

# **SAND REPORT**

SAND2006-0391

Unlimited Release

Printed January 2006

## **Mixed Waste Landfill Annual Groundwater Monitoring Report April 2005**

Mark L. Lyon and Timothy J. Goering

Prepared by  
Sandia National Laboratories  
Albuquerque, New Mexico 87185 and Livermore, California 94550

Sandia is a multiprogram laboratory operated by Sandia Corporation,  
a Lockheed Martin Company, for the U.S. Department of  
Energy under Contract DE-AC04-94AL85000.

Approved for public release; further dissemination unlimited.



Issued by Sandia National Laboratories, operated for the U.S. Department of Energy by Sandia Corporation.

**NOTICE:** This report was prepared as an account of work sponsored by an agency of the U.S. Government. Neither the U.S. Government, nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government, any agency thereof, or any of their contractors or subcontractors. The views and opinions expressed herein do not necessarily state or reflect those of the U.S. Government, any agency thereof, or any of their contractors.

Printed in the United States of America. This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from  
U.S. Department of Energy  
Office of Scientific and Technical Information  
P.O. Box 62  
Oak Ridge, TN 37831

Telephone: (865)576-8401  
Facsimile: (865)576-5728  
E-Mail: reports@adonis.osti.gov  
Online ordering: <http://www.osti.gov/bridge>

Available to the public from  
U.S. Department of Commerce  
National Technical Information Service  
5285 Port Royal Rd  
Springfield, VA 22161

Telephone: (800)553-6847  
Facsimile: (703)605-6900  
E-Mail: orders@ntis.fedworld.gov  
Online order: <http://www.ntis.gov/help/ordermethods.asp?loc=7-4-0#online>



SAND2006-0391  
Unlimited Release  
Printed January 2006

**Mixed Waste Landfill  
Annual Groundwater Monitoring Report  
April 2005  
Sandia National Laboratories,  
Albuquerque, New Mexico**

Mark L. Lyon  
Shaw Environmental, Inc.  
5301 Central Ave. NE, Suite 700  
Albuquerque, New Mexico 87108

Timothy J. Goering  
GRAM, Inc.  
8500 Menaul Blvd., Suite B-370  
Albuquerque, New Mexico 87112

Sandia Contract Nos. 70813 and 190138

**Abstract**

Annual groundwater sampling was conducted at the Sandia National Laboratories' Mixed Waste Landfill (MWL) in April 2005. Seven monitoring wells were sampled using a Bennett™ pump in accordance with the April 2005 Mini-Sampling and Analysis Plan for the MWL (SNL/NM 2005). 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. Sample splits were also collected from several of the wells by the New Mexico Environment Department U.S. Department of Energy Oversight Bureau; however, the split sample results are not included in this report.

The results of the April 2005 annual groundwater monitoring conducted at the MWL showed constituent concentrations within the historical ranges for the site and indicated no evidence of groundwater contamination from the landfill.

## **Acknowledgments**

The authors would like to thank Dick Fate, Fran Nimick, MJ Davis, Amy Blumberg, and John Gould for their review of this report. We also thank Tim Jackson for all the work he does behind the scenes for Sandia's Environmental Restoration (ER) groundwater monitoring program, and the ER groundwater sampling team for their diligent efforts in the field, collecting the samples. Finally, we wish to acknowledge Jerry Peace for his management and oversight of the Mixed Waste Landfill project. 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.

## Contents

1.	Introduction.....	13
2.	Field Methods and Measurements .....	15
2.1	Groundwater Elevation .....	15
2.2	Well Purging and Water Quality Measurements .....	15
2.3	Pump Decontamination.....	15
2.4	Sample Collection.....	16
2.5	Sample Handling and Shipment.....	16
2.6	Waste Management.....	16
3.	Analytical Methods.....	17
3.1	Chemical Analytical Methods.....	17
3.2	Radiochemical Analytical Methods.....	17
4.	Summary of Analytical Results .....	18
4.1	Metals.....	18
4.2	General Chemistry Parameters .....	18
4.3	Organic Compounds .....	19
4.4	Radiochemistry .....	19
4.5	Perchlorate .....	20
5.	QC Results .....	21
5.1	Field QC Samples .....	21
5.1.1	Blind-Spike Samples.....	21
5.1.2	Equipment Blank Samples.....	21
5.1.3	Trip Blank Samples.....	22
5.1.4	Field Duplicate Samples .....	22
5.2	Laboratory QC Samples.....	22
6.	Quarterly Sampling for Perchlorate .....	23
7.	Variances and Nonconformances .....	24
8.	Summary and Conclusions .....	25
9.	References.....	26

**This page left intentionally blank.**

## Figures

- 1 Location of the Mixed Waste Landfill
- 2 Mixed Waste Landfill Monitoring Well Locations

**This page left intentionally blank.**

## Tables

- 1 Groundwater Elevations, Pump Setting Depths, and Monitoring Well Completion Information, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Annual Groundwater Monitoring, April 2005
- 2 Summary of Purge Volumes and Purge Indicator Measurements, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Annual Groundwater Monitoring, April 2005
- 3 Analytical Parameters, Test Methods, and Target Quantitation Limits, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Annual Groundwater Monitoring, April 2005
- 4 Metals Analysis Results, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Annual Groundwater Monitoring, April 2005
- 5 General Chemistry Analysis Results, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Annual Groundwater Monitoring, April 2005
- 6 Detected Volatile and Extractable Organic Compounds, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Annual Groundwater Monitoring, April 2005
- 7 Radiochemical Analysis Results, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Annual Groundwater Monitoring, April 2005
- 8 Duplicate Sample Analysis Results, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Annual Groundwater Monitoring, April 2005
- 9 Groundwater Elevations, Pump Setting Depths, and Monitoring Well Completion Information, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Quarterly Groundwater Sampling for Perchlorate Analysis, April 2004 to February 2005
- 10 Summary of Purge Volumes and Purge Indicator Measurements, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Quarterly Groundwater Sampling for Perchlorate Analysis, April 2004 to February 2005
- 11 Perchlorate Analysis Results, EPA Method 314.0, Mixed Waste Landfill, Sandia National Laboratories/New Mexico, Quarterly Groundwater Sampling, April 2004 to April 2005

**This page left intentionally blank.**

## Acronyms and Abbreviations

DOE	U.S. Department of Energy
$E_h$	oxidation/reduction potential
EPA	U.S. Environmental Protection Agency
FOP	Field Operating Procedure
GEL	General Engineering Laboratories, Inc.
HWB	Hazardous Waste Bureau
L	liter(s)
MCL	Maximum Contaminant Level
MDL	method detection limit
$\mu\text{g}$	microgram(s)
$\mu\text{m}$	micron(s)
mg	milligram(s)
MWL	Mixed Waste Landfill
NMED	New Mexico Environment Department
pCi	picocurie(s)
PQL	practical quantitation limit
QC	quality control
RPD	relative percent difference
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
TAL	target analyte list
VOC	volatile organic compound

**This page left intentionally blank.**

# 1. Introduction

Annual groundwater sampling was conducted at the Mixed Waste Landfill (MWL) located in Technical Area 3 at Sandia National Laboratories/New Mexico (SNL/NM). Sampling was conducted by SNL/NM Department 6147 from April 4 through April 19, 2005. 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. Figure 1 shows the location of the MWL, and Figure 2 shows the locations of monitoring wells at the MWL.

Additionally, quarterly groundwater sampling activities and results for perchlorate analysis are reported here for MWL-BW1 and MWL-MW1. These wells were sampled in April, August, and November 2004, and again in February 2005, for perchlorate analysis.

Monitoring well MWL-MW4 is screened at two discrete intervals 20 feet apart, and an inflatable packer separates the screened intervals. During the 2005 sampling event, only the upper interval of MWL-MW4 was sampled, using a dedicated pump, 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 2005 Mini-Sampling and Analysis Plan (SNL/NM 2005). Sample splits were collected by the New Mexico Environment Department (NMED) U.S. Department of Energy (DOE) Oversight Bureau from several wells. For comparison purposes, the list of analytical parameters was modified to include those parameters analyzed by the NMED DOE Oversight Bureau. The chemical analytical parameters selected for monitoring included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals, total uranium, nitrate plus nitrite, perchlorate, 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 plutonium, isotopic uranium, strontium-90, 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 three equipment blank samples for VOCs, TAL metals, total uranium, and uranium-235 and -238 analyses only, three performance evaluation samples containing a range of known cadmium concentrations, and ten trip blank samples for VOC analysis.

The remainder of this report is organized as follows: Chapter 2 provides a discussion of field methods and measurements used during this sampling activity; Chapter 3 discusses analytical methods; Chapter 4 provides a summary of the analytical results; Chapter 5 provides QC results; Chapter 6 addresses quarterly sampling for perchlorates; and Chapter 7 presents variances from requirements in the MWL April 2005 Mini-Sampling and Analysis Plan (SNL/NM 2005).

Summaries of findings for the April 2005 sampling event, as well as for five quarters of sampling for perchlorate at MWL-MW1 and MWL-BW1, are presented in Chapter 8. References are included in Chapter 9.

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 analysis results. Table 5 presents the general chemistry analysis results. Table 6 summarizes detected organic compounds. Table 7 summarizes the radiochemical analysis results, and Table 8 compares the duplicate sample analysis results to the sample results. Tables 9 through 11 present field measurements, well purging data, and analytical results for the four quarters of sampling for perchlorate at MWL-MW1 and MWL-BW1. Complete field and laboratory documentation are on file at the SNL/NM Customer Funded Records Center.

## 2. 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.

### 2.1 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. Tables 1 and 9 report groundwater elevations, static water heights, and monitoring well completion information.

### 2.2 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 needed for each sample. Total purge volumes presented in Tables 2 and 10 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, pH, oxidation/reduction potential ( $E_h$ ), and dissolved oxygen 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 the alkalinity titration. Water quality measurements were recorded on Field Measurement Log forms. Groundwater pH, temperature, specific conductance, turbidity, dissolved oxygen, and  $E_h$  were measured during purging, before sample collection. Tables 2 and 10 show the final three measurements taken before the samples were collected. Water quality parameter field measurements were not taken after sample collection.

### 2.3 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). Equipment blank samples were collected after decontamination to verify the effectiveness of the procedure. Three equipment blank samples were collected during the April 2005 annual groundwater sampling event. Equipment blank samples are discussed in Section 5.1.2.

## **2.4 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. Sample fractions for dissolved TAL metals were collected at MWL-MW1, MWL-MW2, and MWL-MW3, and for major cation analyses at all wells in addition to the routine metals analysis containers. Samples for major dissolved TAL metals and major cation analyses were passed through an in-line filter (0.45-micron [ $\mu\text{m}$ ] pore size) prior to being placed into the sample container.

## **2.5 Sample Handling and Shipment**

Immediately after collection, all sample containers were custody-taped, sealed in plastic bags, and placed on ice in shipping containers. Analytical 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).

## **2.6 Waste Management**

All purge and decontamination water was containerized on site pending 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.

## **3. Analytical Methods**

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

### **3.1 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, SVOCs by EPA Test Method 8270C, 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. Perchlorate was analyzed in selected samples by EPA Method 314.0. EPA test methods for chemical analyses are summarized in Table 3.

### **3.2 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, strontium-90 by EPA 905.0, and tritium by EPA 906.0. Isotopic plutonium was determined using Method Pu-11-RC referenced to the "Procedures Manual of the Environmental Measurements Laboratory," HASL-300 (U.S. Department of Homeland Security 1997). Radiochemical analytical methods are also summarized in Table 3.

## 4. Summary of Analytical Results

Tables summarizing the groundwater monitoring results are included at the end of this report. Table 4 summarizes the total metals and filtered major cation results. Table 5 summarizes the general chemistry results. Table 6 summarizes the detected organic constituents, and Table 7 summarizes the radiochemical results. Table 11 presents quarterly sampling results for perchlorate at MWL-MW1 and MWL-BK1. Results for chemical and radiological constituents are compared to established EPA Safe Drinking Water Act Regulations Maximum Contaminant Levels (MCL) (EPA 2001), where applicable. Metals and radiochemical results are also compared to the NMED Hazardous Waste Bureau (HWB) maximum background levels (Dinwiddie 1997).

### 4.1 Metals

Samples were analyzed for total TAL metals on unfiltered samples. Samples split with the NMED DOE Oversight Bureau were also analyzed for dissolved TAL metals. Dissolved sample fractions were collected by passing the groundwater through 0.45- $\mu\text{m}$ , glass-fiber filters in the field. No reported metals concentrations exceeded EPA MCLs in groundwater samples collected during April 2005. Metals concentrations reported above NMED-HWB maximum background values include barium, nickel, and uranium. The MWL-MW5 barium result of 0.127 milligrams (mg)/liter (L) was slightly above the NMED-HWB background value of 0.120 mg/L. Nickel concentrations from MWL-MW1 and MWL-BW1 samples were detected above the NMED-HWB maximum background value of 0.028 mg/L at 0.424 and 0.0355 mg/L, respectively. Nickel was also detected in the dissolved (field-filtered) sample fraction from MWL-MW1 above the NMED-HWB maximum background value at 0.405 mg/L. Barium and nickel concentrations reported during this annual sampling event are consistent with previously reported data. Nickel concentrations exceeding NMED-HWB maximum background values are attributed to corrosion of the stainless steel screens in the monitoring wells.

Total uranium results exceeded the NMED-HWB maximum background value of 0.0052 mg/L at all wells, except MWL-MW3. Total uranium concentrations exceeding the NMED-HWB maximum background value ranged from 0.00553 mg/L in the MWL-MW1 field-filtered, dissolved sample fraction to 0.00946 mg/L in MWL-MW6. Total uranium results from the April 2005 samples were consistent with data from previous sampling events.

Table 4 summarizes the metals parameters from all groundwater samples collected during the annual groundwater sampling at the MWL. Samples for major cation analyses were filtered through a 0.45- $\mu\text{m}$ , glass-fiber filter to allow mass-balance calculations and to facilitate geochemical analyses of the data. Major cation analysis results on filtered samples are also shown in Table 4.

### 4.2 General Chemistry Parameters

No general chemistry parameters exceeded established MCLs in the groundwater samples. Nitrate plus nitrite (as nitrogen) was detected below the MCL of 10 mg/L at concentrations ranging from 0.787 mg/L at MWL-MW5 to 3.25 mg/L at MWL-MW3. Fluoride was detected

below the MCL of 4.0 mg/L at concentrations ranging from 0.688 mg/L at MWL-BW1 to 0.896 mg/L at MWL-MW3. The general chemistry analysis results are presented in Table 5.

### 4.3 Organic Compounds

Groundwater samples from the MWL monitoring wells showed no detections for VOCs greater than the practical quantitation limits (PQL). Acetone was detected in samples from MWL-MW2 (1.95 micrograms [ $\mu\text{g}$ ]/L) and MWL-MW4 (1.44 and 2.24  $\mu\text{g}$ /L) at estimated concentrations less than the PQL but greater than the method detection limit (MDL). The levels of acetone detected are likely laboratory-introduced contamination. Acetone was also detected at estimated concentrations in samples from MWL-MW1 and MWL-MW3. However, the results were qualified as not detected during data validation due to similar acetone concentrations in one or more QC blank samples. Acetone is a common laboratory contaminant and was also detected in several method blank and trip blank samples.

Analysis results for SVOCs (Table 6) showed an estimated concentration, less than the PQL but greater than the MDL, for the common laboratory contaminant bis(2-ethylhexyl) phthalate in the sample from MWL-MW3 (4.26  $\mu\text{g}$ /L). Because bis(2-ethylhexyl) phthalate, a plasticizer, is a common laboratory contaminant, the likely source is laboratory-introduced contamination. SVOCs were analyzed only in samples from MWL-MW2 and MWL-MW3. A sample fraction for SVOC analysis was collected at MWL-MW1 and shipped to the laboratory; however, the analysis request was cancelled due to laboratory error.

### 4.4 Radiochemistry

Groundwater samples from the MWL monitoring wells were analyzed for gamma-emitting radionuclides, gross alpha/beta activity, isotopic plutonium, isotopic uranium, strontium-90, and tritium. The results, presented in Table 7, were compared to the established EPA MCLs and NMED-HWB maximum background concentration levels (SNL/NM 1996). Radiological parameters were not detected above established MCLs, with one exception. Gross alpha activity was measured in the parent sample (of the field duplicate pair) from MWL-MW4 at 24.5 picocuries (pCi)/L (or 22.3 pCi/L excluding contribution from uranium), exceeding the MCL of 15 pCi/L. A confirmatory reanalysis of the MWL-MW4 sample for gross alpha activity was performed on August 10, 2005. Results for the reanalysis showed gross alpha activity at 11.1 pCi/L (or 8.9 pCi/L excluding contribution from uranium), less than the EPA MCL. Gross alpha activity in the field duplicate sample from MWL-MW4 was well below the MCL at 4.00 pCi/L (1.81 pCi/L excluding contribution from uranium).

Gross alpha and beta activity levels were detected above laboratory reporting limits in all environmental samples. Gross alpha activity levels ranged from  $6.59 \pm 3.44$  pCi/L in the MWL-MW1 sample to  $24.5 \pm 3.43$  pCi/L in MWL-MW4. Gross beta activity levels ranged from  $4.23 \pm 1.12$  pCi/L in the MWL-MW4 field duplicate sample to  $9.29 \pm 3.50$  pCi/L in the MWL-MW5 sample.

Tritium, analyzed by EPA Method 906.0, and gamma-emitting isotopes, analyzed by EPA Method 901.1, were not detected above laboratory reporting limits in any of the groundwater samples.

Isotopic plutonium and strontium-90 were measured only in samples from MWL-MW1, MWL-MW2, and MWL-MW3. Plutonium isotopes and strontium-90 were not detected above laboratory reporting limits in any of those samples.

## **4.5 Perchlorate**

Analyses for perchlorate were performed on samples from MWL-MW1, MWL-MW2, MWL-MW6, and MWL-BW1 only. Results for perchlorate were nondetect above the MDL of 0.004 mg/L in all samples. The perchlorate results for the April 2005 samples are presented in Table 11 along with perchlorate results for samples collected from MWL-MW1 and MWL-BW1 during the four previous calendar quarters.

## 5. QC Results

QC samples were purchased from vendors and 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 qualified in accordance with AOP [Administrative Operating Procedure] 00-03, "Data Validation Procedure for Chemical and Radiochemical Data" (SNL/NM 2000). Results for each QC analysis and the impact on data quality are discussed in the following sections.

### 5.1 Field QC Samples

The field QC samples included blind-spike samples, collection of equipment rinse blank samples, laboratory-prepared trip blank samples, and field duplicate samples. The following sections discuss each QC sample type.

#### 5.1.1 Blind-Spike Samples

Three blind-spike samples were procured and submitted to the laboratory for TAL metals analysis, total uranium, and uranium-235 and -238. The blind-spike samples were submitted as coming from fictitious locations MWL-MW7, MWL-MW8, and MWL-MW9 in a manner identical to the environmental samples. The samples contained known concentrations of cadmium at 0.0001 mg/L (MWL-MW7), 0.0005 mg/L (MWL-MW8), and 0.001 mg/L (MWL-MW9). Percent recoveries for MWL-MW8 and MWL-MW9 were 103 and 95 percent, respectively. The known concentration of 0.0001 mg/L of cadmium for MWL-MW7 is at the MDL, and the laboratory result was nondetect, which is not an unexpected result. If analytical errors follow the normal distribution, then replicate analyses of spiked samples at the MDL should yield nondetect results 50 percent of the time.

#### 5.1.2 Equipment Blank Samples

Three equipment blank samples were collected during the annual sampling activities. The first equipment blank sample, MWL-EB1, was collected on April 1, 2005, prior to purging MWL-MW1 to dryness on April 4, 2005. The second equipment blank sample, MWL-EB2, was collected on April 4, 2005, after purging MWL-MW1 to dryness and prior to purging MWL-MW2 on April 5, 2005. MWL-MW2 was purged to dryness on April 5, 2005. The third equipment blank sample, MWL-EB3, was collected after sampling MWL-MW2 on April 12, 2005, and prior to purging and sampling MWL-MW6 on April 14, 2005. Equipment blank samples were analyzed for VOCs, metals, total uranium, and uranium-235 and -238.

The VOCs acetone and dibromochloromethane were detected in equipment blank sample MWL-EB3 at estimated concentrations less than the relevant PQLs. No other VOCs were detected in any equipment blank sample.

Estimated concentrations, less than the relevant PQLs, of several metals were detected in all three equipment blank samples. Metals detected at these low levels included arsenic, barium, calcium, copper, iron, selenium, thallium, vanadium, and zinc. The low levels of VOCs and metals detected in the equipment blank samples indicate the effectiveness of the decontamination procedures. Associated environmental samples with results less than five times equipment blank

concentrations were qualified as estimated values in accordance with AOP 00-03, "Data Validation Procedure for Chemical and Radiochemical Data" (SNL/NM 2000).

### **5.1.3 Trip Blank Samples**

A laboratory-prepared trip blank sample was returned to the laboratory with each shipment containing samples for VOC analysis. Ten trip blank samples were submitted during annual groundwater sampling and were used to assess VOC contamination that might have occurred during sample shipping and storage. Low levels of VOCs were detected in trip blank samples MWL-TB3, MWL-TB6, and MWL-TB7 associated with the environmental or equipment blank samples MWL-MW1, MWL-MW3, and MWL-EB3, respectively. Estimated concentrations of acetone, a common laboratory contaminant, were detected in MWL-TB3 (1.94 µg/L) and MWL-TB6 (1.97 µg/L). Carbon disulfide was detected in MWL-TB7 at an estimated concentration of 2.05 µg/L. Similar levels of acetone in the environmental samples MWL-MW1 and MWL-MW3 were qualified as not detected during data validation.

### **5.1.4 Field Duplicate Samples**

Duplicate groundwater samples were collected at MWL-MW4. Relative percent differences (RPD) precision measurements for constituents detected above the PQL in both the parent and duplicate samples are presented in Table 8. All RPD measurements for chemical analyses were calculated less than 10 RPD, indicating acceptable precision.

## **5.2 Laboratory QC 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 2000). 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.

## 6. Quarterly Sampling for Perchlorate

Field and laboratory results for samples collected at MWL-MW1 and MWL-BW1 and analyzed for perchlorate over the previous four calendar quarters, April, August, and November 2004 and February 2005 are detailed in Tables 9 through 11. Table 9 shows groundwater elevations, pump setting depths, and monitoring well completion information. Table 10 summarizes purge volumes and purge indicator measurements for each sampling event. Table 11 presents the analytical results for the perchlorate analyses. Perchlorate samples were also collected in April 2005 from wells MWL-MW1, MWL-MW2, MWL-MW6, and MWL-BW1. These data are also included in Table 11. All samples showed no perchlorate detected above the MDL of 0.004 mg/L.

## **7. Variances and Nonconformances**

All analytical and field methods were in conformance with the MWL Mini-Sampling and Analysis Plan (SNL/NM 2005). Additional sample fractions were collected for field-filtered, dissolved metals and SVOC analyses at MWL-MW1, MWL-MW2, and MWL-MW3. However, the analysis of the SVOC sample fraction from MWL-MW1 was inadvertently cancelled due to laboratory error.

## 8. Summary and Conclusions

Annual groundwater sampling was conducted at the MWL in April 2005. No inorganic or organic parameters were detected above the corresponding MCLs in any samples. The gross alpha radioactivity measurement at MWL-MW4 of  $24.5 \pm 3.43$  pCi/L (or  $22.3 \pm 3.43$  pCi/L, excluding uranium) exceeded the EPA MCL of 15 pCi/L. Reanalysis of the MWL-MW4 sample showed gross alpha activity at  $11.1 \pm 3.89$  pCi/L (or  $8.9 \pm 3.89$  pCi/L, excluding uranium), which is less than the EPA MCL. The duplicate field sample from MWL-MW4 was well below the MCL at  $4.00 \pm 1.44$  pCi/L (or  $1.8 \pm 1.44$  pCi/L, excluding uranium).

Groundwater samples collected in April 2005 from the MWL monitoring wells showed no organic compound detection greater than the PQL. Estimated concentrations for acetone, less than the PQL but greater than the MDL, are likely inadvertent laboratory-introduced contamination. Analysis results for SVOCs showed an estimated concentration for the common laboratory contaminant bis(2-ethylhexyl) phthalate in the sample from MWL-MW3.

No metals analysis results were reported greater than the established MCLs in any groundwater sample from the MWL in April 2005. Metals concentrations reported above the NMED-HWB maximum background values include barium, nickel, and uranium. The MWL-MW5 barium result of 0.127 mg/L was slightly above the NMED-HWB background value of 0.120 mg/L. Nickel concentrations from MWL-MW1 and MWL-BW1 samples were detected above the NMED-HWB maximum background value of 0.028 mg/L at 0.424 and 0.0355 mg/L, respectively. Nickel was also detected in the dissolved (field-filtered) sample fraction from MWL-MW1 above the NMED-HWB maximum background value at 0.405 mg/L. Barium and nickel concentrations reported during this annual sampling event are consistent with previously reported data. Nickel concentrations exceeding the NMED-HWB maximum background value are attributed to corrosion of the stainless steel screens in the monitoring wells. Total uranium results exceeded the NMED-HWB maximum background value of 0.0052 mg/L at all wells, except MWL-MW3. Total uranium concentrations exceeding the NMED-HWB maximum background value ranged from 0.00553 mg/L in the MWL-MW1 field-filtered, dissolved sample fraction to 0.00946 mg/L in MWL-MW6. Total uranium results from the April 2005 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 for the Middle Rio Grande Basin (USGS 2002).

No general chemistry parameters exceeded established MCLs in the groundwater samples. Nitrate plus nitrite (as nitrogen) was detected below the MCL of 10 mg/L at concentrations ranging from 0.787 mg/L at MWL-MW5 to 3.25 mg/L at MWL-MW3. Fluoride was detected below the MCL of 4.0 mg/L at concentrations ranging from 0.688 mg/L at MWL-BW1 to 0.896 mg/L at MWL-MW3.

Radioactivity and radionuclides were not detected at levels greater than the corresponding MCL or NMED-HWB background concentration levels except for the original analysis of the parent sample for gross alpha activity at MWL-MW4. Reanalysis of the MWL-MW4 sample showed gross alpha activity less than the EPA MCL.

## 9. References

Dinwiddie, R.S. (New Mexico Environment Department), 1997, Letter to M.J. Zamorski (U.S. Department of Energy), "Request for Supplemental Information: Background Concentrations Report, SNL/KAFB," September 24, 1997.

EPA, see U.S. Environmental Protection Agency.

Sandia National Laboratories/New Mexico (SNL/NM), 1994a, "Field Analytical Measurement of Groundwater," *FOP 94-46*, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), 1994b, "General Equipment Decontamination," *FOP 94-26*, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), 1994c, "Field Sample Management and Custody," *FOP 94-34*, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), 1995, "Measurement of Ground-Water Level," *FOP 95-02*, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), 1996, "Background Concentrations of Constituents of Concern to the Sandia National Laboratories/New Mexico Environmental Restoration Project and Kirtland Air Force Base Installation Restoration Project," Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), 2000, "Data Validation Procedure for Chemical and Radiochemical Data," Rev. 0, *AOP 00-03*, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), 2005, "Mixed Waste Landfill April 2005 Mini-Sampling and Analysis Plan," Sandia National Laboratories, Albuquerque, New Mexico.

SNL/NM, see Sandia National Laboratories/New Mexico.

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.

U.S. Environmental Protection Agency (EPA), 1979, "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020, U.S. Environmental Protection Agency, Cincinnati, Ohio.

U.S. Environmental Protection Agency (EPA), 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Rev. 1, U.S. Environmental Protection Agency, Washington, D.C.

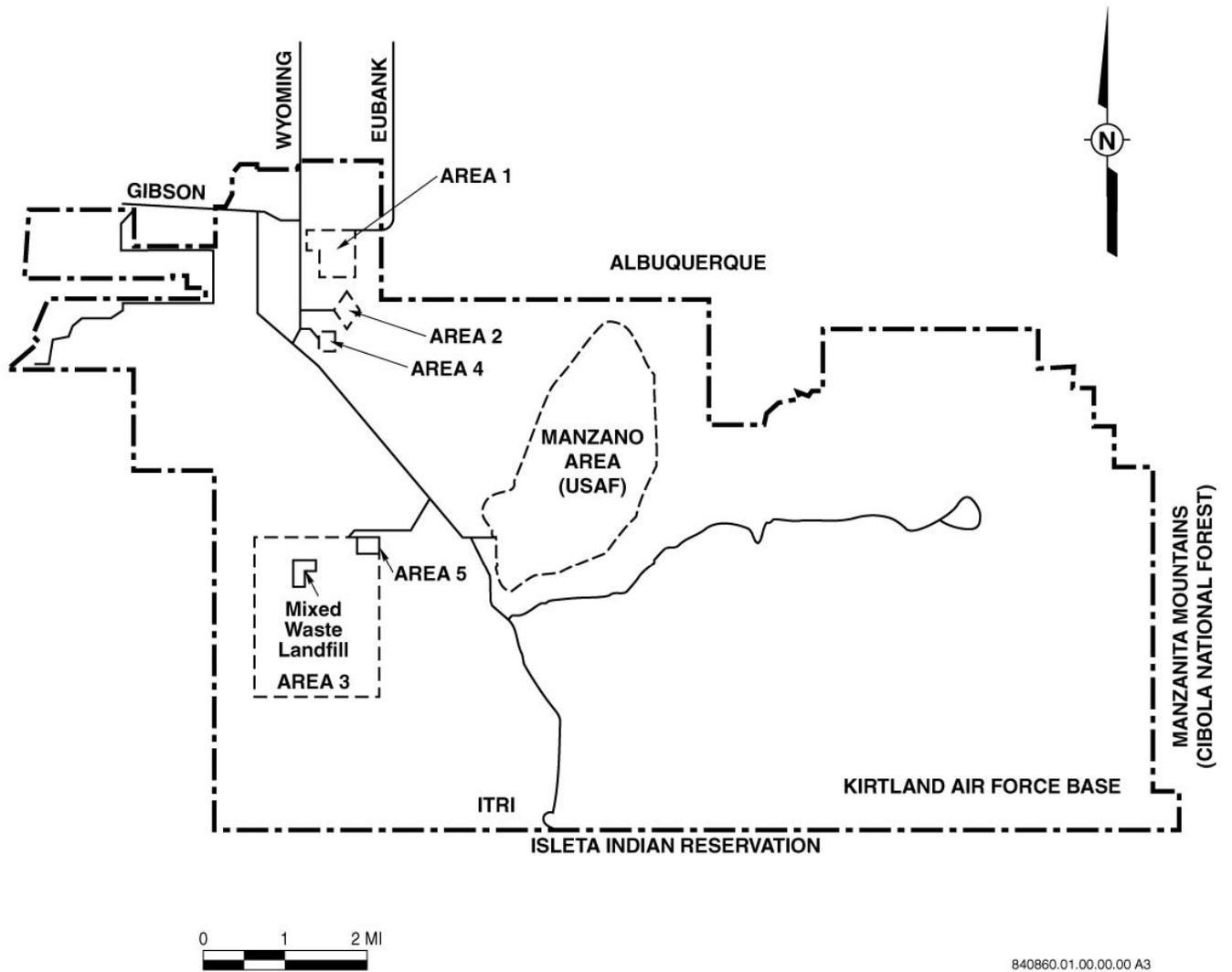
U.S. Environmental Protection Agency (EPA), 1988, “User’s Guide to the Contract Laboratory Program,” U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 2001, National Primary Drinking Water Regulations, Title 40, Code of Federal Regulations, Part 141, Subpart B, Office of Water, U.S. Environmental Protection Agency, Washington, D.C.

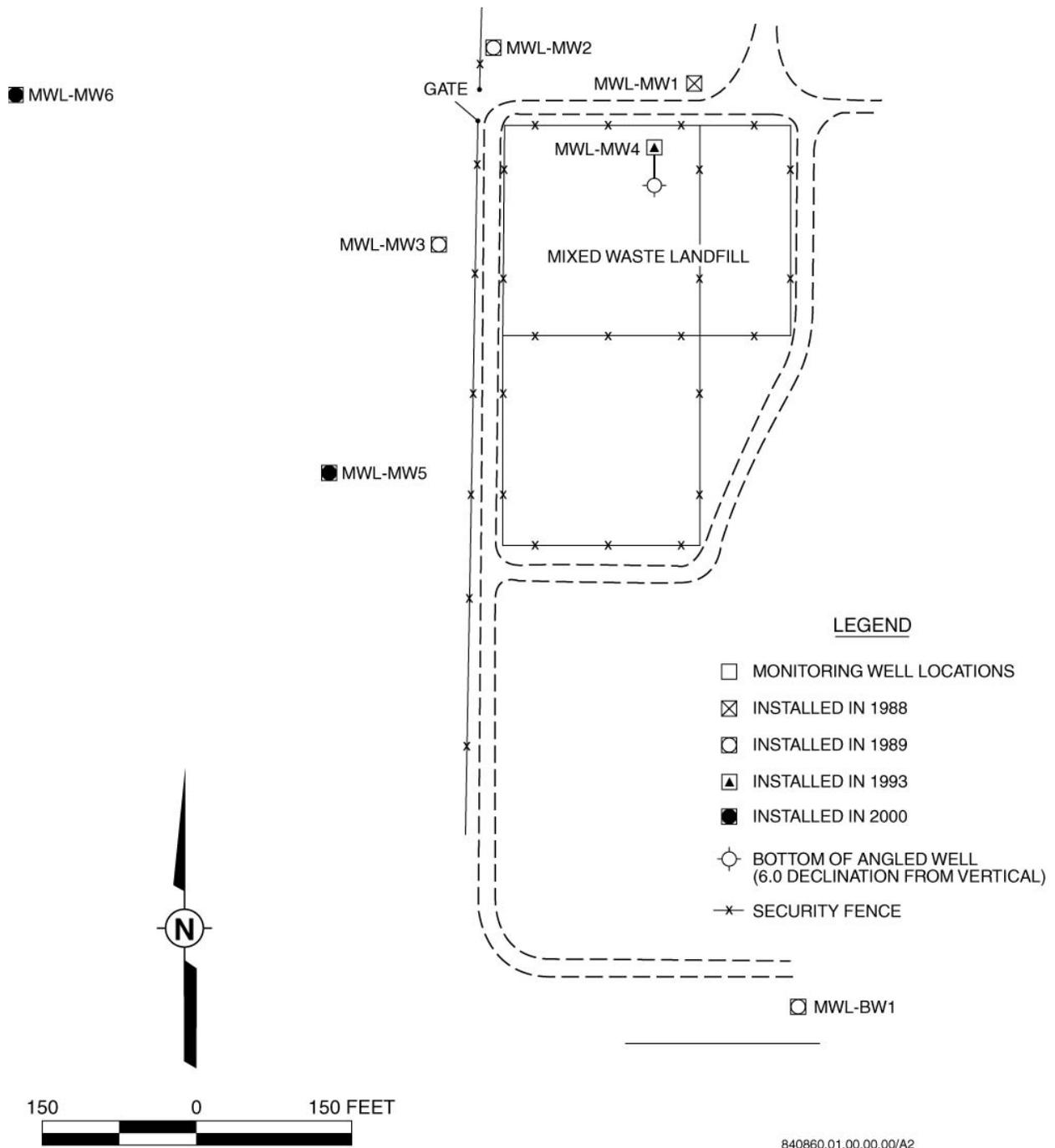
U.S. Geological Survey (USGS), 2002, “Preliminary Summary Statistics—All Ground-Water Sites, Middle Rio Grande Basin,” prepared by Laura Bexfield, Water Resources Division, U.S. Geological Survey, Albuquerque, New Mexico.

USGS, see U.S. Geological Survey.

# FIGURES



**Figure 1 Location of the Mixed Waste Landfill**



**Figure 2 Mixed Waste Landfill Monitoring Well Locations**

# **TABLES**

**Table 1**  
**Groundwater Elevations, Pump Setting Depths, and**  
**Monitoring Well Completion Information**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

<b>Well Number</b>	<b>Date of Measurement</b>	<b>Measurement Point Elevation (FAMSL)<sup>a</sup></b>	<b>Depth to Water (FBTOC)</b>	<b>Groundwater Elevation (FAMSL)<sup>a</sup></b>	<b>Total Well Depth<sup>b</sup> (FBTOC)</b>	<b>Static Water Height (feet)</b>	<b>Pump Setting Depth (FBTOC)</b>
MWL-MW1	04-04-05	5381.54	466.97	4914.57	478	11	478
MWL-MW2	04-05-05	5377.26	463.46	4913.80	477	14	471
MWL-MW3	04-07-05	5381.32	468.68	4912.64	479	10	474
MWL-MW4	04-18-05	5383.46	497.63	4888.56 <sup>c</sup>	548	12 <sup>d</sup>	509
MWL-MW5	04-06-05	5379.89	491.75	4888.14	521.5	30	509
MWL-MW6	04-14-05	5372.64	485.58	4887.06	530.5	45	518
MWL-BW1	04-08-05	5384.51	470.52	4913.99	477	6	474

<sup>a</sup>Measurement point is the top of well casing.

<sup>b</sup>Total well depth to bottom of sump.

<sup>c</sup>Elevation shown reflects well MWL-MW4 orientation of 6 degrees from vertical.

<sup>d</sup>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 2005**

Sample Attributes	Measurement Relative to Sampling	Purge Volume (gallons)	pH (at 25°C)	Temp (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTU)	E <sub>h</sub> (mV)	DO (% Sat)
MWL-MW1 <sup>a</sup> Date purge began: 04-04-05	Before sampling:	29	7.62	16.11	511	5.64	273.0	76.7
		31	7.74	17.45	512	6.59	266.0	70.3
		33	7.75	17.65	512	6.42	263.3	70.0
Date sampled: 04-11-05	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL-MW2 <sup>a</sup> Date purge began: 04-05-05	Before sampling:	21	7.74	10.40	522	0.54	96.0	58.7
		22	7.83	12.68	523	0.78	77.8	48.7
		23	7.85	15.42	525	1.27	75.6	38.0
Date sampled: 04-12-05	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL-MW3 <sup>a</sup> Date purge began: 04-07-05	Before sampling:	7	7.67	15.80	476	18.2	262.1	42.8
		9	7.68	17.15	477	15.9	256.2	41.7
		14	7.10	14.85	408	14.3	56.0	94.6
Date sampled: 04-13-05	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL-MW4 <sup>a</sup> Date purge began: 04-18-05	Before sampling:	37	6.94	19.23	532	4.46	-83.9	83.6
		39	7.05	19.73	551	3.39	-121.3	24.4
		41	7.07	19.63	551	3.29	-127.9	29.1
Date sampled: 04-19-05	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL-MW5 Date purged: 04-06-05	Before sampling:	55	7.17	19.92	795	4.80	123.2	28.8
		60	7.17	20.08	796	4.76	123.6	29.0
		65	7.17	20.11	797	4.79	123.4	29.0
Date sampled: 04-06-05	After sampling:	NM	NM	NM	NM	NM	NM	NM

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 2005**

Sample Attributes	Measurement Relative to Sampling	Purge Volume (gallons)	pH (at 25°C)	Temp (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTU)	E <sub>h</sub> (mV)	DO (% Sat)
MWL-MW6 Date purged: 04-14-05	Before sampling:	100	7.36	21.47	745	0.17	-59.9	30.7
		105	7.36	21.47	747	0.25	-60.1	30.9
		109	7.36	21.55	747	0.23	-60.2	31.0
Date sampled: 04-14-05	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL-BW1 <sup>a</sup> Date purge began: 04-08-05	Before sampling:	7	7.90	15.78	498	2.79	278.2	65.4
		7.5	7.90	16.01	498	2.76	277.8	64.5
		12.5	7.51	17.68	476	1.32	NM	79.6
	Date sampled: 04-15-05	After sampling:	NM	NM	NM	NM	NM	NM

<sup>a</sup>Wells were purged to dryness. Purge volumes show total gallons removed prior to sampling.

°C            Degrees Celsius.  
DO            Dissolved oxygen.  
E<sub>h</sub>            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 2005**

Analytical Parameter	Test Method <sup>a</sup>	Target Quantitation Limit <sup>b</sup>
Total metals TAL, major cations, and uranium	EPA 6020 EPA 7470A	0.0002–0.250 mg/L
Dissolved (field filtered) metals TAL and uranium	EPA 6020 EPA 7470A	0.0002–0.250 mg/L
Volatile organic compounds	EPA 8260B	1–5 µg/L
Semivolatile organic compounds	EPA 8270C	1–20 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
Perchlorate	EPA 314.0	0.012 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
Isotopic plutonium	Pu-11-RC	MDA is isotope-specific
Strontium 90	EPA 905.0	0.65 pCi/L
Tritium	EPA 906.0	200 pCi/L

<sup>a</sup>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.

<sup>b</sup>For target compounds only. Reporting limits may be elevated if an interfering component is present or if sample dilution is required.

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 Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

					Sample No.: Well ID: Sampling Date: Sample Type:	068139 MWL-MW1 04-11-05 Environmental	068143 MWL-MW2 04-12-05 Environmental	068145 MWL-MW3 04-13-05 Environmental	068149 MWL-MW4 04-19-05 Environmental
Parameter	Analytical Method <sup>a</sup>	Practical Quantitation Limit (mg/L)	MCL (mg/L)	NMED-HWB <sup>b</sup> Approved Background (mg/L)	All Results in mg/L				
Aluminum (T)	6020	0.015	NE	NE	0.0312	0.0297	0.118 J, P1	ND (0.005)	
Aluminum (D)	6020	0.015	NE	NE	ND (0.005)	ND (0.005)	ND (0.005)	NA	
Antimony (T)	6020	0.002	0.006	0.0060	ND (0.0005)	ND (0.0005)	ND (0.0005)	ND (0.0005)	
Antimony (D)	6020	0.002	0.006	0.0060	ND (0.0005)	ND (0.0005)	ND (0.0005)	NA	
Arsenic (T)	6020	0.005	0.010	0.014	ND (0.0015 B)	0.00162 J, B	0.00321 J, B	0.00565 J, B	
Arsenic (D)	6020	0.005	0.010	0.014	0.0017 J, B	0.00229 J, B	0.00456 J, B	NA	
Barium (T)	6020	0.002	2.0	0.120	0.0685	0.0971	0.0911	0.103 B	
Barium (D)	6020	0.002	2.0	0.120	0.0658	0.0959	0.0811	NA	
Beryllium (T)	6020	0.0005	0.004	0.004	ND (0.0001)	ND (0.0001)	ND (0.0001)	ND (0.0001)	
Beryllium (D)	6020	0.0005	0.004	0.004	ND (0.0001)	ND (0.0001)	ND (0.0001)	NA	
Cadmium (T)	6020	0.001	0.005	0.00047	ND (0.0001)	ND (0.0001)	0.000135 J	0.000263 J	
Cadmium (D)	6020	0.001	0.005	0.00047	ND (0.0001)	ND (0.0001)	ND (0.0001)	NA	
Calcium (T)	6020	0.100	NE	NE	53.2 B	49.5 B	47.3 B	57.2	
Calcium (D)	6020	0.100	NE	NE	52.5 B	49.3 J, B	44.2 B	NA	
Calcium (D) <sup>c</sup>	6020	0.100	NE	NE	52.6 B	50.1	45.2 B	57.1	
Chromium (T)	6020	0.003	0.1	0.043	0.0368 J, A2	0.00217 J	0.00787	0.00105 J	
Chromium (D)	6020	0.003	0.1	0.043	0.001	ND (0.001)	0.00392	NA	
Cobalt (T)	6020	0.001	NE	0.0025	0.00131	0.000412 J	0.00118	0.000177 J	
Cobalt (D)	6020	0.001	NE	0.0025	0.000482 J	0.000144 J	ND (0.0001)	NA	
Copper (T)	6020	0.001	1.3 <sup>d</sup>	<0.050	0.00357	0.00153	0.0042	0.000925 J	
Copper (D)	6020	0.001	1.3 <sup>d</sup>	<0.050	0.000985 J	0.00101	0.000852 J	NA	

Refer to footnotes at end of table.

**Table 4 (Continued)**  
**Metals Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

					Sample No.:	068139	068143	068145	068149
					Well ID:	MWL-MW1	MWL-MW2	MWL-MW3	MWL-MW4
					Sampling Date:	04-11-05	04-12-05	04-13-05	04-19-05
					Sample Type:	Environmental	Environmental	Environmental	Environmental
Parameter	Analytical Method <sup>a</sup>	Practical Quantitation Limit (mg/L)	MCL (mg/L)	NMED-HWB <sup>b</sup> Approved Background (mg/L)	All Results in mg/L				
Iron (T)	6020	0.025	NE	NE	0.697	0.235 B	0.473 B	0.303	
Iron (D)	6020	0.025	NE	NE	0.135	0.175 B	0.121 B	NA	
Lead (T)	6020	0.002	0.015 <sup>d</sup>	0.010	ND (0.0005)	ND (0.0005)	0.002 J	ND (0.0005)	
Lead (D)	6020	0.002	0.015 <sup>d</sup>	0.010	ND (0.0005)	ND (0.0005)	ND (0.0005)	NA	
Magnesium (T)	6020	0.015	NE	NE	19.7	19.0	15.8 B	21.2	
Magnesium (D)	6020	0.015	NE	NE	19.5	19.1 J	14.8 B	NA	
Magnesium (D) <sup>c</sup>	6020	0.015	NE	NE	18.5	19.9	15.9 B	21.0	
Manganese (T)	6020	0.005	NE	NE	0.019	0.00415 J	0.0259	0.00457 J	
Manganese (D)	6020	0.005	NE	NE	0.00563	ND (0.001)	0.00158 J	NA	
Mercury (T)	7470A	0.0002	0.002	0.002	ND (0.00005)	ND (0.00005)	ND (0.00005)	ND (0.00005 UJ, B3)	
Mercury (D)	7470A	0.0002	0.002	0.002	ND (0.00005)	ND (0.00005)	ND (0.00005)	NA	
Nickel (T)	6020	0.002	NE	0.028	<b>0.424</b>	0.00802	0.0173	0.00452	
Nickel (D)	6020	0.002	NE	0.028	<b>0.405</b>	0.00711	0.0115	NA	
Potassium (T)	6020	0.300	NE	NE	3.40	4.57	3.95	4.81	
Potassium (D)	6020	0.300	NE	NE	3.55	4.56	3.80	NA	

Refer to footnotes at end of table.

**Table 4 (Continued)  
Metals Analysis Results  
Mixed Waste Landfill, Sandia National Laboratories/New Mexico  
Annual Groundwater Monitoring, April 2005**

					Sample No.: Well ID: Sampling Date: Sample Type:	068139 MWL-MW1 04-11-05 Environmental	068143 MWL-MW2 04-12-05 Environmental	068145 MWL-MW3 04-13-05 Environmental	068149 MWL-MW4 04-19-05 Environmental
Parameter	Analytical Method <sup>a</sup>	Practical Quantitation Limit (mg/L)	MCL (mg/L)	NMED-HWB <sup>b</sup> Approved Background (mg/L)	All Results in mg/L				
Potassium (D) <sup>c</sup>	6020	0.300	NE	NE	3.42	4.57	3.84	4.96	
Selenium (T)	6020	0.005	0.05	0.005	0.0043 J, B	0.00316 J, B	0.00351 J, B	0.00434 J, B	
Selenium (D)	6020	0.005	0.05	0.005	<b>0.00518 J, B</b>	0.00496 J, B	<b>0.00501 J, B</b>	NA	
Silver (T)	6020	0.001	NE	<0.010	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	
Silver (D)	6020	0.001	NE	<0.010	ND (0.0002)	ND (0.0002)	ND (0.0002)	NA	
Sodium (T)	6020	0.250	NE	NE	49.4	47.9	47.2	47.2	
Sodium (D)	6020	0.250	NE	NE	49.9 J	48.0 J	44.8	NA	
Sodium (D) <sup>c</sup>	6020	0.250	NE	NE	52.6	52.5	50.2	46.7	
Thallium (T)	6020	0.001	0.002	0.002	ND (0.0004)	ND (0.0004)	0.000402 J	ND (0.0004)	
Thallium (D)	6020	0.001	0.002	0.002	ND (0.0004)	ND (0.0004)	ND (0.0004)	NA	
Uranium, Total (T)	6020	0.0002	0.030	0.0052	<b>0.00559</b>	<b>0.00654</b>	0.00514	<b>0.00628</b>	
Uranium, Total (D)	6020	0.0002	0.030	0.0052	<b>0.00553</b>	<b>0.00678</b>	0.00513	NA	
Vanadium (T)	6020	0.030	NE	0.013	ND (0.002) UJ, B3	ND (0.002)	0.00258 J	0.0098 J	
Vanadium (D)	6020	0.030	NE	0.013	ND (0.002) UJ, B3	ND (0.002)	ND (0.002)	NA	
Zinc (T)	6020	0.010	NE	0.260	0.0127	0.0245	0.0484	0.023	
Zinc (D)	6020	0.010	NE	0.260	0.00513 J	0.00886 J	0.00658 J	NA	

Refer to footnotes at end of table.

**Table 4 (Continued)  
Metals Analysis Results  
Mixed Waste Landfill, Sandia National Laboratories/New Mexico  
Annual Groundwater Monitoring, April 2005**

					Sample No.: Well ID: Sampling Date: Sample Type:	068150 MWL-MW4 04-19-05 Duplicate	068152 MWL-MW5 04-06-05 Environmental	068154 MWL-MW6 04-14-05 Environmental	068135 MWL-BW1 04-15-05 Environmental
Parameter	Analytical Method <sup>a</sup>	Practical Quantitation Limit (mg/L)	MCL (mg/L)	NMED-HWB <sup>b</sup> Approved Background (mg/L)	All Results in mg/L				
Aluminum (T)	6020	0.015	NE	NE	ND (0.005)	0.0413	ND (0.005)	0.0239	
Aluminum (D)	6020	0.015	NE	NE	NA	NA	NA	NA	
Antimony (T)	6020	0.002	0.006	0.0060	ND (0.0005)	ND (0.0005)	ND (0.0005)	ND (0.0005)	
Antimony (D)	6020	0.002	0.006	0.0060	NA	NA	NA	NA	
Arsenic (T)	6020	0.005	0.010	0.014	0.00623 J, B	0.00165 J, B	0.00262 J, B, B2	ND (0.0015)	
Arsenic (D)	6020	0.005	0.010	0.014	NA	NA	NA	NA	
Barium (T)	6020	0.002	2.0	0.120	0.104 B	0.127	0.105 J	0.0748	
Barium (D)	6020	0.002	2.0	0.120	NA	NA	NA	NA	
Beryllium (T)	6020	0.0005	0.004	0.004	ND (0.0001)	ND (0.0001)	ND (0.0001)	ND (0.0001)	
Beryllium (D)	6020	0.0005	0.004	0.004	NA	NA	NA	NA	
Cadmium (T)	6020	0.001	0.005	0.00047	0.000263 J	ND (0.0001)	ND (0.0001)	ND (0.0001)	
Cadmium (D)	6020	0.001	0.005	0.00047	NA	NA	NA	NA	
Calcium (T)	6020	0.100	NE	NE	58.0	78.4 B	76.0 J	44.2 B	
Calcium (D)	6020	0.100	NE	NE	NA	NA	NA	NA	
Calcium (D) <sup>c</sup>	6020	0.100	NE	NE	57.9	79.7 B	74.8 J	43.8 B	
Chromium (T)	6020	0.003	0.1	0.043	0.00125 J	0.00104 J	ND (0.001)	0.00606	
Chromium (D)	6020	0.003	0.1	0.043	NA	NA	NA	NA	
Cobalt (T)	6020	0.001	NE	0.0025	0.000182 J	0.000249 J	0.000139 J	0.000211 J	
Cobalt (D)	6020	0.001	NE	0.0025	NA	NA	NA	NA	
Copper (T)	6020	0.001	1.3 <sup>d</sup>	<0.050	0.000993 J	0.00128	0.000751 J, B2	0.000752 J	
Copper (D)	6020	0.001	1.3 <sup>d</sup>	<0.050	NA	NA	NA	NA	
Iron (T)	6020	0.025	NE	NE	0.318	0.517	0.282 J, P1	0.200 B	
Iron (D)	6020	0.025	NE	NE	NA	NA	NA	NA	

Refer to footnotes at end of table.

**Table 4 (Continued)**  
**Metals Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

					Sample No.:	068150	068152	068154	068135
					Well ID:	MWL-MW4	MWL-MW5	MWL-MW6	MWL-BW1
					Sampling Date:	04-19-05	04-06-05	04-14-05	04-15-05
					Sample Type:	Duplicate	Environmental	Environmental	Environmental
Parameter	Analytical Method <sup>a</sup>	Practical Quantitation Limit (mg/L)	MCL (mg/L)	NMED-HWB <sup>b</sup> Approved Background (mg/L)	All Results in mg/L				
Lead (T)	6020	0.002	0.015 <sup>d</sup>	0.010	ND (0.0005)	0.00113 J	ND (0.0005)	ND (0.0005)	
Lead (D)	6020	0.002	0.015 <sup>d</sup>	0.010	NA	NA	NA	NA	
Magnesium (T)	6020	0.015	NE	NE	20.3	28.9	26.0 J	20.3	
Magnesium (D)	6020	0.015	NE	NE	NA	NA	NA	NA	
Magnesium (D) <sup>c</sup>	6020	0.015	NE	NE	21.9	29.0	26.4 J	20.8	
Manganese (T)	6020	0.005	NE	NE	0.00483 J	0.0377	ND (0.001)	0.00282 J	
Manganese (D)	6020	0.005	NE	NE	NA	NA	NA	NA	
Mercury (T)	7470A	0.0002	0.002	0.002	ND (0.00005 UJ, B3)	ND (0.00005 UJ, B3)	ND (0.00005 UJ, B3)	ND (0.00005)	
Mercury (D)	7470A	0.0002	0.002	0.002	NA	NA	NA	NA	
Nickel (T)	6020	0.002	NE	0.028	0.00489	0.0017 J	0.00133 J	<b>0.0355</b>	
Nickel (D)	6020	0.002	NE	0.028	NA	NA	NA	NA	
Potassium (T)	6020	0.300	NE	NE	4.94	5.88	4.72	3.49	
Potassium (D)	6020	0.300	NE	NE	NA	NA	NA	NA	
Potassium (D) <sup>c</sup>	6020	0.300	NE	NE	4.91	5.89	4.68	3.35	
Selenium (T)	6020	0.005	0.05	0.005	0.00481 J, B	0.00279 J, B	0.00384 J, B, B2	0.00405 J, B	
Selenium (D)	6020	0.005	0.05	0.005	NA	NA	NA	NA	
Silver (T)	6020	0.001	NE	<0.010	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	

Refer to footnotes at end of table.

**Table 4 (Continued)**  
**Metals Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

					Sample No.:	068150	068152	068154	068135
					Well ID:	MWL-MW4	MWL-MW5	MWL-MW6	MWL-BW1
					Sampling Date:	04-19-05	04-06-05	04-14-05	04-15-05
					Sample Type:	Duplicate	Environmental	Environmental	Environmental
Parameter	Analytical Method <sup>a</sup>	Practical Quantitation Limit (mg/L)	MCL (mg/L)	NMED-HWB <sup>b</sup> Approved Background (mg/L)	All Results in mg/L				
Silver (D)	6020	0.001	NE	<0.010	NA	NA	NA	NA	
Sodium (T)	6020	0.250	NE	NE	47.4	64.1	55.5 J	53.7	
Sodium (D)	6020	0.250	NE	NE	NA	NA	NA	NA	
Sodium (D) <sup>c</sup>	6020	0.250	NE	NE	49.1	70.7 J	55.2	51.6	
Thallium (T)	6020	0.001	0.002	0.002	ND (0.0004)	ND (0.0004)	ND (0.0004)	ND (0.0004)	
Thallium (D)	6020	0.001	0.002	0.002	NA	NA	NA	NA	
Uranium, Total (T)	6020	0.0002	0.030	0.0052	<b>0.00624</b>	<b>0.00901</b>	<b>0.00946</b>	<b>0.00687</b>	
Uranium, Total (D)	6020	0.0002	0.030	0.0052	NA	NA	NA	NA	
Vanadium (T)	6020	0.030	NE	0.013	0.0101 J	ND (0.002)	0.00424 J, B2	0.00364 J	
Vanadium (D)	6020	0.030	NE	0.013	NA	NA	NA	NA	
Zinc (T)	6020	0.010	NE	0.260	0.0225	0.0173	0.00268 J, B2	0.0222	
Zinc (D)	6020	0.010	NE	0.260	NA	NA	NA	NA	

Note: Values in **bold** exceed EPA MCL or NMED-HWB maximum background values.

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

<sup>b</sup>Dinwiddie, R.S. (New Mexico Environment Department), 1997, Letter to M.J. Zamorski, U.S. Department of Energy, "Request for Supplemental Information: Background Concentrations Report, SNL/KAFB," September 24, 1997.

<sup>c</sup>Results from major cation analyses on samples filtered through 0.45- $\mu$ m, glass-fiber filter. Duplicate analyses of dissolved calcium, magnesium, and sodium were inadvertently requested for samples that were split with the DOE Oversight Bureau.

<sup>d</sup>Values shown are EPA Action Levels.

**Table 4 (Continued)**  
**Metals Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

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.
D	Analysis result is on a dissolved basis. The sample was filtered in the field through a 0.45- $\mu$ m, glass-fiber filter.
DOE	U.S. Department of Energy.
EPA	U.S. Environmental Protection Agency.
HWB	Hazardous Waste Bureau.
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.
$\mu$ m	Micron.
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.
NMED	New Mexico Environment Department.
P1	Replicate sample precision exceeds 20 relative percent difference.
T	Analysis result is on a total, unfiltered basis.
UJ	The material was analyzed for but was not detected. The sample quantitation limit is an estimated quantity.

**Table 5**  
**General Chemistry Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

				Sample No.: Well ID: Sampling Date: Sample Type	068139 MWL-MW1 04-11-05 Environmental	068143 MWL-MW2 04-12-05 Environmental	068145 MWL-MW3 04-13-05 Environmental	068149 MWL-MW4 04-19-05 Environmental
Parameter	Analytical Method <sup>a</sup>	Practical Quantitation Limit <sup>b</sup> (mg/L)	MCL (mg/L)	All Results in mg/L				
Bromide	9056	0.200	NE	0.174 J	0.203	0.226	0.249	
Chloride	9056	0.400	NE	32.3	39.8	30.3	49.0 B	
Fluoride	9056	0.100	4.0	0.754	0.772	0.896	0.852 B	
Sulfate	9056	0.800	NE	41.9	33.7	37.4	36.7 B	
Nitrate plus Nitrite, as N	353.1	0.200	10	3.17	1.83	3.25	1.94	
Alkalinity, field measurement <sup>c</sup>	HACH	1	NE	192	199	175	185	
				Sample No.: Well ID: Sampling Date: Sample Type	068150 MWL-MW4 04-19-05 Duplicate	068152 MWL-MW5 04-06-05 Environmental	068154 MWL-MW6 04-14-05 Environmental	068135 MWL-BW1 04-15-05 Environmental
Bromide	9056	0.200	NE	0.251	0.378	0.394	0.230	
Chloride	9056	0.400	NE	44.9 B	79.2	69.6	26.0	
Fluoride	9056	0.100	4.0	0.867 B	0.703	0.776	0.688	
Sulfate	9056	0.800	NE	36.6 B	46.7	44.4	42.2	
Nitrate plus Nitrite, as N	353.1	0.200	10	1.94	0.787	1.08	2.82	
Alkalinity, field measurement <sup>c</sup>	HACH	1	NE	NA	295	275	192	

Refer to footnotes at end of table.

**Table 5 (Continued)**  
**General Chemistry Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

<sup>a</sup>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.

<sup>b</sup>Reporting limits may be elevated in the event an interfering component is present or if sample dilution is required.

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

B Analyte detected in the associated laboratory method blank.

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.

N Nitrogen.

NA Not analyzed.

NE Not established.

**Table 6**  
**Detected Volatile and Extractable Organic Compounds**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

Analyte			Acetone	bis(2-Ethylhexyl) phthalate
Practical Quantitation Limit (µg/L)			5.00	10.00
MCL (µg/L)			NE	NE
Sample Location	Sample Date	Sample No.	All Results in µg/L	All Results in µg/L
MWL-MW1	04-11-05	068139	5.00 U, B1	NA
MWL-MW2	04-12-05	068143	1.95 J	ND (1.90)
MWL-MW3	04-13-05	068145	5 UJ, B1, A	4.26 J
MWL-MW4	04-19-05	068149	1.44 J	NA
MWL-MW4 (Duplicate)	04-19-05	068150	2.24 J	NA
MWL-MW5	04-06-05	68152	ND (1.25)	NA
MWL-MW6	04-14-05	068154	ND (1.25)	NA
MWL-BW1	04-15-05	068135	ND (1.25)	NA

- A Laboratory control sample percent recovery exceeds acceptance criteria.
- B1 Compound also detected in the trip blank.
- CFR Code of Federal Regulations.
- EPA U.S. Environmental Protection Agency.
- 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.
- NA No analysis results reported.
- ND Not detected above the method detection limit shown in parentheses.
- NE Not established.
- U Qualified undetected in data validation above the detection limit shown.

**Table 7**  
**Radiochemical Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

Sample No.: Well ID: Sampling Date:		068139 MWL-MW1 04-11-05		
All results in pCi/L				
Analyte	MCL <sup>a</sup>	NMED-HWB <sup>b</sup> Approved Background	Results <sup>c</sup> ± TPU	MDA <sup>d</sup>
Gross Alpha	15 <sup>e</sup>	NE	6.59 ± 3.44	4.40
Gross Beta	4 (mrem/year dose)	NE	5.61 ± 1.48	2.54
Tritium	NE	NE	0.00 ± 120 U	210
Plutonium-238	NE	NE	-0.0165 ± 0.0253 U	0.042
Plutonium-239/240	NE	NE	0.00549 ± 0.0152 U	0.045
Strontium-90	NE	NE	0.236 ± 0.296 U	0.647
Uranium-235	NE	0.41	0.078 <sup>f</sup>	0.022 <sup>f</sup>
Uranium-238	NE	3.0	1.865 <sup>f</sup>	0.017 <sup>f</sup>
Sample No.: Well ID: Sampling Date:		068143 MWL-MW2 04-12-05		
Gross Alpha	15 <sup>e</sup>	NE	8.03 ± 1.45	1.21
Gross Beta	4 (mrem/year dose)	NE	7.90 ± 1.42	2.19
Tritium	NE	NE	0.00 ± 120 U	210
Plutonium-238	NE	NE	-0.0145 ± 0.0219 U	0.028
Plutonium-239/240	NE	NE	-0.00181 ± 0.0118 U	0.030
Strontium-90	NE	NE	0.0509 ± 0.232 U	0.545
Uranium-235	NE	0.41	0.091 <sup>f</sup>	0.022 <sup>f</sup>
Uranium-238	NE	3.0	2.184 <sup>f</sup>	0.017 <sup>f</sup>
Sample No.: Well ID: Sampling Date:		068145 MWL-MW3 04-13-05		
Gross Alpha	15 <sup>e</sup>	NE	7.64 ± 1.68	1.83
Gross Beta	4 (mrem/year dose)	NE	7.88 ± 2.84	4.22
Tritium	NE	NE	-76.4 ± 114 U	207
Plutonium-238	NE	NE	-0.0158 ± 0.023 U	0.034
Plutonium-239/240	NE	NE	0.00225 ± 0.0182 U	0.037
Strontium-90	NE	NE	0.142 ± 0.375 U	0.782
Uranium-235	NE	0.41	0.076 <sup>f</sup>	0.022 <sup>f</sup>
Uranium-238	NE	3.0	1.717 <sup>f</sup>	0.017 <sup>f</sup>
Sample No.: Well ID: Sampling Date:		068149 MWL-MW4 04-19-05		
Gross Alpha	15 <sup>e</sup>	NE	<b>24.5 ± 3.43</b>	1.34
Gross Alpha <sup>g</sup>	15 <sup>e</sup>	NE	11.1 ± 3.89	4.42
Gross Beta	4 (mrem/year dose)	NE	7.43 ± 1.62	2.33
Gross Beta <sup>g</sup>	4 (mrem/year dose)	NE	30.7 ± 4.51	5.56
Tritium	NE	NE	-38.5 ± 113 U	202
Uranium-235	NE	0.41	0.089 <sup>f</sup>	0.022 <sup>f</sup>
Uranium-238	NE	3.0	2.097 <sup>f</sup>	0.017 <sup>f</sup>

Refer to footnotes at end of table.

**Table 7 (Continued)**  
**Radiochemical Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

Sample No.: Well ID: Sampling Date:		068150 MWL-MW4 (Duplicate) 04-19-05		
All results in pCi/L				
Analyte	MCL <sup>a</sup>	NMED-HWB <sup>b</sup> Approved Background	Results <sup>c</sup> ± TPU	MDA <sup>d</sup>
Gross Alpha	15 <sup>e</sup>	NE	4.00 ± 1.44	1.88
Gross Beta	4 (mrem/year dose)	NE	4.23 ± 1.12	1.65
Tritium	NE	NE	0.00 ± 116 U	203
Uranium-235	NE	0.41	0.089 <sup>f</sup>	0.022 <sup>f</sup>
Uranium-238	NE	3.0	2.083 <sup>f</sup>	0.017 <sup>f</sup>
Sample No.: Well ID: Sampling Date:		068152 MWL-MW5 04-06-05		
Gross Alpha	15 <sup>e</sup>	NE	11.8 ± 2.48	3.04
Gross Beta	4 (mrem/year dose)	NE	9.29 ± 3.50	6.63
Tritium	NE	NE	-38.5 ± 117 U	209
Uranium-235	NE	0.41	0.128 <sup>f</sup>	0.022 <sup>f</sup>
Uranium-238	NE	3.0	<b>3.007<sup>f</sup></b>	0.017 <sup>f</sup>
Sample No.: Well ID: Sampling Date:		068154 MWL-MW6 04-14-05		
Gross Alpha	15 <sup>e</sup>	NE	11.8 ± 2.08	1.57
Gross Beta	4 (mrem/year dose)	NE	7.29 ± 1.30	1.91
Tritium	NE	NE	-38.8 ± 114 U	204
Uranium-235	NE	0.41	0.141 <sup>f</sup>	0.022 <sup>f</sup>
Uranium-238	NE	3.0	<b>3.155<sup>f</sup></b>	0.017 <sup>f</sup>

Refer to footnotes at end of table.

**Table 7 (Continued)**  
**Radiochemical Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

Sample No.:		068135		
Well ID:		MWL-BW1		
Sampling Date:		04-15-05		
All results in pCi/L				
Analyte	MCL <sup>a</sup>	NMED-HWB <sup>b</sup> Approved Background	Results <sup>c</sup> ± TPU	MDA <sup>d</sup>
Gross Alpha	15 <sup>e</sup>	NE	9.99 ± 1.87	1.45
Gross Beta	4 (mrem/year dose)	NE	6.12 ± 1.00	1.23
Tritium	NE	NE	-116 ± 141 U	250
Uranium-235	NE	0.41	0.093 <sup>f</sup>	0.022 <sup>f</sup>
Uranium-238	NE	3.0	2.295 <sup>f</sup>	0.017 <sup>f</sup>

Note: Values in **bold** exceed EPA MCL or NMED-HWB maximum background values.

<sup>a</sup>U.S. Environmental Protection Agency Primary Drinking Water Standards, 40 CFR Part 141, Subpart B and as revised in Subpart G.

<sup>b</sup>Dinwiddie, R.S. (New Mexico Environment Department), 1997, Letter to M.J. Zamorski, U.S. Department of Energy, "Request for Supplemental Information: Background Concentrations Report, SNL/KAFB," September 24, 1997.

<sup>c</sup>Laboratory results have a total propagated uncertainty; if the total propagated uncertainty value equals or exceeds the count value, the isotope is considered not to be present.

<sup>d</sup>MDA in pCi/L.

<sup>e</sup>Excluding uranium and radon, but including radium-226.

<sup>f</sup>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.

<sup>g</sup>Results from sample reanalysis on August 10, 2005.

CFR Code of Federal Regulations.

EPA U.S. Environmental Protection Agency.

HWB Hazardous Waste Bureau.

ID Identification.

MCL Maximum contaminant level.

MDA Minimum detectable activity.

mrem Millirem.

NE Not established.

NMED New Mexico Environment Department.

pCi/L Picocurie(s) per liter.

TPU Total propagated uncertainty.

U Laboratory qualifier indicating result is less than the MDA.

**Table 8**  
**Duplicate Sample Analysis Results**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Annual Groundwater Monitoring, April 2005**

Sample No. Sample Location	068149 MWL-MW4	068150 MWL-MW4 (Duplicate)	RPD
	Results (R <sub>1</sub> )	Results (R <sub>2</sub> )	
Parameter <sup>a</sup>	All results in mg/L, except as noted		
Arsenic (T)	0.00565 J, B	0.00623 J, B	NC
Barium (T)	0.103 B	0.104 B	1
Bromide	0.249	0.251	1
Cadmium (T)	0.000263 J	0.000263 J	NC
Calcium (T)	57.2	58.0	1
Calcium (D)	57.1	57.9	1
Chloride	49.0 B	44.9 B	9
Chromium (T)	0.00105 J	0.00125 J	NC
Cobalt (T)	0.000177 J	0.000182 J	NC
Copper (T)	0.000925 J	0.000993 J	NC
Fluoride	0.852 B	0.867 B	2
Gross Alpha	24.5 pCi/L	4.00 pCi/L	144
Gross Beta	7.43 pCi/L	4.23 pCi/L	55
Iron (T)	0.303	0.318	5
Magnesium (T)	21.2	20.3	4
Magnesium (D)	21.0	21.9	4
Manganese (T)	0.00457 J	0.00483 J	NC
Nickel (T)	0.00452	0.00489	8
Nitrate plus Nitrite, as N	1.94	1.94	0
Potassium (T)	4.81	4.94	3
Potassium (D)	4.96	4.91	1
Selenium (T)	0.00434 J, B	0.00481 J, B	NC
Sodium (T)	47.2	47.4	0
Sodium (D)	46.7	49.1	5
Sulfate	36.7 B	36.6 B	0
Uranium, Total (T)	0.00628	0.00624	1
Uranium-238 (T)	0.00624	0.0062	1
Uranium-235 (T)	0.000041 J	0.000041 J	NC
Vanadium (T)	0.0098 J	0.0101 J	NC
Zinc (T)	0.023	0.0225	2

<sup>a</sup>Parameters not detected in both samples are not listed. RPD is not calculated for estimated values.

B Analyte detected in associated laboratory method blank.

D Analysis result is on a dissolved basis. The sample was filtered in the field through a 0.45-micron, glass-fiber filter.

J Analyte detected below practical quantitation limit or reported as an estimated concentration.

mg/L Milligram(s) per liter.

N Nitrogen.

NC Not able to calculate.

pCi/L Picocurie(s) per liter.

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

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

where:

R<sub>1</sub> = analysis result

R<sub>2</sub> = duplicate analysis result

T Analysis result is on a total, unfiltered basis.

**Table 9**  
**Groundwater Elevations, Pump Setting Depths, and**  
**Monitoring Well Completion Information**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Quarterly Groundwater Sampling for Perchlorate Analysis**  
**April 2004 to February 2005**

<b>Well Number</b>	<b>Date of Measurement</b>	<b>Measurement Point Elevation (FAMSL<sup>a</sup>)</b>	<b>Depth to Water (FBTOC)</b>	<b>Groundwater Elevation (FAMSL<sup>a</sup>)</b>	<b>Total Well Depth<sup>b</sup> (FBTOC)</b>	<b>Static Water Height (feet)</b>	<b>Pump Setting Depth (FBTOC)</b>
MWL-MW1	04-12-04	5381.54	466.57	4914.97	478	11	477
MWL-MW1	08-27-04	5381.54	466.77	4914.77	478	11	478
MWL-MW1	11-12-04	5381.54	466.81	4914.73	478	11	478
MWL-MW1	02-11-05	5381.54	466.92	4914.62	478	11	478
MWL-BW1	04-13-04	5384.51	469.98	4914.53	477	7	475
MWL-BW1	08-25-04	5384.51	470.22	4914.29	477	7	474
MWL-BW1	11-08-04	5384.51	470.31	4914.20	477	7	474
MWL-BW1	02-09-05	5384.51	470.29	4914.22	477	7	474

<sup>a</sup>Measurement point is the top of well casing.

<sup>b</sup>Total well depth to bottom of sump.

FAMSL Feet above mean sea level.

FBTOC Feet below top of casing.

**Table 10**  
**Summary of Purge Volumes and Purge Indicator Measurements**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Quarterly Groundwater Sampling for Perchlorate Analysis**  
**April 2004 to February 2005**

Sample Attributes	Measurement Relative to Sampling	Purge Volume (gallons)	pH (at 25°C)	Temp (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTU)	E <sub>h</sub> (mV)	DO (% Sat)
MWL-MW1 <sup>a</sup> Date purge began: 04-12-04 Date sampled: 04-16-04	Before sampling:	28	7.69	16.88	666	6.04	230.2	71.9
		33	7.80	19.63	670	6.24	223.9	69.4
		35	7.83	19.90	669	6.59	222.9	68.1
	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL-MW1 <sup>a</sup> Date purge began: 08-27-04 Date sampled: 08-31-04	Before sampling:	25	8.10	18.86	540	4.30	170.3	75.6
		28	8.21	20.08	539	6.14	169.3	73.3
		31	8.19	20.55	538	6.78	170.1	76.5
	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL-MW1 <sup>a</sup> Date purge began: 11-12-04 Date sampled: 11-16-04	Before sampling:	30	7.73	16.46	522	4.33	230.4	75.2
		32	7.73	17.32	524	6.92	221.3	74.0
		34	7.73	17.62	523	8.91	215.7	73.2
	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL-MW1 <sup>a</sup> Date purge began: 02-11-05 Date sampled: 02-21-05	Before sampling:	25	7.67	10.52	541	32.2	183.0	98.5
		29	7.69	14.99	570	14.1	178.6	68.3
		33	7.65	17.00	568	9.23	172.1	73.0
	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL- BW1 <sup>a</sup> Date purged: 04-13-04 Date sampled: 04-20-04	Before sampling:	13.5	8.05	17.51	697	4.32	317	67.8
		14.5	8.05	17.73	698	4.19	316	67.0
		15.5	8.06	17.73	695	4.08	313	71.6
	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL- BW1 <sup>a</sup> Date purged: 08-25-04 Date sampled: 09-01-04	Before sampling:	8	9.11	16.49	3	1.46	184.2	69.1
		10	7.83	16.61	467	1.17	169.4	83.1
		11	7.81	17.4	518	0.99	157.3	83.6
	After sampling:	NM	NM	NM	NM	NM	NM	NM

Refer to footnotes at end of table.

**Table 10 (Continued)**  
**Summary of Purge Volumes and Purge Indicator Measurements**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Quarterly Groundwater Sampling for Perchlorate Analysis**  
**April 2004 to February 2005**

Sample Attributes	Measurement Relative to Sampling	Purge Volume (gallons)	pH (at 25°C)	Temp (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTU)	E <sub>h</sub> (mV)	DO (% Sat)
MWL-BW1 <sup>a</sup> Date purge began: 11-08-04	Before sampling:	10	5.68	14.61	2	0.37	267.6	77.6
		12	6.83	13.88	112	0.87	252.7	97.3
		14	8.02	14.06	504	0.74	234.8	68.8
Date sampled: 11-15-04	After sampling:	NM	NM	NM	NM	NM	NM	NM
MWL- BW1 <sup>a</sup> Date purge began: 02-09-05	Before sampling:	6	7.42	15.02	529	0.91	201.2	61.7
		8	8.64	11.88	546	16.9	128.2	92.6
		9	8.21	15.83	543	NM	147.6	68.8
Date sampled: 02-16-05	After sampling:	NM	NM	NM	NM	NM	NM	NM

<sup>a</sup>Wells were purged to dryness. Purge volumes show total gallons removed prior to sampling.

°C Degrees Celsius.  
DO Dissolved oxygen.  
E<sub>h</sub> 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 11**  
**Perchlorate Analysis Results, EPA Method 314.0**  
**Mixed Waste Landfill, Sandia National Laboratories/New Mexico**  
**Quarterly Groundwater Sampling**  
**April 2004 to April 2005**

			Analyte
			Perchlorate
			0.012
			NE
Sample Location	Sample Date	Sample No.	All Results in mg/L
MWL-MW1	04-16-04	64694	ND (0.004)
MWL-MW1	08-31-04	65695	ND (0.004)
MWL-MW1	11-16-04	66268	ND (0.004)
MWL-MW1	02-21-05	66940	ND (0.004)
MWL-MW1	04-11-05	68139	ND (0.004)
MWL-BW1	04-20-04	64707	ND (0.004)
MWL-BW1	09-01-04	65696	ND (0.004)
MWL-BW1	11-15-04	66267	ND (0.004)
MWL-BW1	02-16-05	66939	ND (0.004)
MWL-BW1	04-15-05	68135	ND (0.004)
MWL-MW2	04-12-05	68143	ND (0.004)
MWL-MW6	04-14-05	68154	ND (0.004)

CFR Code of Federal Regulations.

EPA U.S. Environmental Protection Agency.

MCL Maximum Contaminant Level, U.S. Environmental Protection Agency Drinking Water Standards, 40 CFR 141, Subparts B and as revised in Subpart G.

mg/L Milligram(s) per liter.

ND Not detected above the method detection limit shown in parentheses.

NE Not established.

DISTRIBUTION:

1 MS-0750 J. Peace, 6116  
1 MS-1089 F. Nimick, 6140  
1 MS-1087 D. Stockham, 6146  
1 MS-1089 D. Fate, 6147  
1 MS-1089 T. Goering, 6147  
1 MS-1042 F. Lauffer, 10331  
1 MS-1042 S. Hwang, 10331  
1 MS-1087 T. Jackson, 6146  
1 MS-0184 J. Gould, DOE/OKSO  
1 MS-0779 K. Wahi (GRAM, Inc.), 6147  
1 MS-1089 M. Goodrich (Shaw Environmental, Inc.)  
1 MS-1089 M. Lyon (Shaw Environmental, Inc.)  
  
2 MS-9018 Central Technical Files, 8945-1  
2 MS-0899 Technical Library, 9616