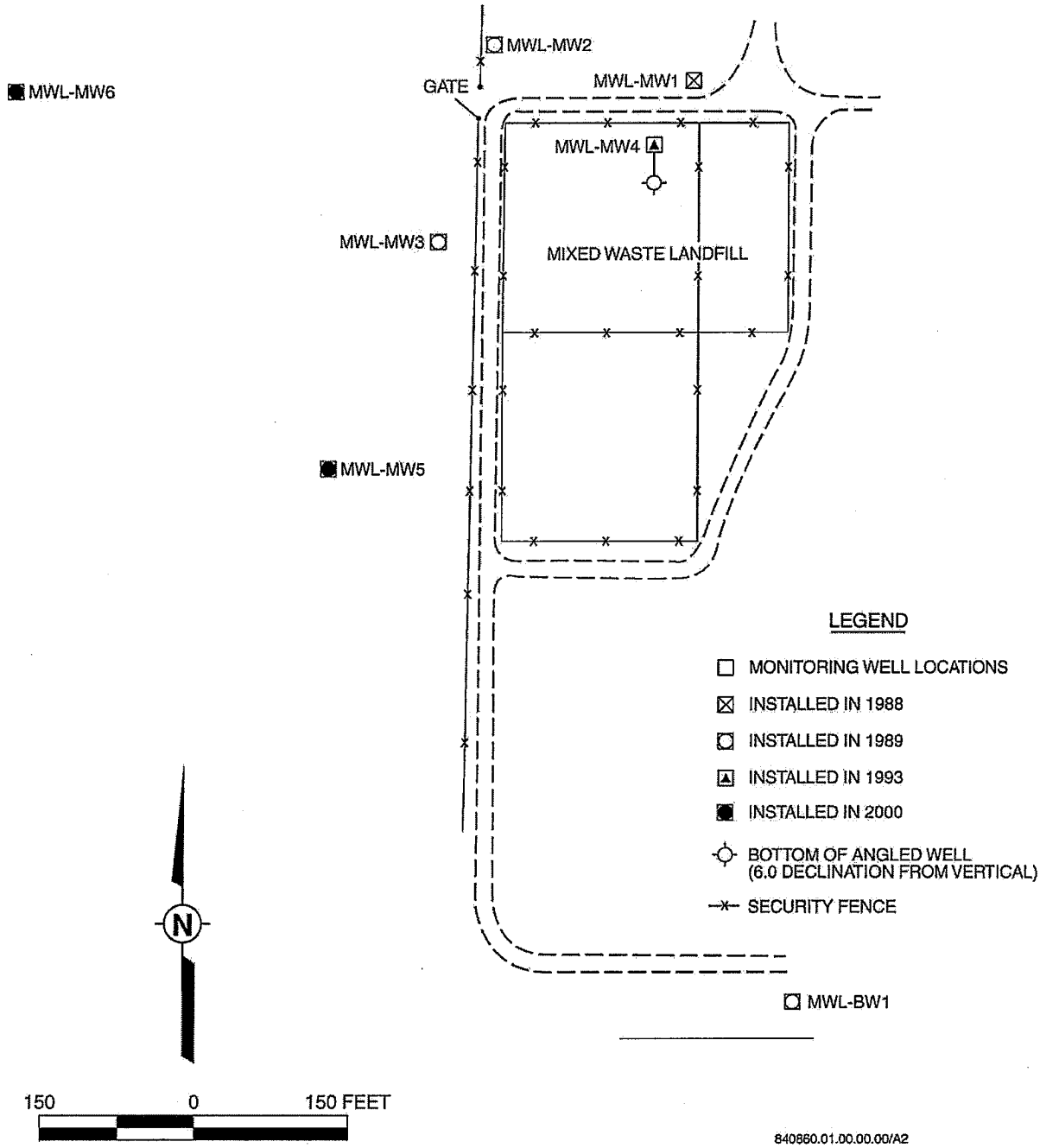

Figure 2 Mixed Waste Landfill Monitoring Well Locations

TABLES

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Table 1

Groundwater Elevations, Pump Setting Depths, and Monitoring Well Completion Information Mixed Waste Landfill, Sandia National Laboratories/New Mexico Annual Groundwater Monitoring, April 2006

Well Number	Date of Measurement	Measurement Point Elevation (FAMSL[a])	Depth to Water (FBTOC)	Groundwater Elevation (FAMSL[a])	Total Well Depth[b] (FBTOC)	Static Water Height (feet)	Pump Setting Depth (FBTOC)
MWL-MW1	04-05-06	5381.54	467.62	4913.92	478	10	478
MWL-MW2	04-03-06	5377.26	464.05	4913.21	477	12	471
MWL-MW3	04-07-06	5381.32	469.28	4912.04	479	9	474
MWL-MW4	04-05-06	5383.46	497.90	4888.29[c]	548	11[d]	509
MWL-MW5	04-14-06	5379.89	492.04	4887.85	521.5	29	509
MWL-MW6	04-17-06	5372.64	486.00	4886.64	530.5	44	518
MWL-BW1	04-04-06	5384.51	472.31	4912.20	477	4	474

[a]Measurement point is the top of well casing.
[b]Total well depth to bottom of sump.
[c]Elevation shown reflects well MWL-MW4 orientation of 6 degrees from vertical.
[d]Depth to the top of the packer is 509.67 FBTOC.
FAMSL = Feet above mean sea level.
FBTOC = Feet below top of casing.

Table 2

Summary of Purge Volumes and Purge Indicator Measurements
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

Sample Attributes	Measurement Relative to Sampling	Purge Volume (gallons)	pH (at 25°C)	Temp (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTU)	E_h (mV)	DO (% Sat)
MWL-MW1[a]	Before sampling:	30	7.53	14.38	585	13.7	93.3	73.8
Date purge began:		32	7.61	17.44	590	16.3	84.0	68.5
04-05-06		34	7.64	18.66	590	14.0	75.7	69.6
Date sampled:	After sampling:	NM	NM	NM	NM	NM	NM	NM
04-12-06								
MWL-MW2[a]	Before sampling:	12	7.85	17.63	588	2.62	90.5	13.7
Date purge began:		16	7.33	20.05	558	2.82	90.8	56.5
04-03-06		20	7.78	20.43	592	3.25	68.3	29.8
Date sampled:	After sampling:	NM	NM	NM	NM	NM	NM	NM
04-10-06								
MWL-MW3[a]	Before sampling:	6	7.86	16.55	495	41.4	133.2	61.6
Date purge began:		8	7.90	16.96	496	62.6	137.8	59.5
04-07-06		13	7.56	16.91	485	76.2	83.6	91.3
Date sampled:	After sampling:	NM	NM	NM	NM	NM	NM	NM
04-13-06								
MWL-MW4[a]	Before sampling:	41	7.40	18.58	624	1.97	431.8	58.1
Date purge began:		46	7.37	19.47	626	0.41	295.6	7.7
04-05-06		51	7.39	19.51	626	0.69	290.5	13.2
Date sampled:	After sampling:	NM	NM	NM	NM	NM	NM	NM
04-06-06								
MWL-MW5	Before sampling:	65	7.15	20.70	912	1.88	32.3	32.0
Date purged:		70	7.14	20.72	914	1.58	32.1	32.2
04-14-06		72	7.14	20.78	914	1.32	32.2	32.3
Date sampled:	After sampling:	NM	NM	NM	NM	NM	NM	NM
04-14-06								

Refer to footnotes at end of table.

Table 2 *(Continued)*

Summary of Purge Volumes and Purge Indicator Measurements
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

Sample Attributes	Measurement Relative to Sampling	Purge Volume (gallons)	pH (at 25°C)	Temp (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTU)	E_h (mV)	DO (% Sat)
MWL-MW6	Before sampling:	65	7.26	21.26	847	0.36	-13.8	32.6
Date purged:		70	7.25	21.28	849	0.34	-13.7	32.1
04-17-06		72	7.25	21.30	849	0.39	-13.9	32.3
Date sampled: 04-17-06	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL-BW1[a]	Before sampling:	NM	NM	NM	NM	NM	NM	NM
Date purge began:		6	7.57	15.27	469	2.35	125.3	89.4
04-04-06		8	7.24	14.28	490	3.94	42.8	84.3
Date sampled: 04-18-06	After sampling:	NM	NM	NM	NM	NM	NM	NM

[a]Wells were purged to dryness. Purge volumes show total gallons removed prior to sampling.

°C = Degrees Celsius.
DO = Dissolved oxygen.
E_h = Oxidation/reduction potential.
µmhos/cm = Micro-mhos per centimeter.
mV = Millivolts.
NM = Not measured.
NTU = Nephelometric turbidity units.
% Sat = Percent saturation.
pH = Potential of hydrogen.
Temp = Temperature.

Table 3

Analytical Parameters, Test Methods, and Target Quantitation Limits
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

Analytical Parameter	Test Method[a]	Target Quantitation Limit[b]
Total metals TAL, major cations, and uranium	EPA 6020 EPA 7470A	0.0002–0.250 mg/L
Volatile organic compounds	EPA 8260B	1–5 µg/L
Nitrate plus nitrite (as nitrogen)	EPA 353.1	0.250 mg/L
Major anions Bromide, fluoride, chloride, and sulfate	EPA 9056	0.100–0.800 mg/L
Radionuclides		
Gamma-emitting radionuclides	EPA 901.1	MDA is isotope-specific
Gross alpha	EPA 900.0	2.5 pCi/L
Gross beta	EPA 900.0	3.5 pCi/L
Tritium	EPA 906.0	200 pCi/L
Uranium-238 / 235	EPA 6020	0.0168/0.0216 pCi/L[c]

[a]Analytical methods used are referenced to either U.S. Environmental Protection Agency, 1979, "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020, U.S. Environmental Protection Agency, Cincinnati, Ohio, or U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd ed., Rev. 1, U.S. Environmental Protection Agency, Washington, D.C. Radiochemistry method for isotopic plutonium is referenced to the U.S. Department of Homeland Security, 1997, "Procedures Manual of the Environmental Measurements Laboratory," *HASL-300*, Volume 1, 28th Ed., U.S. Department of Homeland Security, New York.

[b]For target compounds only. Reporting limits may be elevated if an interfering component is present or if sample dilution is required.

[c]Target quantitation limits for uranium-238 and uranium-235 are calculated from mass concentration quantitation limits reported for EPA Method 6020.

EPA = U.S. Environmental Protection Agency.
MDA = Minimum detectable activity.
µg/L = Microgram(s) per liter.
mg/L = Milligram(s) per liter.
pCi/L = Picocurie(s) per liter.
TAL = Target Analyte List.

Table 4

Metals Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

			Sample No.:	076304	076305	076307	076311
			Well ID:	MWL-MW1	MWL-MW1	MWL-MW2	MWL-MW3
			Sampling Date:	04-12-06	04-12-06	04-10-06	04-13-06
			Sample Type:	Environmental	Duplicate	Environmental	Environmental
Parameter	Analytical Method[a]	Practical Quantitation Limit (mg/L)	MCL (mg/L)	All Results in mg/L			
Aluminum	6020	0.015	NE	0.0244 J, B, B2	0.0302 B	0.048	3.63 J, A2
Antimony	6020	0.002	0.006	0.000535 J, B, B3	ND (0.0005 B)	ND (0.0005)	ND (0.0005)
Arsenic	6020	0.005	0.010	ND (0.0015)	ND (0.0015)	0.00203 J	0.00244 J, B
Barium	6020	0.002	2.0	0.0636	0.0655	0.0992	0.110
Beryllium	6020	0.0005	0.004	ND (0.0001)	ND (0.0001)	ND (0.0001)	0.000208 J
Cadmium	6020	0.001	0.005	ND (0.0001)	ND (0.0001)	ND (0.0001)	0.000569 J
Calcium	6020	0.100	NE	47.5 B	48.3 B	50.1 B	50.5 B
Chromium	6020	0.003	0.1	**0.219**	**0.208**	0.00271 J, B	**0.133 B, J, P1**
Chromium[b]	6020	0.003	0.1	**0.232 J[b]**	**0.197 J[b]**	NA	**0.169 J[b]**
Cobalt	6020	0.001	NE	0.00177	0.00178	0.000535 J	0.00331
Copper	6020	0.001	1.3[c]	0.00703 J, B	0.00677 J, B	0.0015	0.0136
Iron	6020	0.025	NE	1.67 B	1.64 B	0.377 J, B	4.22
Lead	6020	0.002	0.015[c]	ND (0.0005)	ND (0.0005)	0.00088 J	0.00558 J, P1
Magnesium	6020	0.015	NE	17.2	17.4	18.1	14.5 J
Manganese	6020	0.005	NE	0.0236	0.0232	0.00551	0.0771
Mercury	7470A	0.0002	0.002	ND (0.00005)	0.00081	ND (0.00005 UJ, B3)	ND (0.00005)
Nickel	6020	0.002	NE	0.467	0.477	0.00676	0.157
Potassium	6020	0.300	NE	3.13	3.37	4.52	4.36
Selenium	6020	0.005	0.05	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)
Silver	6020	0.001	NE	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)
Sodium	6020	0.250	NE	44.3	47.7	44.6	43.6

Refer to footnotes at end of table.

Table 4 *(Continued)*

Metals Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

			Sample No.:	076304	076305	076307	076311
			Well ID:	MWL-MW1	MWL-MW1	MWL-MW2	MWL-MW3
			Sampling Date:	04-12-06	04-12-06	04-10-06	04-13-06
			Sample Type:	Environmental	Duplicate	Environmental	Environmental
Parameter	Analytical Method[a]	Practical Quantitation Limit (mg/L)	MCL (mg/L)	All Results in mg/L			
Thallium	6020	0.001	0.002	0.000518 J	ND (0.0004)	0.00058 J	ND (0.0004)
Uranium, Total	6020	0.0002	0.030	0.00531	0.00537	0.00623	0.005
Vanadium	6020	0.030	NE	ND (0.002)	ND (0.002)	0.00721 J	ND (0.010 UJ, A2)
Zinc	6020	0.010	NE	0.0111 J, B, B2	0.0105 J, B, B2	0.0286 B	0.126 B

Refer to footnotes at end of table.

Table 4 *(Continued)*

Metals Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

			Sample No.:	076313	076317	076319	076300
			Well ID:	MWL-MW4	MWL-MW5	MWL-MW6	MWL-BW1
			Sampling Date:	04-06-06	04-14-06	04-17-06	04-18-06
			Sample Type:	Environmental	Environmental	Environmental	Environmental
Parameter	Analytical Method[a]	Practical Quantitation Limit (mg/L)	MCL (mg/L)	All Results in mg/L			
Aluminum	6020	0.015	NE	0.045 J, B, P1	0.0244	ND (0.005)	0.091
Antimony	6020	0.002	0.006	ND (0.0005)	ND (0.0005 B)	ND (0.0005 B)	0.000582 J, B3
Arsenic	6020	0.005	0.010	0.00813 J, B	ND (0.0015)	ND (0.0015)	0.00189 J
Barium	6020	0.002	2.0	0.0925	0.126	0.109	0.0625
Beryllium	6020	0.0005	0.004	ND (0.0001)	ND (0.0001)	ND (0.0001)	ND (0.0001)
Cadmium	6020	0.001	0.005	ND (0.0001)	ND (0.0001)	ND (0.0001)	0.000193 J
Calcium	6020	0.100	NE	58.8	95.2 B	89.6 B	26.5 B
Chromium	6020	0.003	0.1	0.00265 J, B	0.00109 J, B2	0.00123 J	0.0234
Cobalt	6020	0.001	NE	0.00028 J	0.000266 J, B2	0.000225 J	0.000349 J
Copper	6020	0.001	1.3[c]	0.00116 J, B	0.000909 J	0.000939 J	0.00415
Iron	6020	0.025	NE	0.441	0.411	0.316	0.361 B
Lead	6020	0.002	0.015[c]	0.00145 J	ND (0.005)	ND (0.0005)	0.00167 J
Magnesium	6020	0.015	NE	18.7	31.6	28.7	19.0
Manganese	6020	0.005	NE	0.00844	0.0132	ND (0.001)	0.0054
Mercury	7470A	0.0002	0.002	ND (0.00005 UJ, B3)	ND (0.00005 UJ, B3)	ND (0.00005 UJ, B3)	ND (0.00005 UJ, B3)
Nickel	6020	0.002	NE	0.00297	0.00197 J	0.00162 J	0.068
Potassium	6020	0.300	NE	4.77	5.71	5.61	4.12
Selenium	6020	0.005	0.05	ND (0.0025)	ND (0.0025)	ND (0.0025)	ND (0.0025)
Silver	6020	0.001	NE	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)
Sodium	6020	0.250	NE	39.5	71.8	65.9	49.3
Thallium	6020	0.001	0.002	ND (0.0004)	ND (0.0004)	ND (0.0004)	0.00059 J
Uranium, Total	6020	0.0002	0.030	0.00595	0.0099	0.0101	0.00554
Vanadium	6020	0.030	NE	0.0189 J, B	0.00659 J	0.0073 J	0.00434 J
Zinc	6020	0.010	NE	0.0197	0.0077 J, B, B2	0.00267 J, B	0.0455 B

Refer to footnotes at end of table.

Table 4 *(Continued)*

Metals Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

Note: Values in **bold** exceed EPA MCL.

[a]Analytical methods from U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd ed., Rev. 1, U.S. Environmental Protection Agency, Washington, D.C.

[b]Selected samples reanalyzed for chromium on June 14, 2006.

[c]Values shown are EPA Action Levels.

A2 = Matrix spike percent recovery exceeded acceptance criteria.
B = Analyte detected in the associated laboratory method blank.
B2 = Analyte detected in associated equipment blank sample.
B3 = Analyte detected in associated initial calibration blank or continuing calibration blank.
CFR = Code of Federal Regulations.
EPA = U.S. U.S. Environmental Protection Agency.
ID = Identification.
J = Analyte detected below practical quantitation limit or reported as an estimated concentration.
MCL = Maximum Contaminant Level, U.S. EPA Primary Drinking Water Standards, 40 CFR Part 141, Subpart B and as revised in Subpart G.
mg/L = Milligram(s) per liter.
NA = Not analyzed.
ND = The analyte was not detected above the method detection limit indicated in parentheses.
NE = Not established.
P1 = Replicate sample precision exceeds 20 relative percent difference.
UJ = The material was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

Table 5

General Chemistry Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

			Sample No.:	076304	076305	076307	076311
			Well ID:	MWL-MW1	MWL-MW1	MWL-MW2	MWL-MW3
			Sampling Date:	04-12-06	04-12-06	04-10-06	04-13-06
			Sample Type	Environmental	Duplicate	Environmental	Environmental
Parameter	Analytical Method[a]	Practical Quantitation Limit[b] (mg/L)	MCL (mg/L)	All Results in mg/L			
Bromide	9056	0.200	NE	0.243	0.230	0.249	0.263
Chloride	9056	0.400	NE	32.1	32.3	39.5	31.0
Fluoride	9056	0.100	4.0	0.927	0.903	0.838 B	0.951
Sulfate	9056	0.800	NE	44.2	43.6	38.6 B	39.2
Nitrate plus Nitrite, as N	353.1	0.200	10	4.49	4.47	3.23	3.79
Alkalinity, field measurement[c]	HACH	1	NE	192	NA	196	175
			Sample No.:	076313	076317	076319	076300
			Well ID:	MWL-MW4	MWL-MW5	MWL-MW6	MWL-BW1
			Sampling Date:	04-06-06	04-14-06	04-17-06	04-18-06
			Sample Type	Environmental	Environmental	Environmental	Environmental
Bromide	9056	0.200	NE	0.287	0.486	0.430	0.234
Chloride	9056	0.400	NE	49.1	85.1	74.4	26.8
Fluoride	9056	0.100	4.0	0.997 B	0.786	0.793	0.766
Sulfate	9056	0.800	NE	35.5 B	54.7	50.5	42.2
Nitrate plus Nitrite, as N	353.1	0.200	10	1.91 B	0.911	0.877	4.58
Alkalinity, field measurement[c]	HACH	1	NE	186	298	286	193

[a]Analytical methods used are referenced to either U.S. Environmental Protection Agency, 1979, "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020, U.S. Environmental Protection Agency, Cincinnati, Ohio or U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd ed., Rev. 1, U.S. Environmental Protection Agency, Washington, D.C.

[b]Reporting limits may be elevated in the event an interfering component is present or if sample dilution is required.

[c]Alkalinity titration performed in the field using HACH field titrator. Alkalinity results units are mg/L as calcium carbonate.

Table 5 *(Continued)*

General Chemistry Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

B = Analyte detected in the associated laboratory method blank.
CFR = Code of Federal Regulations.
EPA = U.S. U.S. Environmental Protection Agency.
ID = Identification.
MCL = Maximum Contaminant Level, U.S. EPA Primary Drinking Water Standards, 40 CFR Part 141, Subpart B and as revised in Subpart G.
mg/L = Milligram(s) per liter.
N = Nitrogen.
NA = Not analyzed.
NE = Not established.

Table 6

Volatile Organic Compounds
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

	Analyte	Acetone	Carbon Disulfide	Toluene
Practical Quantitation Limit (µg/L)		5.00	5.00	1.00
	MCL (µg/L)	NE	NE	1000
Sample Location	Sample Date	Results in µg/L	Results in µg/L	Results in µg/L
MWL-MW1	04-12-06	5.00 U, B2	5.00 U, B2	ND (0.250)
MWL-MW1 (Duplicate)	04-12-06	ND (1.25)	ND (1.25)	ND (0.250)
MWL-MW2	04-10-06	ND (1.25)	ND (1.25)	1.00 U, B1
MWL-MW3	04-13-06	6.53 U, B2	ND (1.25)	ND (0.250)
MWL-MW4	04-06-06	5.00 U, B1	ND (1.25)	ND (0.250)
MWL-MW5	04-14-06	5.00 U, B2	ND (1.25)	ND (0.250)
MWL-MW6	04-17-06	1.89 J	ND (1.25)	ND (0.250)
MWL-BW1	04-18-06	11.3 U	ND (1.25)	ND (0.250)

B1 = Compound also detected in the trip blank.
B2 = Compound also detected in the associated equipment rinse blank sample.
CFR = Code of Federal Regulations.
J = Analyte detected below practical quantitation limit or reported as an estimated concentration.
MCL = Maximum Contaminant Level, U.S. Environmental Protection Agency Drinking Water Standards, 40 CFR 141, Subparts B and as revised in Subpart G.
µg/L = Microgram(s) per liter.
ND = Not detected above the method detection limit shown in parentheses.
NE = Not established.
U = The analyte was analyzed for was not detected.

Table 7

Radiochemical Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

	Sample No.: Well ID: Sampling Date:	076304 MWL-MW1 04-12-06	
All results in pCi/L			
Analyte	MCL[a]	Results[b] ± TPU	MDA[c]
Gross Alpha	15[d]	8.38 ± 1.40	0.982
Gross Beta	4 (mrem/year dose)	6.07 ± 2.02	3.30
Tritium	NE	-77.6 ± 128 U	230
Uranium-235	NE	0.080[e]	0.022[e]
Uranium-238	NE	1.771[e]	0.017[e]
	Sample No.: Well ID: Sampling Date:	076305 MWL-MW1 (Duplicate) 04-12-06	
Gross Alpha	15[d]	7.91 ± 1.52	1.11
Gross Beta	4 (mrem/year dose)	6.09 ± 1.60	2.40
Tritium	NE	39.2 ± 135 U	232
Uranium-235	NE	0.078[e]	0.022[e]
Uranium-238	NE	1.791[e]	0.017[e]
	Sample No.: Well ID: Sampling Date:	076307 MWL-MW2 04-10-06	
Gross Alpha	15[d]	11.5 ± 1.78	1.52
Gross Beta	4 (mrem/year dose)	10.8 ± 2.11	3.07
Tritium	NE	-35.5 ± 107 U	190
Uranium-235	NE	0.099[e]	0.022[e]
Uranium-238	NE	2.080[e]	0.017[e]
	Sample No.: Well ID: Sampling Date:	076311 MWL-MW3 04-13-06	
Gross Alpha	15[d]	14.7 ± 2.23	1.75
Gross Beta	4 (mrem/year dose)	16.1 ± 2.65	3.52
Tritium	NE	144 ± 115 U	189
Uranium-235	NE	0.076[e]	0.022[e]
Uranium-238	NE	1.667[e]	0.017[e]

Refer to footnotes at end of table.

Table 7 *(Continued)*

Radiochemical Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

	Sample No.:	076313	
	Well ID:	MWL-MW4	
	Sampling Date:	04-06-06	
All results in pCi/L			
Analyte	MCL[a]	Results[b] ± TPU	MDA[c]
Gross Alpha	15[d]	7.75 ± 2.03	2.60
Gross Beta	4 (mrem/year dose)	9.47 ± 2.15	3.30
Tritium	NE	38.9 ± 130 U	224
Uranium-235	NE	0.089[e]	0.022[e]
Uranium-238	NE	1.986[e]	0.017[e]
	Sample No.:	076317	
	Well ID:	MWL-MW5	
	Sampling Date:	04-14-06	
Gross Alpha	15[d]	8.59 ± 4.29	6.17
Gross Beta	4 (mrem/year dose)	10.3 ± 3.42 J, P1	5.94
Tritium	NE	-63.9 ± 106 U	191
Uranium-235	NE	0.138[e]	0.022[e]
Uranium-238	NE	3.303[e]	0.017[e]
	Sample No.:	076319	
	Well ID:	MWL-MW6	
	Sampling Date:	04-17-06	
Gross Alpha	15[d]	10.3 ± 1.65	0.807
Gross Beta	4 (mrem/year dose)	12.8 ± 3.45 J, P1	5.50
Tritium	NE	78.9 ± 113 U	190
Uranium-235	NE	0.143[e]	0.022[e]
Uranium-238	NE	3.394[e]	0.017[e]

Refer to footnotes at end of table.

Table 7 *(Continued)*

Radiochemical Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

	Sample No.:	076300	
	Well ID:	MWL-BW1	
	Sampling Date:	04-18-06	
All results in pCi/L			
Analyte	MCL[a]	Results[b] ± TPU	MDA[c]
Gross Alpha	15[d]	2.13 ± 0.547	0.694
Gross Beta	4 (mrem/year dose)	3.11 ± 0.963	1.63
Tritium	NE	7.40 ± 106 U	184
Uranium-235	NE	0.084[e]	0.022[e]
Uranium-238	NE	1.848[e]	0.017[e]

Note: Values in **bold** exceed EPA MCL.

[a]U.S. Environmental Protection Agency Primary Drinking Water Standards, 40 CFR Part 141, Subpart B and as revised in Subpart G.

[b]Laboratory results have a TPU; if the TPU value equals or exceeds the count value, the isotope is considered not to be present.

[c]MDA in pCi/L.

[d]Excluding uranium and radon, but including radium-226.

[e]Sample analysis results and MDA values for uranium isotopes are calculated from concentrations determined by inductively-coupled plasma mass spectrometry, EPA Method 6020. TPU was not reported.

CFR = Code of Federal Regulations.
EPA = U.S. Environmental Protection Agency.
ID = Identification.
J = Estimated activity, quality control exceedence noted in data validation.
MCL = Maximum contaminant level.
MDA = Minimum detectable activity.
mrem = Millirem.
NE = Not established.
P1 = Replicate error ratio exceeds precision criteria.
pCi/L = Picocurie(s) per liter.
TPU = Total propagated uncertainty.
U = Laboratory qualifier indicating result is less than the MDA.

Table 8

Duplicate Sample Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

Sample No. Sample Location	076304 MWL-MW1	076305 MWL-MW1 (Duplicate)	
	Results (R_1)	Results (R_2)	
Parameter[a]	All results in mg/L, except as noted		RPD
Aluminum	0.0244 J, B, B2	0.0302 B	NC
Barium	0.0636	0.0655	3
Bromide	0.243	0.230	5
Calcium	47.5 B	48.3 B	2
Chloride	32.1	32.3	1
Chromium	0.219	0.208	5
Chromium[b]	0.232 J	0.197 J	NC
Cobalt	0.00177	0.00178	1
Copper	0.00703 J, B	0.00677 J, B	NC
Fluoride	0.927	0.903	3
Gross Alpha	8.38 pCi/L	7.91 pCi/L	6
Gross Beta	6.07 pCi/L	6.09 pCi/L	<1
Iron	1.67 B	1.64 B	2
Magnesium	17.2	17.4	1
Manganese	0.0236	0.0232	2
Nickel	0.467	0.477	2
Nitrate plus Nitrite, as N	4.49	4.47	<1
Potassium	3.13	3.37	7
Sodium	44.3	47.7	7
Sulfate	44.2	43.6	1
Uranium, Total	0.00531	0.00537	1
Uranium-238	0.00527	0.00533	1
Uranium-235	0.000037 J	0.000036 J	NC
Zinc	0.0111 J, B, B2	0.0105 J, B, B2	NC

[a]Parameters not detected in both samples are not listed. RPD is not calculated for estimated values.

[b]Reanalysis for chromium on June 14, 2006.

B = Analyte detected in associated laboratory method blank.
B2 = Analyte detected in associated equipment blank sample.
J = Analyte detected below practical quantitation limit or reported as an estimated concentration.
mg/L = Milligram(s) per liter.
N = Nitrogen.
NC = Not calculated.
pCi/L = Picocurie(s) per liter.

Table 8 *(continued)*

Duplicate Sample Analytical Results
Mixed Waste Landfill, Sandia National Laboratories/New Mexico
Annual Groundwater Monitoring, April 2006

$$RPD = \frac{|R_1 - R_2|}{[(R_1 + R_2)/2]} \times 100$$

RPD = Relative percent difference is calculated with the following equation and rounded to nearest whole number:

where:

R_1 = analysis result

R_2 = duplicate analysis result