National Nuclear Security Administration
Sandia Field Office
P. O. Box 5400
Albuquerque, NM 87185

MAR 26 2013

Mr. John E. Kieling
Manager
Permits Management Program
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Dr. East, Bldg 1
Santa Fe, NM 87505

Subject: Submittal of Chemical Waste Landfill Annual Post-Closure Care Report, Calendar Year 2012, Chemical Waste Landfill Post-Closure Care Permit for the National Nuclear Security Administration, Sandia National Laboratories/New Mexico, Environmental Protection Agency Identification Number NM5890110518

Dear Mr. Kieling:

The Department of Energy and Sandia Corporation are submitting the *Chemical Waste Landfill Annual Post-Closure Care Report, Calendar Year 2012*, dated March 2013, to the New Mexico Environment Department. This submittal is required by Part 2, Section 2.6.3, of the Chemical Waste Landfill (CWL) Post-Closure Care Permit.

This document is comprised of a main report and four annexes that provide information for post-closure care activities conducted at the CWL during Calendar Year 2012. The report and supporting documentation satisfy requirements listed in Permit Attachment 1, Sections 1.9 and 1.12.

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

Sincerely,

Geoffrey L. Beausoleil
Manager

Enclosure

cc:
See Page 2

cc w/enclosure:
William Moats
Hazardous Waste Bureau
New Mexico Environment Department
5500 San Antonio Dr. NE
Albuquerque, NM 87109

Brian Salem
Hazardous Waste Bureau
New Mexico Environment Department
5500 San Antonio Dr. NE
Albuquerque, NM 87109

Thomas Skibitski, NMED/DOE/OB, MS-1396
Records Center, SNL/NM, MS-0651 (electronic copy only)
John Weckerle, SFO/ESH, MS-0184

cc w/o enclosure:
Michael Hazen, SNL/NM, MS-0143
Sidney Gutierrez, SNL/NM, MS-0725
Amy Blumberg, SNL/NM, MS-0141
Terry Cooper, SNL/NM, MS-0728
Pamela Puissant, SNL/NM, MS-0729
Anita Reiser, SNL/NM, MS-0729
Michael Mitchell, SNL/NM, MS-0718
David Rast, SFO/ESH, MS-0184
13-289-499269

Chemical Waste Landfill Annual Post-Closure Care Report, Chemical Waste Landfill Post-Closure Care Permit for Sandia National Laboratories/New Mexico, Environmental Protection Agency Identification Number NM5890110518

CERTIFICATION STATEMENT

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.

Michael W. Hazen, Vice-President
Sandia Corporation
Albuquerque, New Mexico
Operator

1 Mar 2013
Date signed

Geoffrey L. Beausoleil, Manager
U. S. Department of Energy
National Nuclear Security Administration
Sandia Field Office
Owner

26 MAR 2013
Date signed

Sandia National Laboratories

CHEMICAL WASTE LANDFILL
ANNUAL POST-CLOSURE CARE REPORT
CALENDAR YEAR 2012

SANDIA NATIONAL LABORATORIES, NEW MEXICO
LONG-TERM STEWARDSHIP
CHEMICAL WASTE LANDFILL POST-CLOSURE CARE PERMIT

MARCH 2013

U.S. DEPARTMENT OF ENERGY

United States Department of Energy
Sandia Field Office

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ANNUAL CHEMICAL WASTE LANDFILL POST-CLOSURE CARE REPORT CALENDAR YEAR 2012

Facility: Chemical Waste Landfill

Location: Sandia National Laboratories
Albuquerque, New Mexico

EPA ID No.: NM5890110518

Permit Basis: Chemical Waste Landfill Post-Closure Care Permit, issued October 15, 2009, effective June 2, 2011, and subsequently modified.

Owner: United States Department of Energy
Sandia Field Office
Technical Contact: Mr. John Weckerle, Long-Term Stewardship
U.S. Department of Energy, Sandia Field Office
P.O. Box 5400/MS 0184
Albuquerque, NM 87185-5400
(505) 845-6026
John.Weckerle@nnsa.doe.gov

Operator: Sandia Corporation
Technical Contact: Ms. Pamela Puissant, Manager
Long-Term Stewardship
Sandia National Laboratories
P.O. Box 5800/MS 0730
Albuquerque, NM 87185-1042
(505) 844-3185
pmpuiss@sandia.gov

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ACRONYMS AND ABBREVIATIONS

AOP	administrative operating procedure
bgs	below ground surface
CAMU	Corrective Action Management Unit
CFR	Code of Federal Regulations
CWL	Chemical Waste Landfill
CY	Calendar Year
DO	dissolved oxygen
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
ET	Evapotranspirative
FOP	field operating procedure
gpm	gallons per minute
KAFB	Kirtland Air Force Base
LCL	lower confidence limit
LE	Landfill Excavation
MDL	method detection limit
µg/L	micrograms per liter
mg/L	milligrams per liter
NMED	New Mexico Environment Department
NTU	nephelometric turbidity units
OB	Oversight Bureau
OLS	Ordinary least squares
ORP	oxidation-reduction potential
P&A	plug and abandonment
PCCP	Post-Closure Care Permit
pH	Potential of hydrogen (negative logarithm of the hydrogen ion concentration)
PQL	practical quantitation limit
QC	quality control
RL	reporting limit
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SC	specific conductance
SNL/NM	Sandia National Laboratories, New Mexico
TCE	trichloroethene (also trichloroethylene)
UCL	upper confidence limit
VCM	Voluntary Corrective Measure
VE	Vapor Extraction
VOC	volatile organic compound

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1.0 INTRODUCTION

Sandia National Laboratories (SNL) is a multi-purpose engineering and science laboratory owned by the U.S. Department of Energy/National Nuclear Security Administration (DOE) and operated by Sandia Corporation (Sandia), a subsidiary of Lockheed Martin.

The Chemical Waste Landfill (CWL) at SNL/New Mexico (SNL/NM) is a remediated interim status landfill that has undergone closure in accordance with Title 20, Chapter 4, Part 1 of the New Mexico Administrative Code (20.4.1.600 NMAC), incorporating Title 40, Code of Federal Regulations, Part 265, (40 CFR 265) Subpart G and the CWL Final Closure Plan (Closure Plan) (SNL/NM December 1992 and subsequent revisions). The CWL Post-Closure Care Permit (PCCP) (NMED October 2009), which became effective June 2, 2011 (Kieling June 2011) and has subsequently been modified, defines all post-closure requirements. Table 1-1 summarizes the modification history of the PCCP through 2012.

Table 1-1
Chemical Waste Landfill Post-Closure Care Permit Modification History

Date of Modification[a]	Affected Parts of PCCP	Description of Modification
September 26, 2011	Attachment 6 (Contingency Plan)	Updates to emergency response agreements, equipment, emergency coordinators, and inclusion of an evacuation route and assembly point figure and updated figure list.
November 16, 2011	Attachment 6 (Contingency Plan)	Correction of a typographical error in the telephone number for an emergency coordinator.
February 20, 2012	Attachments 1-5	Allowing use of equivalent soil-gas passive venting devices and alternate method for analysis of soil-gas samples; clarification of cover inspection and repair specifications; updates to three figures for well locations; revisions to groundwater purging and stability requirements; inclusion of well completion diagrams for the four groundwater monitoring wells, updates to the list of operating procedures; clarification of soil-gas purging requirements; format updates to inspection forms; and correction of typographical errors

Notes:
[a]Date represents the effective date of modification

1.1 Purpose and Scope

The purpose of this CWL Annual Post-Closure Care Report is to document monitoring, inspection, maintenance, and repair activities conducted during calendar year (CY) 2012 in accordance with Attachment 1 of the CWL PCCP (NMED October 2009 and subsequent revisions). This annual report documents PCCP activities conducted from January through December 2012 and fulfills the CWL PCCP requirement for annual reporting to the New Mexico Environment Department (NMED).

The CWL PCCP requires monitoring and inspection activities that must be documented and reported for each CY. Monitoring activities include semi-annual groundwater monitoring for specific volatile organic compounds (VOCs) and metals, and annual vadose zone soil-gas monitoring for specific VOCs. Inspection activities are required for the following components: final cover (vegetation and surface); storm-water diversion structures; monitoring networks and sampling equipment (groundwater and soil-gas); and security fence, locks, gates, signage, and survey monuments. The CWL final cover is a vegetative at-grade soil cover, or evapotranspirative (ET) cover.

The scope of this report includes documentation of all monitoring and inspection activities for CY 2012, the first full CY of activities under the CWL PCCP. Monitoring and inspections performed during this time period were:

- Two semi-annual groundwater monitoring events.
- One annual soil-gas monitoring event.
- Two semi-annual inspections of the groundwater monitoring network and sampling equipment.
- One annual inspection of the soil-gas monitoring network and sampling equipment.
- One annual inspection of final cover vegetation (i.e., biology inspection of the ET Cover).
- Four quarterly inspections of the final cover surface (i.e., physical features excluding the vegetation covered in the biology inspection), storm-water diversion structures, fence, locks, gates, signs, and survey monuments.

This CY 2012 report is organized as follows:

- Chapter 1 presents background information, purpose and scope, and report organization.
- Chapter 2 provides a description of the final cover system, compliance monitoring system (groundwater and soil-gas), storm-water diversion structures, and security fence (fence, locks, gate, signage, and survey monuments).
- Chapter 3 presents monitoring and inspection, maintenance, and repair requirements.
- Chapter 4 presents groundwater monitoring activities and results.
- Chapter 5 presents soil-gas monitoring activities and results.
- Chapter 6 presents inspection, maintenance, and repair activities and results.
- Chapter 7 summarizes regulatory activities.

- Chapter 8 presents a general summary and conclusions for the 2012 reporting period.
- Chapter 9 lists the references cited in this report.

Annexes are provided that include CY 2012 supporting information as follows:

- Annex A – Groundwater Monitoring Forms and Reports
- Annex B – Soil-Gas Monitoring Forms and Reports
- Annex C – Post-Closure Inspection Forms
- Annex D – Chemical Waste Landfill Biology Report

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2.0 CHEMICAL WASTE LANDFILL POST-CLOSURE CARE CONDITIONS

The CWL is a 1.9-acre remediated interim status landfill located in the southeastern corner of SNL/NM Technical Area III (Figures 2-1 and 2-2) undergoing post-closure care in accordance with the CWL PCCP (NMED October 2009 and subsequent revisions). From 1962 until 1981, the CWL was used for the disposal of chemical and solid waste generated by SNL research activities. Additionally, a small amount of radioactive waste was disposed of during the operational years. Disposal of liquid waste in unlined pits and trenches ended in 1981, and after 1982 all liquid waste disposal was terminated. From 1982 through 1985, only solid waste was disposed of at the CWL, and after 1985 all waste disposal ended. The CWL was also used as a hazardous waste drum-storage facility from 1981 to 1989. A summary of the CWL disposal history is presented in the Closure Plan (SNL/NM December 1992) along with a waste inventory based upon available disposal records and information.

Two voluntary corrective measures (VCMs) were conducted at the CWL. The CWL Landfill Excavation (LE) Voluntary Corrective Measure (VCM) was conducted from September 1998 through February 2002. Soil-vapor extraction was also conducted as a VCM from 1997 through 1998 prior to the LE VCM to reduce the concentrations of VOC soil vapor in the vadose zone, control the VOC soil-gas plume, and to reduce groundwater trichloroethene (TCE) concentrations below the regulatory standard of 5 micrograms per liter (µg/L). All former disposal areas were excavated during the LE VCM and groundwater TCE concentrations have been below the regulatory standard since completion of the Vapor Extraction (VE) VCM in 1998. Approximately 52,000 cubic yards of contaminated soil and debris were removed during the LE VCM.

Additional information on CWL current conditions can be found in the CWL Final RCRA Closure Report for the CWL (SNL/NM, September 2010), the CWL PCCP (NMED, October 2009 and subsequent revisions), and the CWL Corrective Measures Study Report (SNL/NM, December 2004). Detailed information on residual soil contamination at the CWL can be found in Part 3, Section 3.1 and Table 3-1 of the CWL PCCP (NMED October 2009 and subsequent revisions).

The following sections summarize information on the physical characteristics of the CWL, including the final cover system, compliance monitoring system, storm-water diversion structures, and security fence. More detailed information is provided in the CWL PCCP Attachment 1, Section 1.3 through 1.6, respectively.

2.1 Final Cover System

The CWL final cover is a centrally crowned “at-grade” ET Cover designed to minimize infiltration of moisture into the former disposal area and to minimize long-term maintenance consistent with 40 CFR 264.111(a). The crown of the cover slopes to the north and south at a 1-percent grade, and east to west at a 3-percent grade to minimize erosion losses and control run-on/run-off. The ET Cover consists of two discrete layers; a 3-foot-thick native soil layer installed from 4 feet below ground surface (bgs) to 1 foot bgs, and a topsoil layer (approximately 1.5-feet thick) installed from 1 foot bgs to the local grade. The topsoil layer was revegetated with

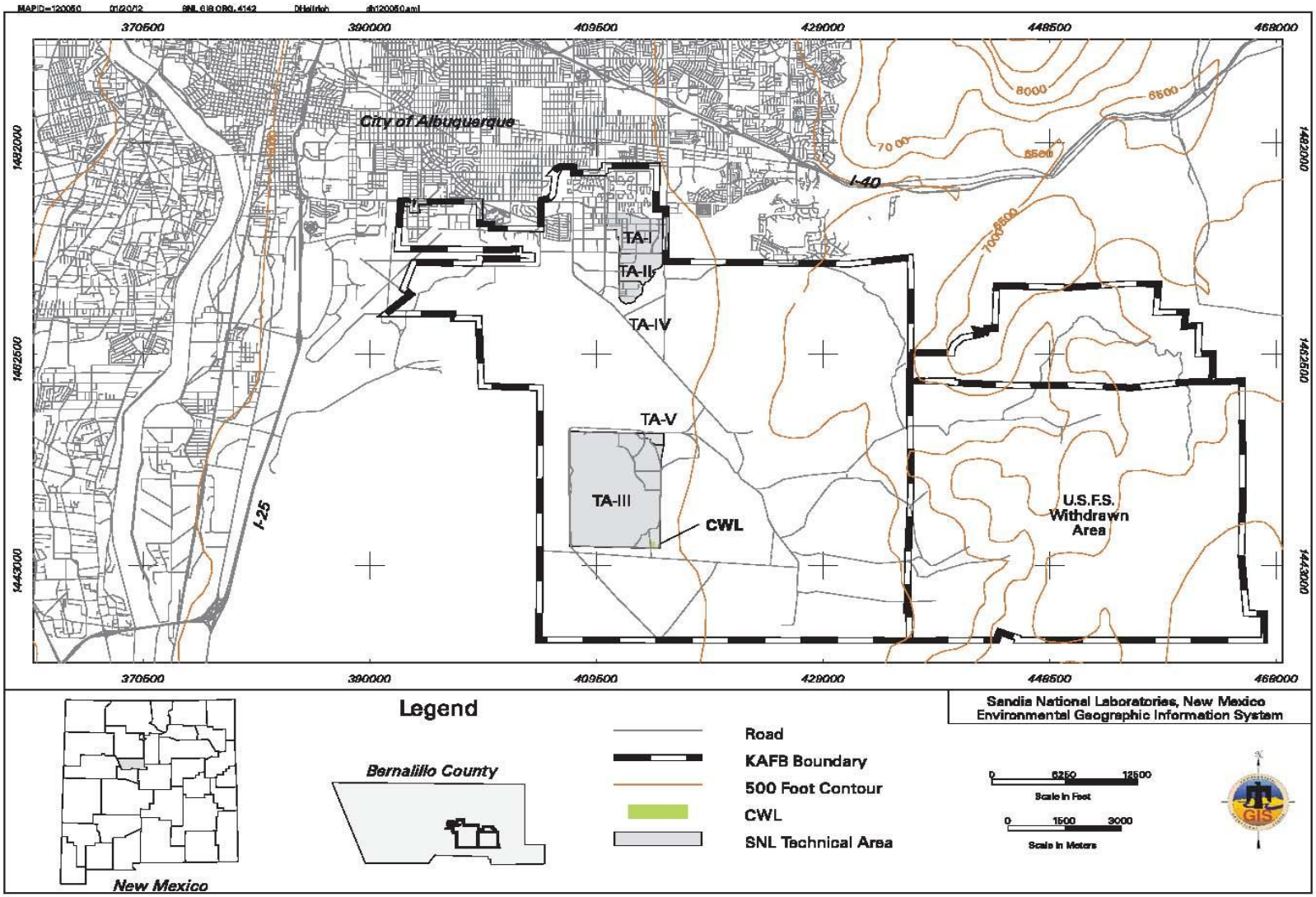

Figure 2-1
Location of the Chemical Waste Landfill with respect to Kirtland Air Force Base and the City of Albuquerque

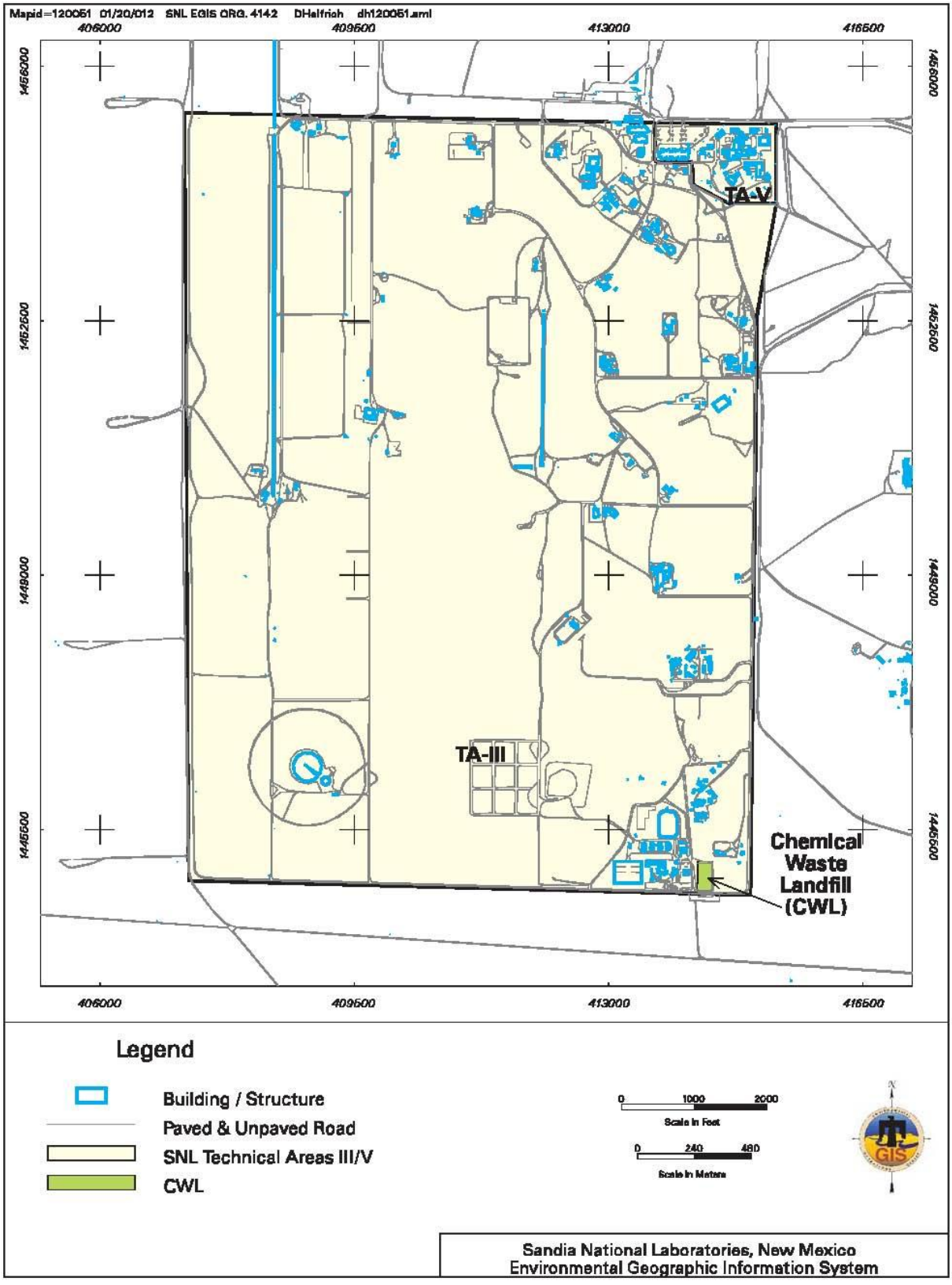

Figure 2-2
Location of the Chemical Waste Landfill within Technical Area III

native plants according to the specifications contained in the Remedial Action Proposal, Annex I, CMS Report (SNL/NM December 2004). Figure 2-3 shows a conceptual schematic profile of the ET Cover and Figure 2-4 shows the central crown and surface drainage patterns.

2.2 Compliance Monitoring System

The compliance monitoring system includes a groundwater monitoring well network and a soil-gas-monitoring well network, which are described in the following sections.

2.2.1 Groundwater Monitoring Network

Groundwater monitoring is performed to ensure the protection of groundwater during the compliance and post-closure care periods. The CWL groundwater monitoring network consists of four NMED-approved monitoring wells that monitor the uppermost part of the regional aquifer in accordance with the requirements of 40 CFR 264.99. The four wells are described below and their locations are shown in Figure 2-4.

- One hydraulically upgradient background well – CWL-BW5, and
- Three hydraulically downgradient compliance wells – CWL-MW9, CWL-MW10, and CWL-MWL11.

Well-completion diagrams for all of the groundwater monitoring wells are provided in Attachment 2 of the CWL PCCP (NMED October 2009 and subsequent revisions).

2.2.2 Soil-Gas Monitoring Network

The soil-gas monitoring network is designed to ensure the protection of groundwater quality by providing early detection data to determine whether the VOC soil-gas plume has the potential to contaminate groundwater at concentrations exceeding regulatory concentration limits. The five multiport wells, shown in Figure 2-4, are designed to monitor the vadose zone at various depths beneath the CWL in the area most contaminated by past disposal of organic liquid waste. The wells and their depth-specific sampling ports are as follows:

- D1 – Sampling Ports at 100, 160, 240, 350, and 470 feet bgs (5 ports)
- D2 – Sampling Ports at 120, 240, 350, 440, and 470 feet bgs (5 ports)
- D3 – Sampling Ports at 120, 170, 350, 440, and 480 feet bgs (5 ports)
- U11 – Sampling Ports at 40, 80, and 120 feet bgs (3 ports)
- U12 – Sampling Ports at 36, 76, and 136 feet bgs (3 ports)

Well-completion diagrams for all of the soil-gas monitoring wells are provided in Attachment 3 of the CWL PCCP (NMED October 2009 and subsequent revisions).

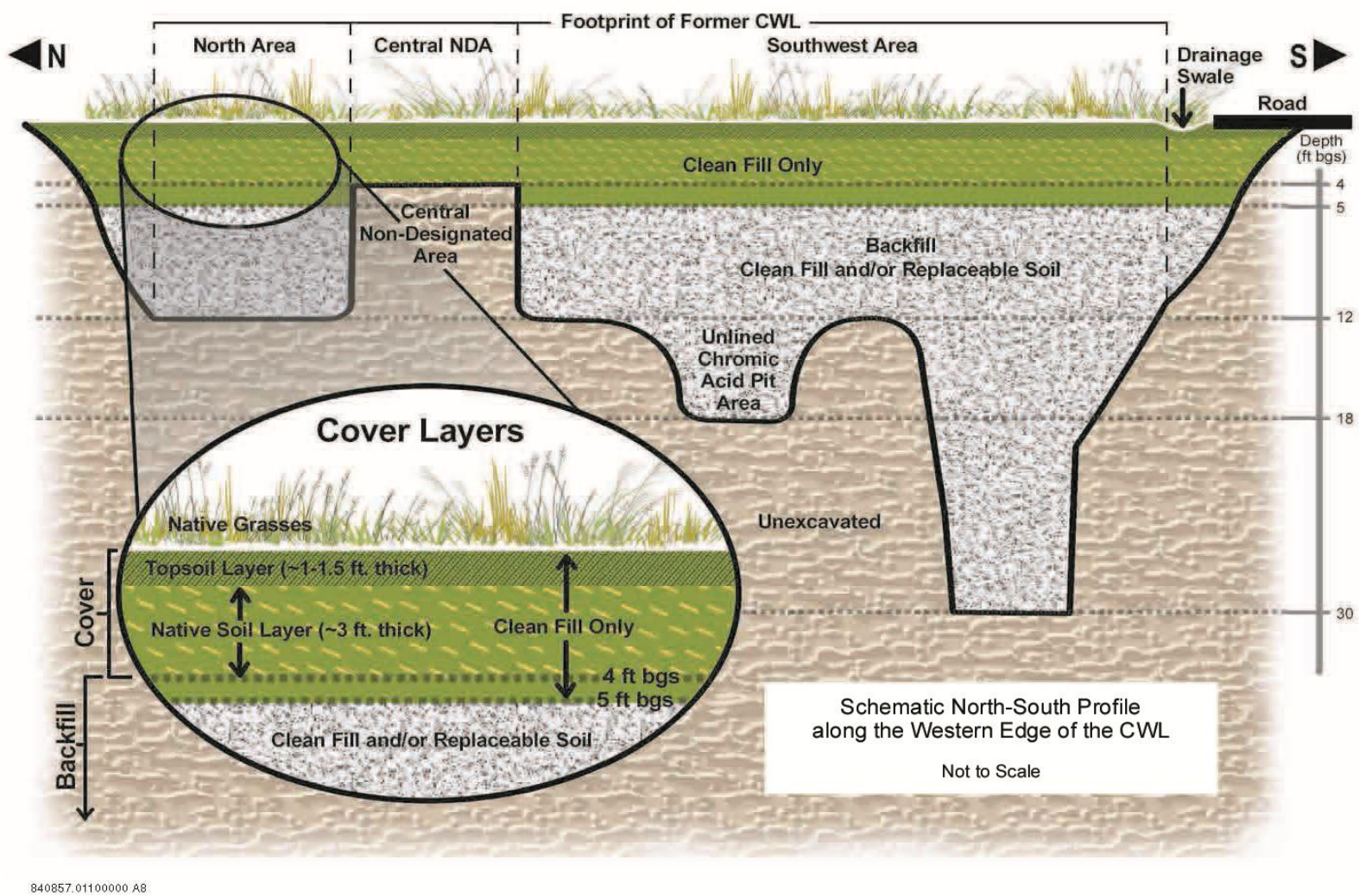

Figure 2-3
Schematic Profile of the Chemical Waste Landfill Evapotranspirative Cover

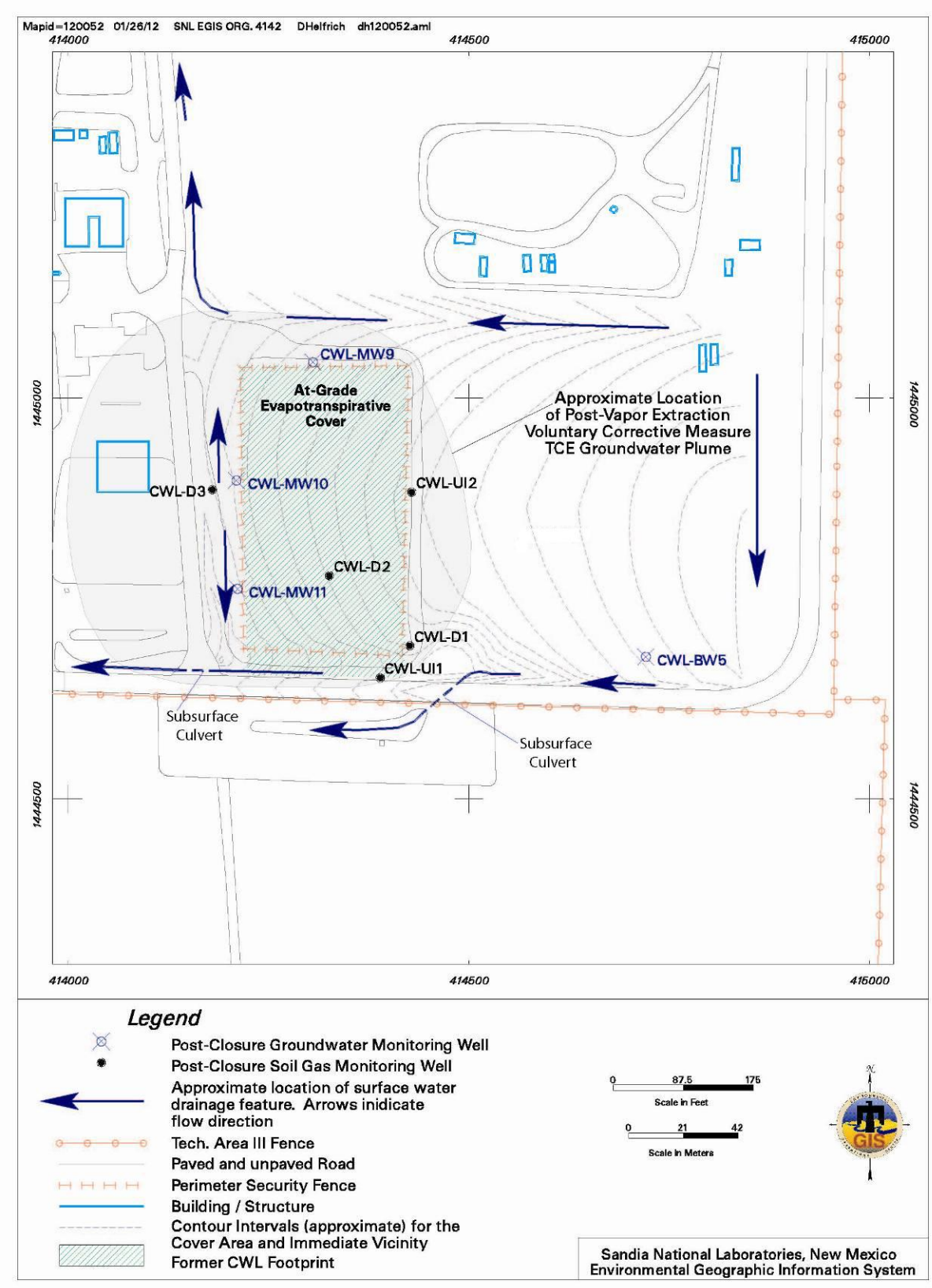

Figure 2-4
Chemical Waste Landfill Surface Drainage Patterns and Monitoring Networks

2.3 Storm-Water Diversion Structures

The function of the storm-water diversion features associated with the CWL is to minimize soil erosion caused by storm-water run-on and run-off and to reduce the amount of water that could potentially percolate into the former disposal area. Drainage features designed to control surface-water run-on and run-off are shown in Figure 2-4 and include: ET Cover surface topography/slopes that direct water away from and off the ET Cover surface; road ditches; boundary swales; and two ditch drainage culverts at the southeastern and southwestern corners of the CWL that divert surface-water from the road ditch away from the CWL. The slight northeast and southeast inflection of the surface topography to the east of the ET Cover prevents significant run-on by directing the upgradient surface water toward the northern and southern boundary swales. Precipitation that falls directly on the ET Cover is diverted toward the boundary swales that intersect at the northwestern and southwestern corners of the site; its impact is minimized by the native vegetation, the central crown, and gently sloping topography (approximately 3-percent grade from east to west) of the ET Cover surface.

2.4 Security Fence

The perimeter security fence location is shown in Figure 2-4. It is a four-strand, barbed-wire fence with two gates. The gates remain locked except during inspections, maintenance, and monitoring activities. Only authorized personnel control the keys to the locks. Warning signs are posted on all sides of the CWL fence at 100-foot intervals and at the gates.

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3.0 MONITORING AND INSPECTION REQUIREMENTS

Monitoring, inspection, maintenance, and repair requirements are defined in the CWL PCCP Attachment 1 (NMED October 2009 and subsequent revisions) and briefly summarized in this chapter. Monitoring requirements include groundwater and soil-gas, which generate empirical data that are evaluated to assess site conditions over the compliance and post-closure care periods. Inspection requirements apply to the final cover, storm-water diversion structures, compliance monitoring system, and security fence. Emergency equipment required by the CWL Contingency Plan (CWL PCCP Attachment 6) is also subject to routine inspections. Maintenance and/or repairs are performed based upon the inspections. Inspection, maintenance, and repair are performed to ensure the adequate performance of the ET Cover, monitoring networks, and surface features throughout the post-closure care period.

Monitoring and inspection activities were conducted in January and July in accordance with CWL PCCP Attachment 5. Results of CY 2012 monitoring and inspection activities are presented in Chapters 4.0, 5.0, and 6.0. The following sections provide information specific to the requirements for each type of monitoring under the PCCP.

3.1 Monitoring Requirements

The frequency, parameters/constituents of concern, and methods for groundwater and soil-gas monitoring are summarized in Table 3-1. The groundwater and soil-gas monitoring networks are described in Section 2.2.1 and 2.2.2 respectively. The groundwater and soil-gas monitoring requirements are detailed in CWL PCCP Attachment 1, Section 1.8. Sampling and analysis plans (SAPs) in CWL PCCP Attachments 2 and 3, respectively, describe the procedures, methods, and analytical protocols for collecting and analyzing groundwater and soil-gas samples.

Table 3-1
Chemical Waste Landfill Groundwater and
Soil-Gas Monitoring Frequency, Parameters, and Methods

Monitoring System	Monitoring Frequency	Monitoring Parameters/ Constituents of Concern	Monitoring Method
Groundwater	Semi-Annually[a]	TCE by EPA Method 8260[b] and Cr and Ni by EPA Methods 6020[a]	Sampling and Analysis per CWL PCCP Attachment 2
Soil Gas	Annually	Compendium Method TO-14 VOCs[c] or equivalent[d]	Sampling and Analysis per CWL PCCP Attachment 3

Notes:
[a]Semi-Annually: An enhanced list of constituents must be analyzed on an annual basis (see Section 1.8.1.1 of PCCP Attachment 1).
[b]EPA November 1986.
[c]EPA January 1999. See Table 1-5 in PCCP Attachment 1 for the list of the TO-14 VOCs.
[d]Use of an analytical method equivalent to TO-14, such as EPA Method TO-15, was approved by NMED in February 2012 as part of a PCCP modification (Kieling February 2012).
EPA = U.S. Environmental Protection Agency.
TO-14 = EPA Method TO-14.

For groundwater monitoring, one semi-annual sampling event must include analysis of all environmental samples for TCE, chromium, and nickel. For the other semi-annual event, analysis of all environmental samples for an enhanced list of constituents comprised of 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), tetrachlorethene (PCE), 1,1-dichloroethene (1,1-DCE), chloroform, and trichlorofluoromethane (Freon 11), in addition to TCE, chromium, and nickel, is required. Groundwater surface elevation must be measured each time groundwater is sampled and the groundwater flow rate, hydraulic gradient, and flow direction must be determined at least annually.

Soil-gas monitoring must be performed annually in accordance with the Soil-Gas SAP (CWL PCCP Attachment 3) using U.S. Environmental Protection Agency (EPA) Compendium Method TO-14 (EPA January 1999) or equivalent (i.e., such as the newer method TO-15) to ensure the collection of data in a manner consistent with historic soil-gas monitoring. Consistency in sampling and analysis is necessary so that results can be evaluated over time to determine changes/trends in soil-gas concentrations.

3.2 Inspection, Maintenance, and Repair Requirements

Inspection requirements for the final cover system, storm-water diversion structures, compliance monitoring system, security fence, and emergency equipment are briefly summarized in this section and detailed in CWL PCCP Attachment 1, Section 1.9. All inspections were performed by personnel who meet the qualification and training requirements of CWL PCCP Attachment 5. The schedule for implementing inspections and prescribed maintenance and/or repairs is provided in CWL PCCP Attachment 1, Section 1.10, Table 1-6. Maintenance and/or repairs are performed as needed based upon the inspections.

3.2.1 Final Cover System Inspection/Maintenance/Repair Requirements

Inspection of the final cover includes vegetation inspection and monitoring by the staff biologist (i.e., biology inspection) and cover inspection by a field technician.

3.2.1.1 Vegetation Inspection and Monitoring

Achieving a sustainable native plant community on the final cover is an important component of overall ET Cover performance. Vegetation minimizes erosion by stabilizing the ET Cover surface and by moving soil moisture from the ET Cover to the atmosphere through transpiration.

Cover vegetation monitoring is to be accomplished in a two-phase approach. The first phase concentrates on establishing the vegetation on the ET Cover from seed to a mature plant community such that successful revegetation criteria (defined in CWL PCCP Attachment 1 Section 1.9) are met. These criteria are provided below.

- Total percent foliar coverage equals 20 percent (i.e., 20 percent of the land surface is covered with living plants versus 80 percent bare surface area;
- Of the 20 percent total foliar coverage, 50 percent or greater comprises native perennial species, and 50 percent or less comprises annual species; and

- No contiguous bare spots greater than 200 square feet (approximately 14 by 14 feet) are present.

During this first phase of vegetation inspection and monitoring a staff biologist must inspect and document the inventory of the main flora populating the cover on a quarterly basis. These inspections are to be documented on the Biology Inspection Form/Checklist (CWL PCCP Attachment 4) and include inspecting the cover for contiguous areas lacking vegetation in excess of 200 square feet, signs of animal intrusion, and deep-rooted plants. Any repairs required by the inspection to address vegetation parameters not meeting CWL PCCP specifications are to be performed as described in Section 3.2.1.3. At the end of each CY, the staff biologist must compile the results of the quarterly inspections, summarize local climate trends, and present recommendations in a summary report that will be included in the annual CWL post-closure care report submitted to NMED.

Once successful revegetation criteria are met, the second phase of cover vegetation inspection and monitoring begins. During this phase the staff biologist inspection frequency changes to annual. The biology inspection is to occur near the end of the growing season (August-September) to most accurately determine the coverage of living plants. As with the first phase, the inspection is to be documented on the Biology Inspection Form/Checklist (CWL PCCP Attachment 4), include inspection results for the same parameters as the first phase of inspection, and be documented in a summary report along with a summary of local climate trends and recommendations.

3.2.1.2 Cover Inspection Requirements

Cover inspections are required to be performed by a field technician on a quarterly basis to assess the physical integrity of the ET Cover. Settlement of the cover surface in excess of 6 inches, erosion of the cover soil in excess of 6 inches deep, areas of ponding water, animal intrusion burrows in excess of 4 inches in diameter, contiguous areas lacking vegetation in excess of 200 square feet, and any other conditions that may impact the cover integrity must be documented on the Post-Closure Inspection Form/Inspection Checklist (CWL PCCP Attachment 4). During the first phase of quarterly cover vegetation monitoring described in Section 3.2.1.1, documentation of animal intrusion burrows in excess of 4 inches in diameter and contiguous areas lacking vegetation in excess of 200 square feet are addressed on the Biology Inspection Form/Checklist. During the second phase of annual cover vegetation monitoring, these inspection parameters must be noted by the field technician on the Post-Closure Inspection Form/Checklist.

3.2.1.3 Cover Repairs

Cover damage exceeding CWL PCCP specifications is required to be repaired within 60 days to a condition that meets or exceeds the original design. However, repairs to fix inadequate cover vegetation may be delayed until the appropriate growing season if approved by NMED in advance, and if measures are taken as needed to prevent excessive erosion of the ET Cover during the delay period. Repairs to the cover are to be completed using materials consistent with the cover installation specifications in accordance with PCCP Attachment 1, Section 1.9.1.3.

3.2.2 Storm-Water Diversion Structure Inspection Requirements

Inspection of the storm-water diversion structures is required on a quarterly basis to verify structural integrity and to ensure adequate performance. This inspection is to be performed at the same time as the cover inspection. Erosion of the channels or sidewalls in excess of 6 inches deep, accumulations of silt greater than 6 inches deep, or debris that block more than one-third of the channel width must be documented on the Post-Closure Inspection Form/Inspection Checklist. Repairs, if needed, will be completed within 60 days.

3.2.3 Monitoring Well Network Inspection Requirements

Inspection of monitoring wells and sampling equipment is required at the same frequency as the associated monitoring, and is to be performed concurrently with all groundwater and soil-gas monitoring events. Inspections must address the condition of the components including protective casings and bollards, wellhead covers/caps/locks, soil-gas sampling ports, well identification markings, and passive venting BaroBalls™ or equivalent devices. Sampling pumps and sample tubing are inspected during each sampling event (pumps are not dedicated to the wells). Pump replacement and maintenance/repair, and tubing replacement are performed on an as-needed basis based upon pump and tubing performance, inspections, and review of analytical sampling results. Excessive accumulation of wind-blown plants and debris that would interfere with any of the groundwater or soil-gas monitoring network components will also be addressed and removed during these inspections within 60 days.

3.2.4 Security Fence Inspection Requirements

Inspection of the fence, gates, locks, and warning signs at the CWL is required on a quarterly basis and is to be performed at the same time as the cover inspection. The condition of the fence, including fence wires, posts, gates, gate locks, and warning signs, is to be inspected and documented on the Post-Closure Inspection Form/Inspection Checklist. Excessive accumulations of wind-blown plants and debris on the fence that would obscure warning signs or block access to the CWL will be addressed during the inspection and removed within 60 days. Local survey monuments must also to be inspected and excess soil and/or vegetation covering these features will be removed within 60 days.

3.2.5 Emergency Equipment Inspection Requirements

Inspection of emergency equipment is required to be performed on a quarterly basis. Emergency equipment is maintained at the nearby Corrective Action Management Unit (CAMU) for use at the CWL, if necessary. A list of emergency equipment and its location is provided in CWL PCCP Attachment 6, Table 6-4.

4.0 GROUNDWATER MONITORING RESULTS

This chapter presents groundwater monitoring activities (i.e., sampling and analysis), analytical results, and data evaluation for CY 2012 in accordance with CWL PCCP Attachment 1, Sections 1.8 and 1.12, and Attachment 2. Groundwater sampling field activities are described in Section 4.1, analytical laboratory results and a discussion of data quality are presented in Section 4.2, data evaluation requirements and results are presented in Section 4.3, and hydrogeologic information on the regional aquifer is presented in Section 4.4. A summary of groundwater monitoring activities and results is provided in Section 8.1.

4.1 Groundwater Sampling Field Activities

This section describes groundwater monitoring activities conducted at the CWL in conformance with the CWL Groundwater SAP, PCCP Attachment 2 (NMED October 2009 and subsequent revisions) that describes the procedures, methods, and analytical protocols for collecting and analyzing groundwater samples. The data quality objective (DQO) for groundwater monitoring is to collect accurate and defensible data of high quality to determine the concentrations of hazardous constituents in the groundwater in the uppermost aquifer underlying the CWL. Field forms and documentation that address calibration of equipment, well purging and water quality measurements, and equipment decontamination activities are provided in Annex A of this report and filed in the SNL/NM Records Center.

CY 2012 was the first full year of monitoring under the CWL PCCP and included two semi-annual groundwater sampling events described in detail in the following paragraphs.

First Semi-Annual Sampling Event – January 17-23, 2012
Groundwater samples were collected from monitoring wells CWL-BW5, CWL-MW9, CWL-MW10, and CWL-MW11. Samples collected from all wells were analyzed for the enhanced list of volatile organic compounds (VOCs), chromium, and nickel. The enhanced list of VOCs includes 1,1-dichloroethene (1,1-DCE), 1,1,2-trichloro-1 2,2-trifluoroethane (Freon 113), chloroform, tetrachloroethene (PCE), TCE, and trichlorofluoromethane (Freon 11). A duplicate sample was collected from CWL-BW5 and analyzed for all parameters.

Representatives of the NMED U.S. Department of Energy Oversight Bureau (NMED OB) were present during sampling and received split samples for all analyses at each monitoring well except CWL-BW5. The NMED OB split analytical results are not included in this report.

Second Semi-Annual Sampling Event – July 5-11, 2012
Groundwater samples were collected from monitoring wells CWL-BW5, CWL-MW9, CWL-MW10, and CWL-MW11. Samples collected from all wells were analyzed for TCE, chromium, and nickel. Duplicate samples were collected from CWL-MW10 and CWL-MW11 and analyzed for all parameters.

4.1.1 Well Purging

Purging removes stagnant water from the well so that a representative groundwater sample can be obtained. For the January 2012 monitoring event the minimum purge requirement for a

portable piston pump was one borehole volume (the volume of all static water in the well plus the volume of water in the adjacent filter packs). Purging continued until four stable field measurements for temperature, specific conductance (SC), potential of hydrogen (pH), and turbidity were obtained in monitoring wells that did not purge dry. As specified in PCCP Attachment 2, Section 2.12, groundwater stability is considered acceptable when measurements are less than five nephelometric turbidity units (NTU) for turbidity, pH is within 0.1 units, temperature is within 1.0 degree Celsius, and SC is within five percent as micromhos per centimeter. Field measurements for water quality parameters were collected using a YSI™ Model 620 Water Quality Meter, and a HACH™ Model 2100P portable turbidity meter. Additional water quality measurements included oxidation-reduction potential (ORP) and dissolved oxygen (DO).

In accordance with requested modifications to the PCCP (Wagner November 2011) that were approved in February 2012 (Kieling February 2012), purging volume and stability requirements were revised for the July 2012 monitoring event. The minimum purge requirement was changed to one saturated casing volume (the volume of all static water in the well screen plus the borehole annulus around the saturated screen interval). However, for the July groundwater sampling event the more conservative (i.e., larger) purging volume based on the original purging requirement was used (i.e., one borehole volume or the volume of all static water in the well screen interval and sump, plus the volume of water in the adjacent borehole annulus filter packs). The new purge volume requirement will be implemented during the next CWL groundwater monitoring event in 2013. Groundwater stability requirements were changed to clarify the stability criterion if final turbidity measurements are greater than 5 NTU; however, this scenario did not occur at any of the CWL groundwater monitoring wells during either sampling event.

The following information applies to both sampling events. A portable Bennett Company groundwater sampling system was used to collect groundwater samples from all wells. Minimum purge requirements were satisfied at all monitoring wells, except at CWL-MW10. This monitoring well was purged to dryness, allowed to recover, and then sampled to collect the most representative groundwater sample possible given the low yield of this well. In an effort to decrease flow rate for wells that purge dry, the existing sampling system is equipped with a flow meter valve located along the discharge line, and with small diameter tubing. During the purging process at wells prone to purging dry, the flow rate is continually adjusted to achieve as low a flow rate as possible without causing the pump to fail. This represents a “best faith effort” to purge the wells at the slowest rate possible given equipment limitations as specified in PCCP Attachment 2, Section 2.12.

Details of purging activities for the two sampling events are described in the following paragraphs for CWL-MW10, which is the only well that purged dry.

First Semi-Annual Sampling Event – January 17-23, 2012-
Monitoring well CWL-MW10 was purged for 167 minutes and slightly more than 21-gallons were purged prior to the well going dry (minimum purge volume goal was 38 gallons). The flow rate was continually adjusted throughout this purge event, within equipment limitations. The average flow rate during this purge is estimated at 0.127 gallons per minute (gpm), equivalent to 0.48 liters per minute.

Second Semi-Annual Sampling Event – July 5-11, 2012
Monitoring well CWL-MW10 was purged approximately 20-gallons prior to the well going dry (minimum purge volume goal was 38 gallons). The flow rate was continually adjusted

throughout this purge event, within equipment limitations. The average flow rate during this purge is estimated at 0.13 gpm, and the estimated flow rate was 0.06 gpm during the final four gallons (equivalent of 0.49 and 0.23 liters per minute, respectively).

4.1.2 Field Quality Control

Field quality control (QC) samples were collected as part of each sampling event and included environmental duplicate, equipment blank, trip blank, and field blank samples. The sampling pump and tubing bundle used to collect groundwater samples were decontaminated prior to sampling each monitoring well according to procedures described in "Groundwater Monitoring Equipment Decontamination," SNL/NM field operating procedure (FOP) FOP 05-03. The field QC samples were submitted for analysis along with the groundwater samples. A brief explanation of the field QC samples for the January and July sampling events is provided below; additional information on each type of QC sample is described in PCCP Attachment 2, Section 2.20.1. Analytical results are presented in Section 4.2.2.

First Semi-Annual Sampling Event – January 17-23, 2012
A duplicate environmental sample was collected from CWL-BW5. The duplicate sample was collected immediately after the original environmental sample to reduce variability caused by time and/or sampling mechanics.

One equipment blank sample (also referred to as a rinsate blank) was collected prior to sampling CWL-BW5 and submitted for all analyses.

A total of five trip blank samples were submitted along with the January 2012 groundwater samples and analyzed for the enhanced list of VOCs (TCE plus tetrachlorethene, 1,1-dichloroethene, trichlorofluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane, and chloroform).

A field blank sample was collected for VOC analysis (enhanced list) by pouring deionized water into sample containers at the CWL-MW10 sample point to simulate the transfer of environmental samples from the sampling system to the sample container.

Second Semi-Annual Sampling Event – July 5-11, 2012
Two duplicate environmental samples were collected; one each from CWL-MW10 and CWL-MW11. The duplicate samples were collected immediately after the original environmental sample to reduce variability caused by time and/or sampling mechanics.

Two equipment blank samples were collected; one each prior to sampling CWL-MW10 and CWL-MW11. The samples were submitted for all analyses.

A total of five trip blank samples were submitted along with the July 2012 groundwater samples and analyzed for TCE.

Two field blank samples were collected for TCE analysis by pouring deionized water into sample containers at the CWL-BW5 and CWL-MW9 sample points to simulate the transfer of environmental samples from the sampling system to the sample container.

4.1.3 Waste Management

Purge and decontamination water generated from sampling activities were placed into 55-gallon containers and stored at the Environmental Resources Field Office less than 90-day waste accumulation area. Approximately 259 gallons of purge water were generated during the January 2012 groundwater sampling event and approximately 281 gallons of purge water were generated during the July 2012 event. Separate waste characterization samples were collected from purge and decontamination water and analyzed for discharge parameters. All purge water was discharged to the sanitary sewer after waste characterization data were compared to Albuquerque Bernalillo County Water Utility Authority discharge limits and an SNL/NM sanitary sewer discharge approval was obtained.

Personal protective equipment and other solid waste generated during January and July 2012 monitoring activities were packaged into 5-gallon plastic buckets and managed as hazardous waste. This waste was submitted to the Hazardous Waste Management Facility for ultimate disposal at a permitted off-site facility.

4.2 Laboratory Results

Groundwater samples and field QC samples were submitted to GEL Laboratories for analyses. Samples were analyzed in accordance with applicable EPA analytical methods. For comparison, hazardous constituent concentration limits from the CWL PCCP are included in the analytical results tables. Analytical results that are above the analytical laboratory method detection limit (MDL) but below the practical quantitation limit (PQL) are qualified as estimated values and designated with a "J" qualifier. Analytical laboratory reports, including certificates of analyses, analytical methods, MDLs, PQLs, dates of analyses, results of QC analyses, and data validation results are filed in the SNL/NM Records Center.

4.2.1 Environmental Sample Results

Table 4-1 summarizes TCE results and Table 4-2 summarizes chromium and nickel results for the January and July 2012 groundwater sampling events. Table 4-3 summarizes results for the additional VOCs (enhanced list) included in the January 2012 event (tetrachlorethene, 1,1-dichloroethene, trichlorofluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane, and chloroform). Table 4-4 summarizes field water quality measurements collected prior to sampling for both events. Field water quality measurements include turbidity, pH, temperature, SC, ORP, and DO. A summary of the results from the January and July sampling events is provided below.

First Semi-Annual Sampling Event – January 17-23, 2012
TCE was only detected above the laboratory MDL at CWL-MW10 at a concentration of 4.68 µg/L, which is below the concentration limit of 5.0 µg/L. None of the enhanced list VOCs (tetrachlorethene, 1,1-dichloroethene, trichlorofluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane, and chloroform) were detected in the samples.

Chromium was not detected above the laboratory MDL in any sample. Nickel was detected in all samples at concentrations ranging from 0.00177 milligrams per liter (mg/L) in CWL-BW5 to

Table 4-1
Summary of Trichloroethene Results
Chemical Waste Landfill Groundwater Monitoring
Analytical Method SW846-8260B[a]
Calendar Year 2012

Well ID	Result (µg/L)	MDL (µg/L)	PQL (µg/L)	Concentration Limit[b] (µg/L)	Laboratory Qualifier[c]	Validation Qualifier[c]	Sample No.
January 2012 Sampling Event							
CWL-BW5 18-Jan-12	ND	0.250	1.00	5.00	U	--	091638-001
CWL-BW5 (Duplicate) 18-Jan-12	ND	0.250	1.00	5.00	U	--	091639-001
CWL-MW9 17-Jan-12	ND	0.250	1.00	5.00	U	--	091632-001
CWL-MW10 23-Jan-12	4.68	0.250	1.00	5.00	--	--	091647-001
CWL-MW11 19-Jan-12	ND	0.250	1.00	5.00	U	--	091643-001
July 2012 Sampling Event							
CWL-BW5 05-July-12	ND	0.300	1.00	5.00	U	--	092579-001
CWL-MW9 06-July-12	ND	0.300	1.00	5.00	U	--	092584-001
CWL-MW10 11-July-12	3.62	0.300	1.00	5.00	--	--	092598-001
CWL-MW10 (Duplicate) 11-July-12	3.62	0.300	1.00	5.00	--	--	092599-001
CWL-MW11 09-July-12	ND	0.300	1.00	5.00	U	--	092591-001
CWL-MW11 (Duplicate) 09-July-12	ND	0.300	1.00	5.00	U	--	092592-001

Notes:
[a]U.S. Environmental Protection Agency, 1986 (and updates), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd edition.
[b]Concentration limit from CWL PCCP, Attachment 1, Table 1-2 (NMED October 2009).
[c]Laboratory/Validation Qualifier - If cell is blank (--), then all quality control samples met acceptance criteria with respect to submitted samples. See explanation for "U" laboratory qualifier below.
EPA = U.S. Environmental Protection Agency.
MCL = Maximum contaminant level. Established by the U.S. Environmental Protection Agency Primary Water Regulations (40 CFR 141.11(b)), National Primary Drinking Water Standards, EPA, July 2002.
MDL = Method detection limit. The minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero, analyte is matrix-specific.
µg/L = Micrograms per liter.
ND = Not detected (at method detection limit).
PQL = Practical quantitation limit. The lowest concentration of analytes in a sample that can be reliably determined within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions.
U = Analyte not present or concentration is below the method detection limit.

Table 4-2
Summary of Chromium and Nickel Results
Chemical Waste Landfill Groundwater Monitoring
Analytical Method SW846-6020[a]
Calendar Year 2012

Well ID/ Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Conc. Limit[b] (mg/L)	Laboratory Qualifier[c]	Validation Qualifier[c]	Sample No.
January 2012 Sampling Event								
CWL-BW5 18-Jan-12	Chromium	ND	0.002	0.010	0.050	U	--	091638-015
	Nickel	0.00177	0.0005	0.002	0.028	J	J+	091638-015
CWL-BW5 (Duplicate) 18-Jan-12	Chromium	ND	0.002	0.010	0.050	U	--	091638-015
	Nickel	0.00218	0.0005	0.002	0.028	--	J+	091638-015
CWL-MW9 17-Jan-12	Chromium	ND	0.002	0.010	0.050	U	--	091632-015
	Nickel	0.00306	0.0005	0.002	0.028	--	J+	091632-015
CWL-MW10 23-Jan-12	Chromium	ND	0.002	0.010	0.050	U	--	091647-015
	Nickel	0.00246	0.0005	0.002	0.028	--	--	091647-015
CWL-MW11 19-Jan-12	Chromium	ND	0.002	0.010	0.050	U	--	091643-015
	Nickel	0.00205	0.0005	0.002	0.028	--	J+	091643-015
July 2012 Sampling Event								
CWL-BW5 05-July-12	Chromium	ND	0.002	0.010	0.050	U	--	092579-015
	Nickel	0.0041	0.0005	0.002	0.028	--	--	092579-015
CWL-MW9 06-July-12	Chromium	ND	0.002	0.010	0.050	U	--	092584-015
	Nickel	0.00435	0.0005	0.002	0.028	--	--	092584-015
CWL-MW10 11-July-12	Chromium	ND	0.002	0.010	0.050	U	--	092598-015
	Nickel	0.00307	0.0005	0.002	0.028	B	--	092598-015
CWL-MW10 (Duplicate) 11-July-12	Chromium	ND	0.002	0.010	0.050	U	--	092599-015
	Nickel	0.00292	0.0005	0.002	0.028	B	--	092599-015
CWL-MW11 09-July-12	Chromium	0.00246	0.002	0.010	0.050	J	--	092591-015
	Nickel	0.00255	0.0005	0.002	0.028	B	0.00264U	092591-015
CWL-MW11 (Duplicate) 09-July-12	Chromium	0.00258	0.002	0.010	0.050	J	--	092592-015
	Nickel	0.00273	0.0005	0.002	0.028	B	--	092592-015

Notes:
[a]U.S. Environmental Protection Agency, 1986 (and updates), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd ed.
[b]Concentration limit from CWL PCCP, Attachment 1, Table 1-2 (NMED October 2009).
[c]Laboratory/Validation Qualifier - If cell is blank (--), then all quality control samples met acceptance criteria with respect to submitted sample. See explanation for "B," "J," and "U" laboratory qualifiers below:
B = Analyte is detected in associated laboratory method blank.
J = Amount detected is below the practical quantitation limit (PQL).

J+ = The associated numerical value is an estimated quantity with a suspected positive bias.
U = Analyte is absent or below the method detection limit.
EPA = U.S. Environmental Protection Agency.
MCL = Maximum contaminant level. Established by the U.S. Environmental Protection Agency Primary Water Regulations (40 CFR 141.11(b)), National Primary Drinking Water Standards, EPA, July 2002.
MDL = Method detection limit. The minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero, analyte is matrix-specific.
mg/L = Milligrams per liter.
ND = Not detected (at method detection limit).
PQL = Practical quantitation limit. The lowest concentration of analytes in a sample that can be reliably determined within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions.

Table 4-3
Summary of Additional Volatile Organic Compound Results
Chemical Waste Landfill Groundwater Monitoring
Analytical Method SW846-8260B[a]
January 2012

Well ID	Analyte	Result (µg/L)	MDL (µg/L)	PQL (µg/L)	MCL (µg/L)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample No.
CWL-BW5	1,1-Dichloroethene	ND	0.300	1.00	7.00	U	--	091638-001
18-Jan-12	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.00	5.00	NE	U	--	091638-001
	Chloroform	ND	0.250	1.00	NE	U	--	091638-001
	Tetrachloroethene	ND	0.300	1.00	5.00	U	--	091638-001
	Trichlorofluoromethane	ND	0.300	1.00	NE	U	--	091638-001
CWL-BW5	1,1-Dichloroethene	ND	0.300	1.00	7.00	U	--	091639-001
(Duplicate) 18-Jan-12	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.00	5.00	NE	U	--	091639-001
	Chloroform	ND	0.250	1.00	NE	U	--	091639-001
	Tetrachloroethene	ND	0.300	1.00	5.00	U	--	091639-001
	Trichlorofluoromethane	ND	0.300	1.00	NE	U	--	091639-001
CWL-MW9	1,1-Dichloroethene	ND	0.300	1.00	7.00	U	--	091632-001
17-Jan-12	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.00	5.00	NE	U	--	091632-001
	Chloroform	ND	0.250	1.00	NE	U	--	091632-001
	Tetrachloroethene	ND	0.300	1.00	5.00	U	--	091632-001
	Trichlorofluoromethane	ND	0.300	1.00	NE	U	--	091632-001
CWL-MW10	1,1-Dichloroethene	ND	0.300	1.00	7.00	U	--	091647-001
23-Jan-12	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.00	5.00	NE	U	--	091647-001
	Chloroform	ND	0.250	1.00	NE	U	--	091647-001
	Tetrachloroethene	ND	0.300	1.00	5.00	U	--	091647-001
	Trichlorofluoromethane	ND	0.300	1.00	NE	U	--	091647-001
CWL-MW11	1,1-Dichloroethene	ND	0.300	1.00	7.00	U	--	091643-001
19-Jan-12	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.00	5.00	NE	U	--	091643-001
	Chloroform	ND	0.250	1.00	NE	U	--	091643-001
	Tetrachloroethene	ND	0.300	1.00	5.00	U	--	091643-001
	Trichlorofluoromethane	ND	0.300	1.00	NE	U	--	091643-001

Notes:
[a]U.S. Environmental Protection Agency, 1986 (and updates), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd edition.
[b]Laboratory/Validation Qualifier - If cell is blank (--), then all quality control samples met acceptance criteria with respect to submitted samples. See explanation for "U" laboratory qualifier below:
EPA = U.S. Environmental Protection Agency.
MCL = Maximum contaminant level. Established by the U.S. Environmental Protection Agency Primary Water Regulations (40 CFR 141.11(b)), National Primary Drinking Water Standards, EPA, July 2002.
MDL = Method detection limit. The minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero, analyte is matrix-specific.
µg/L = Micrograms per liter.
ND = Not detected (at method detection limit).
NE = Not established.
PQL = Practical quantitation limit. The lowest concentration of analytes in a sample that can be reliably determined within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions.
U = Analyte not present or concentration is below the method detection limit.

Table 4-4
Summary of Field Water Quality Measurements[a]
Chemical Waste Landfill Groundwater Monitoring
Calendar Year 2012

Well ID/ Sample Date	Temperature (°C)	SC (µmho/cm)	ORP (mV)	pH	Turbidity (NTU)	DO (% Sat)	DO (mg/L)
January 2012 Sampling Event							
CWL-BW5 18-Jan-12	17.95	1217	411.9	6.65	0.87	70.4	6.56
CWL-MW9 17-Jan-12	18.47	1075	308.6	6.73	0.56	18.0	1.68
CWL-MW10 23-Jan-12	14.72	967	383.9	7.14	3.21	46.0	4.66
CWL-MW11 19-Jan-12	19.61	1100	374.2	6.76	0.46	50.0	4.49
July 2012 Sampling Event							
CWL-BW5 05-July-12	20.86	999	189.3	6.71	0.37	80.4	7.15
CWL-MW9 06-July-12	20.94	889	-1.2	6.77	0.42	21.5	1.90
CWL-MW10 11-July-12	22.76	807	141.0	7.03	2.04	50.6	4.33
CWL-MW11 09-July-12	25.80	931	156.2	6.84	0.65	67.5	5.18

Notes:
[a]Field measurements collected prior to sampling.
°C = Degrees Celsius.
% Sat = Present saturation.
DO = Dissolved oxygen.
mg/L = Milligrams per liter.
µmho/cm = Micromhos per centimeter.
mV = Millivolts.
ORP = Oxidation-reduction potential.
NTU = Nephelometric turbidity units.
pH = Potential of hydrogen (negative logarithm of the hydrogen ion concentration).
SC = Specific Conductance.

0.00306 mg/L in the CWL-MW9 environmental sample. Chromium and nickel were not detected above the established concentration limits.

Second Semi-Annual Sampling Event – July 5-11, 2012
TCE was only detected above the laboratory MDL at CWL-MW10 at a concentration of 3.62 µg/L, which is below the concentration limit of 5.0 µg/L.

Chromium was only detected above the laboratory MDL in the environmental and duplicate samples from CWL-MW11 at estimated concentrations of 0.00246 and 0.00258 mg/L, respectively. Nickel was detected in all samples at concentrations ranging from 0.00273 mg/L in CWL-MW11 duplicate sample to 0.00435 mg/L in the CWL-MW9 environmental sample. The nickel result in the CWL-MW11 environmental sample was qualified as not detected during data validation, since the result is less than five times the concentration detected in the laboratory method blank sample. Chromium and nickel were not detected above the established concentration limits.

4.2.2 Field Quality Control Sample Results

Tables 4-1 through 4-4 present field duplicate results for samples collected in the January and July sampling events. Table 4-5 summarizes results of duplicate sample analyses and the calculated relative percent difference (RPD) values between the environmental and duplicate sample results. RPD values are only calculated for detected constituents and show good agreement (i.e., RPD values < 20 for organics and < 35 for metals).

Table 4-5
Summary of Detected Duplicate Samples
Chemical Waste Landfill Groundwater Monitoring
Calendar Year 2012

Well ID/Parameter	Environmental Sample (R1)	Duplicate Sample (R2)	RPD[a]
January 2012 Sampling Event			
CWL-BW5			
Nickel (mg/L)	0.00177	0.00218	21
July 2012 Sampling Event			
CWL-MW10			
Trichloroethene (µg/L)	3.62	3.62	< 1
Nickel (mg/L)	0.00307	0.0029	6
CWL-MW11			
Chromium (mg/L)	0.00246	0.00258	5
Nickel (mg/L)	ND	0.00273	NC

Notes:
[a]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_1 = Analysis result.
R_2 = Duplicate analysis result.

µg/L = microgram(s) per liter.
mg/L = milligram(s) per liter.
NC = not calculated
ND = not detected

One equipment blank and one field blank sample were collected in January and analyzed for all constituents, including TCE, enhanced list VOCs (tetrachlorethene, 1,1-dichloroethene, trichlorofluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane, and chloroform), chromium, and nickel. None of these constituents were detected except for chloroform in the equipment blank sample. No corrective action was necessary since this compound was not detected in any of the environmental samples. The two equipment blank and two field blank samples collected in July were analyzed for all constituents, including TCE, chromium, and nickel. None of these

constituents were detected. The five trip blank samples and one field blank sample collected in January were analyzed for TCE and the enhanced list of VOCs; none of these VOCs were detected. The five trip blank samples and one field blank sample collected in July were analyzed for TCE only; TCE was not detected.

4.2.3 Data Quality

Field QC sample results met the sampling DQOs and validated the adequacy of the field sampling procedures and protocol. Internal laboratory QC samples, including method blanks, matrix spikes, and laboratory control samples, were analyzed concurrently with environmental groundwater samples. All chemical data was reviewed and qualified in accordance with SNL/NM Administrative Operating Procedure (AOP) AOP 00-03, "Data Validation Procedure for Chemical and Radiochemical Data" (SNL/NM May 2011).

Nickel results in the CWL-BW5, CWL-MW9, and CWL-MW11 January 2012 samples were qualified as estimated values during data validation since nickel was detected in the associated interference check sample. Nickel in the July CWL-MW11 environmental duplicate sample was qualified as not detected during data validation since nickel was reported at a concentration less than five times the detected value in the associated laboratory method blank sample. All data were in compliance with analytical methods and laboratory procedures (i.e., technically defensible). Data Validation Reports and Contract Verification Review forms are provided in Annex A of this report and are filed in the SNL/NM Records Center.

4.2.4 Variances and Non-Conformances

No variances, non-conformances, or project-specific issues were identified during the January and July 2012 semi-annual groundwater sampling events.

After the January groundwater monitoring results were received, DOE and Sandia notified NMED during a conference call on March 5, 2012 (SNL/NM March 2012) regarding installation of passive venting devices (i.e., Baroball™ devices) on all groundwater monitoring wells in accordance with PCCP Attachment 1, Section 1.4.2. Installation was completed on March 9, 2012.

4.3 Data Evaluation

Groundwater monitoring is required to determine whether the groundwater beneath the CWL is in compliance with the groundwater protection standard under 40 CFR § 264.92 and for the determination of statistical significance under 40 CFR § 264.97(h). In accordance with PCCP Attachment 1, Section 1.8.1.2, statistical evaluation of groundwater monitoring results from new wells is not required until after three years of groundwater sampling results have been obtained to allow for the collection of sufficient data (i.e., minimum data set for statistical analysis is six analytical results). For replacement wells, historical groundwater sampling results are used to augment the data sets and increase the amount of data for statistical analysis. Historical groundwater data is limited to data obtained after completion of the VE VCM (July 1998).

Statistical evaluation is limited to results from CWL-BW5/4A for the CY 2012 reporting period. CWL-MW9, CWL-MW10, and CWL-MW11 are new wells installed in 2010 and have been sampled four times (November-December 2010, July-August 2011, January 2012, and July 2012). Statistical evaluation of the results from these wells is not required until the completion of CY 2013 groundwater monitoring.

CWL-BW5 is a replacement well for CWL-BW4A. All results for CWL-BW5 (November-December 2010, July-August 2011, January 2012, and July 2012) and historic results for CWL-BW4A (since completion of the VE VCM) are used for statistical evaluation presented in the following sections. All references to sample results are to CWL-BW5/4A sample results.

4.3.1 Statistical Assessment Requirements

Ground-water monitoring data are statistically evaluated on a well-by-well basis for each of the three hazardous constituents in accordance with the PCCP Attachment 1, Section 1.8.1.2. The hazardous constituents and their respective concentration limits are listed in Table 4-6. Prediction and confidence intervals are calculated and used to evaluate semi-annual groundwater monitoring results. In addition, the cumulative percentage of sample results that are greater than the median (i.e., Median Test) is calculated to determine if there is statistically significant evidence of increased contamination. If a result is below the analytical laboratory detection limits, the MDL for the constituent is used for statistical analysis. More detailed information regarding statistical assessment requirements is provided below and statistical assessment results for CY 2012 groundwater monitoring data are presented in Section 4.3.2.

Table 4-6
Concentration Limits for the Hazardous Constituents of Concern at the Chemical Waste Landfill

Hazardous Constituent	Concentration Limit	Basis of Concentration Limit
Trichloroethene	5 µg/L	EPA MCL, 40 CFR § 264.94(b)
Chromium	0.050 mg/L	Table 1, 40 CFR § 264.94(a)(2)
Nickel	0.028 mg/L	Background level, 40 CFR § 264.94(a)(1)

Notes:
EPA = U.S. Environmental Protection Agency
MCL = Maximum contaminant level.
µg/L = Micrograms per liter.
mg/L = Milligrams per liter.

Prediction and Confidence Intervals

The probability that each semi-annual sample result for a given hazardous constituent falls within the range of previous sample results is determined using prediction intervals. The prediction interval for a given hazardous constituent is the range between the 95% upper confidence limit (UCL) of the mean and the 95% lower confidence limit (LCL) of the mean. Therefore, the probability of a sample result for a given hazardous constituent falling within the range of previous sample results (i.e., between the LCL and the UCL) is 95%. Sample results are also compared to the historical range (minimum and maximum result) to determine whether semi-annual results for the reporting period fall within, below, or above the range of previous sample results.

The 95% LCL is also used to determine statistically significant evidence that the concentration limit for the particular hazardous constituent has been exceeded (NMED October 2009 and subsequent revisions). The calculated 95% LCL is compared to the concentration limit in Table 4-5 and if it exceeds the concentration limit, this is statistically significant evidence that the concentration limit has been exceeded, which triggers corrective action in accordance with PCCP Attachment 1, Section 1.8.3. Individual sample results that exceed the concentration limit do not constitute an exceedance requiring corrective action.

Median Test

The median value is calculated using all historic data prior to the sampling event(s) being evaluated. For example, the median value against which the July 2012 sample results are compared was calculated using all historic results obtained since July 1998 (i.e., completion of the VE VCM) not including the July 2012 sample results. For the next groundwater monitoring event, the median will be recalculated and include the July 2012 sample results. If the cumulative percentage of results that are greater than the median for a given hazardous constituent is 80% or greater, that is considered statistically significant evidence of increased contamination. No action is required due to statistically significant evidence of increasing contamination unless a concentration limit is exceeded (NMED October 2009 and subsequent revisions).

4.3.2 Statistical Assessment Results

CY 2012 groundwater sampling data and statistical analysis for CWL-BW5/4A are discussed in this section. CWL-BW5/4A statistical assessment results are presented in Table 4.-7 and shown graphically in Figures 4-1 through 4-3.

Prediction Intervals

CY 2012 sample results for chromium and TCE were lower than their respective 95% LCLs, and thus are below the prediction interval (range of 95% LCL to 95% UCL). This is due to the decrease in the laboratory detection limit over time and the fact that chromium and TCE are often not detected. Chromium and TCE were not detected in both the January and July 2012 CWL-BW5 groundwater samples. The result for nickel fell within the range of the 95% LCL and 95% UCL. Results for all three hazardous constituents fell within the historical range.

Confidence Intervals

The three hazardous constituent 95% LCLs and 95% UCLs of the mean for the CWL-BW5/4A sample results are presented in Table 4-7 and shown on the associated control charts (Figures 4-1 through 4-3). All 95% LCLs are below the respective concentration limits and therefore there are no exceedances of any concentration limits. There is a single historical nickel result that is greater than the concentration limit (0.49 mg/L) that occurred in a sample from CWL-BW4A collected in August 2001 (Figure 4-2). However, the calculated 95% LCL for nickel is 0.0029 mg/L, significantly below the concentration limit of 0.028 mg/L.

Table 4-7
CWL-BW5/4A Statistical Assessment Results Summary
Calendar Year 2012 Sampling Results

Hazardous Constituent[a]	Minimum[b]	Maximum[b]	Mean[c]	Standard Deviation[c]	LCL[c]	UCL[c]	Distribution Type[c]	Median Test[d]	Concentration Limit Exceeded[e]?
Chromium (mg/L)	0.00038	0.0125	0.0034	0.0033	0.0034	0.005	Lognormal	27%	No
Nickel (mg/L)	0.00109	0.049	0.0057	0.0088	0.0029	0.0084	Normal	50%	No
TCE (µg/L)	0.1	0.6	0.32	0.12	0.28	0.36	Normal	12%	No

Notes:
[a]Hazardous Constituent and Concentration Limit from CWL Permit Attachment 1, Section 1.4.1, Table 1-2 (Table 4-6 of this report).
[b]Minimum and maximum result determined from historical data.
[c]Mean, LCL, UCL, Standard Deviation, and Distribution Type determined using PRO-UCL statistical program.
[d] Median Test is the cumulative percentage of sample results that are greater than the median.
[e]Exceedance determined by comparing the sample result (Tables 4-1, 4-2, and 4-3) against the concentration limit in CWL Permit Attachment 1, Table 1-2 (Table 4-6 of this report).
LCL = Lower confidence limit.
µg/L = Micrograms/liter.
mg/L = Milligrams/liter.
TCE = Trichloroethene.
UCL = Upper confidence limit.

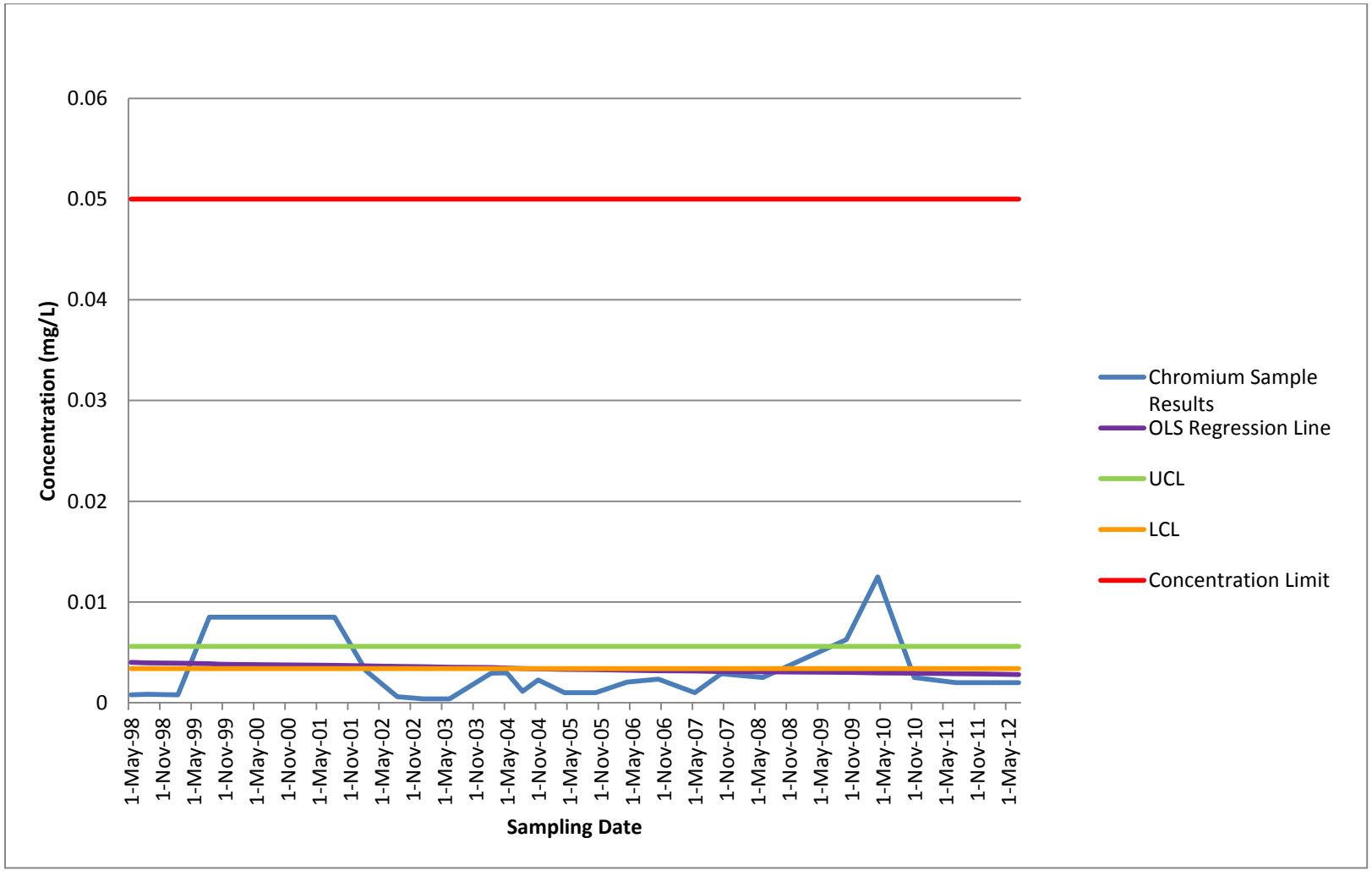

Figure 4-1
Chromium Control Chart for CWL-BW5/4A

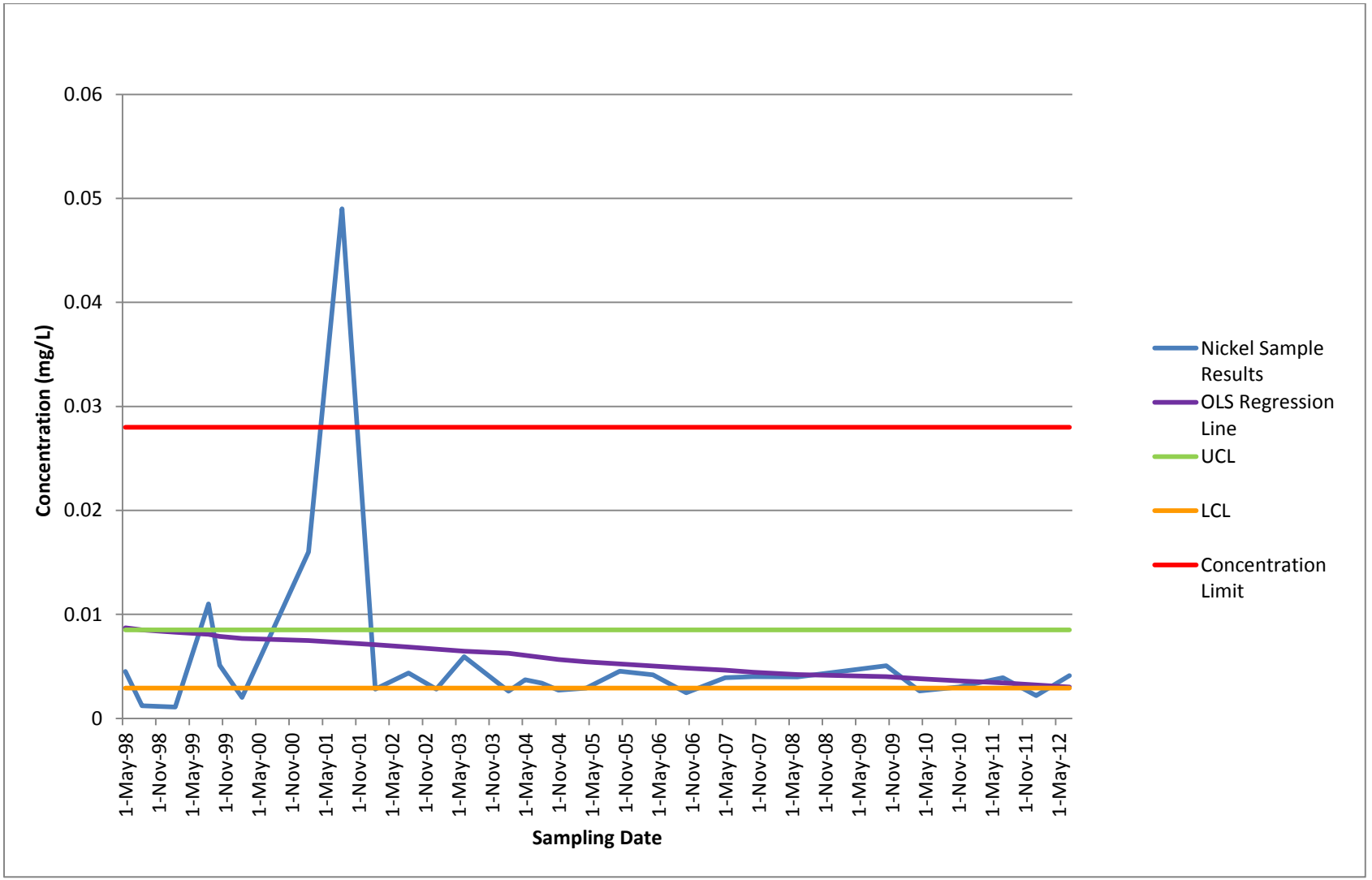

Figure 4-2
Nickel Control Chart for CWL-BW5/4A

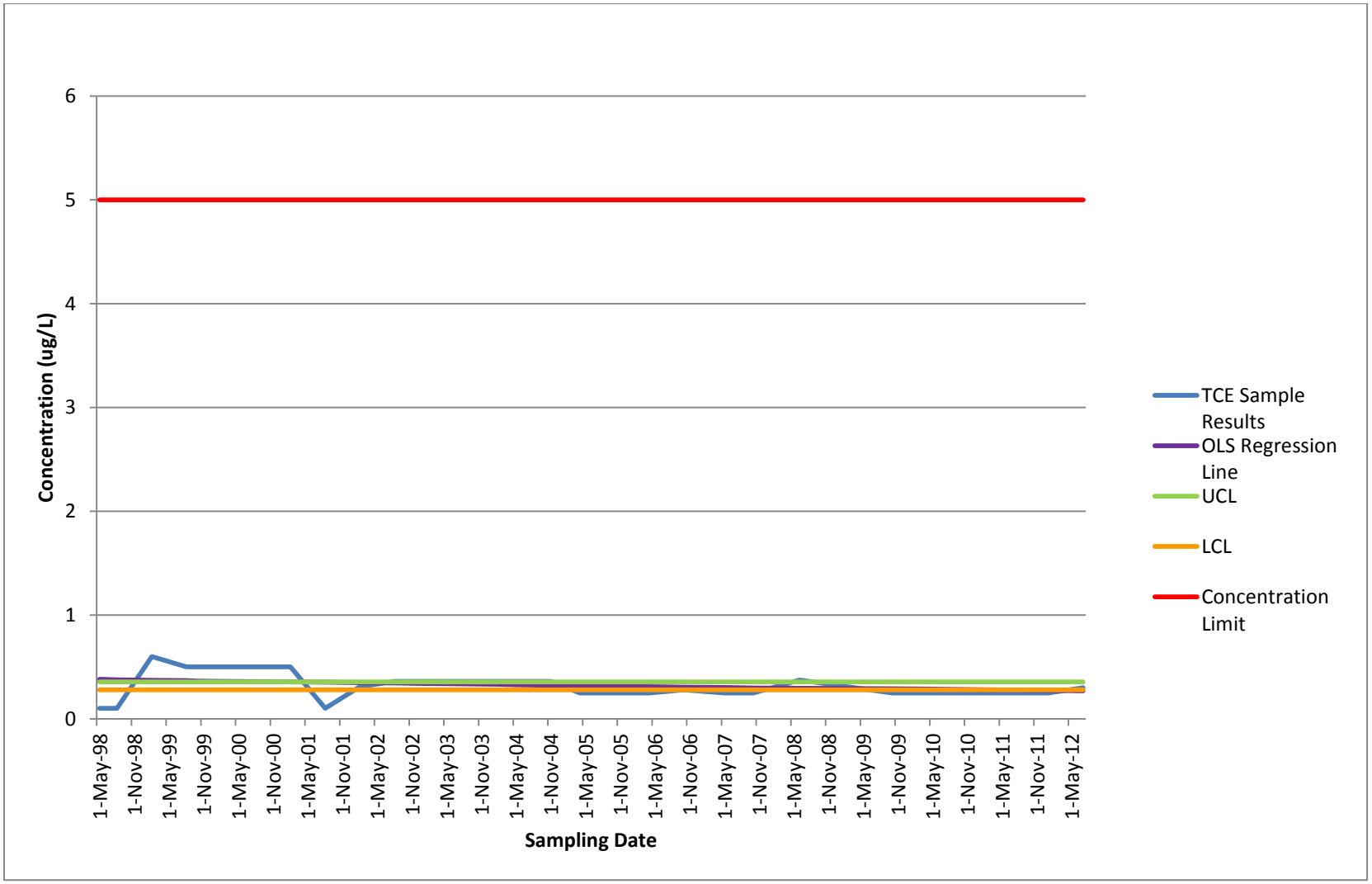

Figure 4-3
TCE Control Chart for CWL-BW5/4A

Median Test

The cumulative percentage of sample results greater than the median (i.e., Median Test) for the three hazardous constituents is below 80%. Therefore, there is no statistically significant evidence of increasing contamination for any of the hazardous constituents. The Median Test result for nickel, 50%, is typical for a consistent data set characterized by detections that reflect limited natural variation. The low median test results for both chromium and TCE (27% and 12%, respectively) reflect a data set influenced by non-detection results and an analytical laboratory detection limit that has decreased over time.

In addition, the ordinary least squares (OLS) regression line is shown on Figures 4-1 through 4-3. This line provides a visual representation of the overall trend of the sample results. As shown in Figures 4-1 through 4-3, all three hazardous constituents show a slight decreasing trend, consistent with the Median Test results.

4.4 Hydrogeologic Assessment

The regional aquifer in the area of the CWL is located within the Santa Fe Group alluvial sediments at a depth of approximately 485 to 500 feet bgs. Regional groundwater beneath Kirtland Air Force Base (KAFB) flows generally westward away from the mountains toward the Rio Grande. Pumping by the City of Albuquerque and KAFB have modified the natural groundwater flow regime and resulted in a steady decline of the upper surface of the regional aquifer. Water levels at the CWL have been declining since monitoring began at the CWL in the 1985. The average rate of decline has been somewhat variable over time, but typically in the range of 0.4 to 0.8 feet per year. The groundwater elevation decline between October 2011 and October 2012 at the CWL wells ranged from 0.33 (CWL-MW11) to 0.72 (CWL-MW10).

In CY 2012, water levels were measured in all wells on a quarterly basis, and during the January and July semi-annual sampling events. Figure 4-4 is the potentiometric surface map of the regional aquifer beneath the CWL, based upon October 2012 water level measurements. Based on this map the local groundwater flow direction is to the north, west, and south in the northern, central, and southern parts of the site, respectively. This pattern is generally consistent with the hydrogeologic conceptual model for the KAFB area. Localized changes in the water table surface reflect site-specific geologic controls (i.e., vertical and lateral changes in the saturated Santa Fe Group alluvial sediments). The horizontal gradient ranges from approximately 0.006 to 0.011. Groundwater velocities were calculated using the current potentiometric surface gradient, representative hydraulic conductivity data, and an effective porosity of 29 percent (SNL/NM October 1995). The calculated velocity ranges from approximately 5.8×10^{-4} to 1.1×10^{-3} feet per day (2.0×10^{-7} to 3.0×10^{-7} centimeters per second). This very low velocity range is consistent with previous CWL estimates for horizontal groundwater flow.

During 2012 slug tests were performed on the four groundwater monitoring wells to determine the hydraulic conductivity of the aquifer in these locations. This testing is not required by the PCCP but part of the normal routine for groundwater monitoring wells installed at SNL/NM. The testing was completed in August and the data are currently being processed and evaluated. Results will be presented in the CY2013 Annual Report.

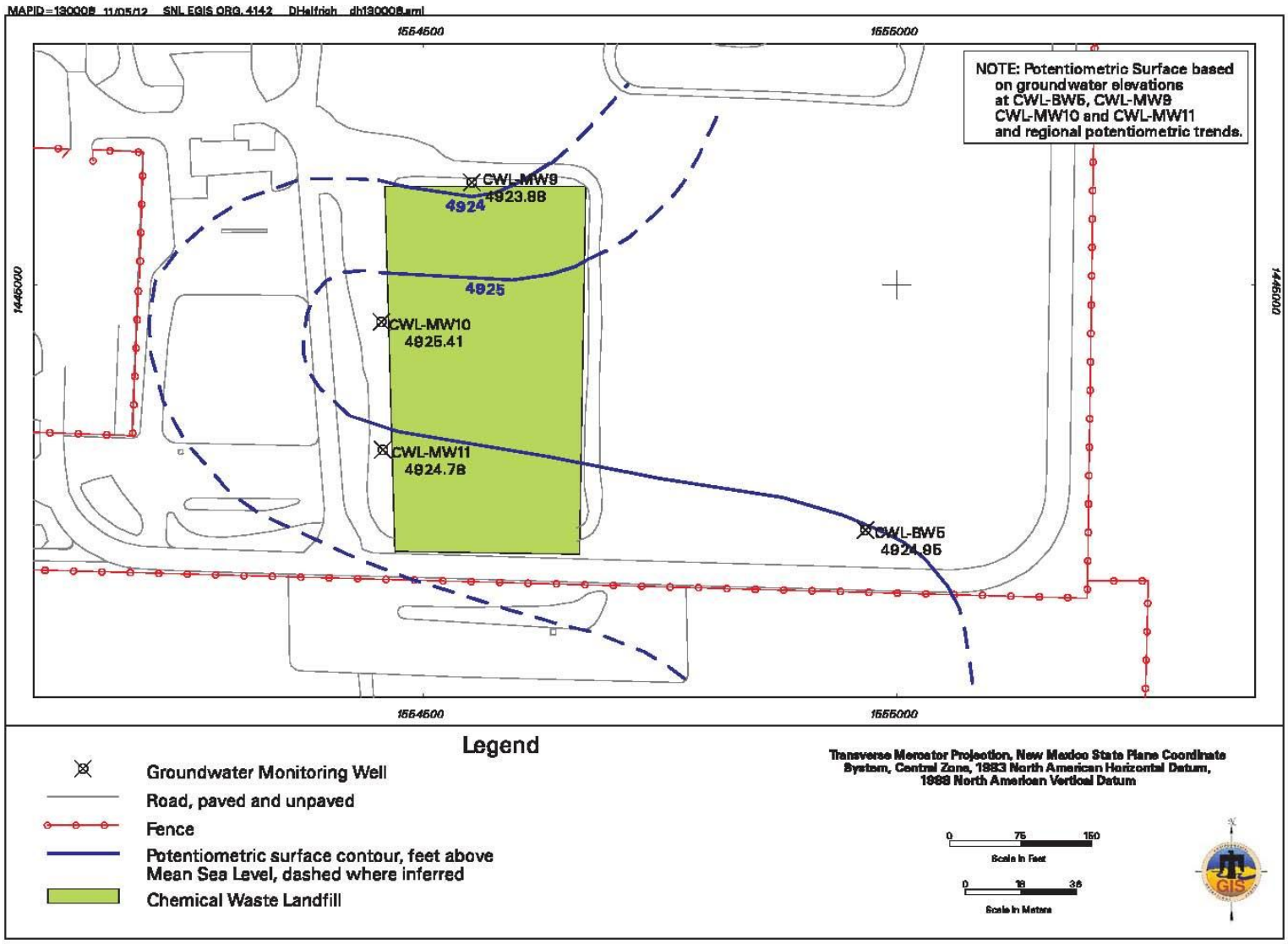

Figure 4-4
Potentiometric Surface of the Regional Aquifer at the Chemical Waste Landfill, October 2012

5.0 SOIL-GAS MONITORING RESULTS

This chapter presents soil-gas monitoring activities (i.e., sampling and analysis), analytical results, and data evaluation for CY 2012 in accordance with CWL PCCP Attachment 1, Sections 1.8 and 1.12, and Attachment 3. The CY 2012 annual soil-gas sampling event was the first performed under the PCCP, which became effective June 2, 2011. Soil-gas sampling field activities are described in Section 5.1, analytical laboratory results and a discussion of data quality are presented in Section 5.2, and data evaluation requirements and results are presented in Section 5.3. A summary of soil-gas monitoring activities and results is provided in Section 8.1.

5.1 Soil-Gas Sampling Field Activities

This section describes soil-gas monitoring activities conducted at the CWL in conformance with the CWL Soil-Gas SAP, PCCP Attachment 3 (NMED October 2009 and subsequent revisions) that describes the procedures, methods, and analytical protocols for collecting and analyzing soil-gas samples. The DQO for soil-gas monitoring is to collect accurate and defensible data of high quality to assess the concentrations of hazardous constituents at various depths in the vadose zone at the CWL (i.e., unsaturated soil and sediments above the regional groundwater aquifer). Field forms and documentation that address calibration of equipment, well evacuation, purge volumes, and vacuum pressure readings for each sample container are provided in Annex B of this report and filed in the SNL/NM Records Center.

Soil-gas samples were collected from monitoring wells CWL-UI-1, CWL-UI-2, CWL-D1, CWL-D2, and CWL-D3 in January. Supplemental soil-gas sampling (well/port-specific) was performed in March and May 2012. The three sampling events are summarized below.

- January – Initial annual soil-gas sampling event. All wells and ports sampled (including collection of duplicate samples), except for the 440 foot bgs sampling port at well CWL-D3 (i.e., CWL-D3-440). During sampling this port was discovered to be blocked/obstructed and could not be sampled.

- March – CWL-D3-440 rehabilitation and sampling. On March 5 the Department of Energy (DOE) and Sandia proposed a CWL-D3-440 sampling port rehabilitation plan and requested direction from NMED (SNL/NM March 2012). In accordance with NMED direction, the sampling port was reopened using pressurized ultra-pure grade nitrogen on March 22. A preliminary sample was collected immediately after opening and purging the port on March 22. The environmental sample was collected 7 days later on March 29 in accordance with NMED direction.

- May – Duplicate Resampling due to RPD issue. Two sampling ports (CWL-UI2-36 and well CWL-D3-480) were resampled in May because specific constituents failed the RPD requirement in the January environmental-duplicate pair samples.

Samples collected from all wells/sampling ports were analyzed using the EPA TO-14 analytical method for the 50 VOCs listed in PCCP Attachment 1, Table 1-5. Duplicate samples were collected from CWL-UI2, CWL-D1, and CWL-D3 at selected sample depths. Details of the CY2012 soil-gas sampling event under the CWL PCCP are described in the following sections.

5.1.1 Well Evacuation

Purging removes stagnant air from each monitoring well port and sample tubing, allowing the collection of representative soil gas from the soil pore space surrounding the sampling port in the subsurface. In accordance with the SAP, the minimum purge requirement is 30 minutes for monitoring activities prior to February 2012 (i.e., prior to NMED approval of the November 2011 permit modification request) and three tubing volumes afterwards. Purging continued after meeting minimum requirements until field measurements for VOC levels stabilized in accordance with PCCP Attachment 3, Section 3.9.2. VOCs were measured by attaching a VOC monitoring instrument to the exhaust port of the vacuum pump.

The CWL soil-gas sampling equipment includes a vacuum pump, a sampling manifold assembly, and a multiport purging chamber. The multiport purging chamber is equipped with individual valves, fittings, and tubing that can be connected to up to ten individual sample ports. Valves were connected to each sampling port and purging was performed until minimum purge requirements were satisfied. Upon completion of purging, soil-gas samples were collected in SUMMA® canisters per laboratory protocols and sent to the off-site laboratory for analysis.

5.1.2 Field Quality Control

Field QC samples include environmental duplicate samples (minimum of two per annual monitoring event) and field blank samples. Field QC samples were submitted for analysis with the soil-gas samples and analytical results are presented in Section 5.2.2 and Annex B.

Duplicate environmental samples are collected immediately after the original environmental sample in order to reduce variability caused by time and/or sampling mechanics. These sample results are used to evaluate the reproducibility of the sampling and analytical processes. During the January sampling event duplicate environmental samples were collected from monitoring wells CWL-UI2-36, CWL-D1-160, and CWL-D3-480 (three total duplicate samples). Duplicate samples were analyzed for the full list of TO-14 constituents. Resampling based on RPD requirements at CWL-UI2-36 and CWL-D3-440 was conducted in May.

Field QC blank samples are prepared in the field during sampling activities by collecting an ultra-pure grade nitrogen gas sample. Results are used to assess whether contamination of the samples may have resulted from ambient field conditions. A total of eight QC field blank samples were submitted for analysis with CY 2012 environmental samples (five in January, one in March, and two in May).

5.1.3 Waste Management

Only a small volume of solid waste (personal protective equipment) was generated during the three soil-gas monitoring events. This waste was combined with the groundwater monitoring

solid waste and managed as hazardous waste. This waste was submitted to the Hazardous Waste Management Facility for ultimate disposal at a permitted off-site facility.

5.2 Laboratory Results

Soil-gas samples were submitted to Test America, Inc. in Los Angeles, California for chemical analyses by EPA Method TO-14. Analytical reports (i.e., certificates of analyses), analytical methods, method detection limits (MDLs), reporting limits (RLs), dates of analyses, results of field QC analyses, and data validation reports are included in Annex B and filed in the SNL/NM Records Center.

5.2.1 Environmental Sample Results

Table 5-1 summarizes detected VOCs from soil-gas samples collected in CY 2012. Detected VOCs included acetone, chloroethane, chloroform, dichlorodifluoromethane, 1,1-dichloroethene (1,1-DCE), 1,2-dichloropropane, methylene chloride, tetrachlorethene, toluene, 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), TCE, trichlorofluoromethane (Freon 11), 4-methyl-2-pentanone, and m,p-xylene. TCE was detected in all samples at reported concentrations ranging from 61 parts per billion by volume (ppbv) at CWL-D3 (480 foot bgs sample port) to 22,000 ppbv at CWL-D1 (240 foot bgs sample port). No soil-gas concentrations from the three deepest sampling ports (CWL-D1-470, CWL-D2-470, CWL-D3-480) exceeded the trigger level of 20 ppmv, and only two VOCs exceeded 0.5 ppmv (TCE at CWL-D1-470 and CWL-D2-470 and 1,1,2-trichloro-1,2,2-trifluoroethane at CWL-D2-470).

The March sampling of the CWL-D3-440 involved the collection of two samples. A preliminary sample was collected immediately after the port was reopened using pressurized ultra-pure grade nitrogen on March 22. In accordance with NMED direction on March 5, the environmental sample was collected 7 days later on March 29. The sample port and tubing were purged to remove greater than 3 tubing volumes of air prior to sample collection. Results of the two samples were very similar, with concentrations generally being higher in the March 29 sample. TCE and 1,1,2-trichloro-1,2,2-trifluoroethane concentrations were 5.9 and 1.1 ppmv in the preliminary sample, and 6.8 and 1.1 ppmv in the environmental sample. Several other VOCs were detected in both samples at concentrations less than 1 ppmv. Only the March 29 analytical results are presented in Table 5-1.

In May 2012, SNL/NM personnel resampled two monitoring wells because the duplicate samples collected during January 2012 failed the RPD requirement of less than 20% for specific constituents. The original January and May resample results (environmental and duplicate sample pairs) for wells CWL-UI2-36 and CWL-D3-480 are presented in Tables 5-1 and 5-2, and discussed in the Section 5.2.2.

5.2.2 Field Quality Control Sample Results

Table 5-2 presents field duplicate results for samples collected from wells CWL-UI2-36, CWL-D1-160, and CWL-D3-480 and RPD calculations that were performed for all detected compounds that are reported at concentrations exceeding the analytical laboratory reporting

Table 5-1
Summary of Detected Volatile Organic Compounds
Chemical Waste Landfill Soil-Gas Monitoring
Analytical Method TO-14A[a]
Calendar Year 2012

Well ID/Sample Port	Analyte	Result (ppbv)	MDL (ppbv)	RL (ppbv)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample Number
CWL-UI1-40	Chloroform	940	77	150	--	--	091655-001
25-Jan-12	1,1-Dichloroethene	250	77	150	--	--	091655-001
	Tetrachloroethene	4200	77	150	--	--	091655-001
	Trichloroethene	5200	77	150	--	--	091655-001
	Trichlorofluoromethane	240	77	150	--	--	091655-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	930	77	150	--	--	091655-001
	Total Organics[c]	11760	NA	NA	NA	NA	091655-001
CWL-UI1-80	Chloroform	670	110	210	--	--	091656-001
25-Jan-12	1,1-Dichloroethene	430	110	210	--	--	091656-001
	Methylene Chloride	130	110	210	J	--	091656-001
	Tetrachloroethene	1200	110	210	--	--	091656-001
	Trichloroethene	6500	110	210	--	--	091656-001
	Trichlorofluoromethane	250	110	210	--	--	091656-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1000	110	210	--	--	091656-001
	Total Organics[c]	10180	NA	NA	NA	NA	091656-001
CWL-UI1-120	Chloroform	480	110	230	--	--	091657-001
25-Jan-12	1,1-Dichloroethene	470	110	230	--	--	091657-001
	Methylene Chloride	250	110	230	--	--	091657-001
	Tetrachloroethene	880	110	230	--	--	091657-001
	Trichloroethene	7700	110	230	--	--	091657-001
	Trichlorofluoromethane	290	110	230	--	--	091657-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1000	110	230	--	--	091657-001
	Total Organics[c]	11070	NA	NA	NA	NA	091657-001
CWL-UI2-36	Chloroform	550	42	84	--	--	091659-001
25-Jan-12	Tetrachloroethene	180	42	84	--	--	091659-001
	Trichloroethene	3100	42	84	--	--	091659-001
	Trichlorofluoromethane	180	42	84	--	--	091659-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	630	42	84	--	--	091659-001
	Total Organics[c]	4640	NA	NA	NA	NA	091659-001
CWL-UI2-36 (Duplicate)	Chloroform	510	43	87	--	--	091660-001
25-Jan-12	Tetrachloroethene	170	43	87	--	--	091660-001
	Trichloroethene	3000	43	87	--	--	091660-001
	Trichlorofluoromethane	140	43	87	--	--	091660-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	580	43	87	--	--	091660-001
	Total Organics[c]	4400	NA	NA	NA	NA	091660-001

Refer to footnotes at end of table.

Table 5-1 *(Continued)*
Summary of Detected Volatile Organic Compounds
Chemical Waste Landfill Soil-Gas Monitoring
Analytical Method TO-14A[a]
Calendar Year 2012

Well ID/Sample Port	Analyte	Result (ppbv)	MDL (ppbv)	RL (ppbv)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample Number
CWL-UI2-36 (Re-sample) 07-May-12	Chloroform	600	36	73	--	--	092337-001
	Dichlorodifluoromethane	41	36	73	J	--	092337-001
	Tetrachloroethene	190	36	73	--	--	092337-001
	Trichloroethene	3200	36	73	--	--	092337-001
	Trichlorofluoromethane	220	36	73	--	--	092337-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	790	36	73	--	--	092337-001
	Total Organics[c]	5041	NA	NA	NA	NA	092337-001
CWL-UI2-36 (Re-sample Duplicate) 07-May-12	Chloroform	570	44	89	--	--	092338-001
	Tetrachloroethene	190	44	89	--	--	092338-001
	Trichloroethene	3200	44	89	--	--	092338-001
	Trichlorofluoromethane	210	44	89	--	--	092338-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	760	44	89	--	--	092338-001
	Total Organics[c]	4930	NA	NA	NA	NA	092338-001
CWL-UI2-76 25-Jan-12	Chloroform	780	72	140	--	--	091661-001
	Tetrachloroethene	230	72	140	--	--	091661-001
	Trichloroethene	5600	72	140	--	--	091661-001
	Trichlorofluoromethane	240	72	140	--	--	091661-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1000	72	140	--	--	091661-001
	Total Organics[c]	7850	NA	NA	NA	NA	091661-001
CWL-UI2-136 25-Jan-12	Chloroform	670	110	220	--	--	091662-001
	1,1-Dichloroethene	270	110	220	--	--	091662-001
	1,2-Dichloropropane	130	110	270	J	--	091662-001
	Tetrachloroethene	280	110	220	--	--	091662-001
	Trichloroethene	8500	110	220	--	--	091662-001
	Trichlorofluoromethane	300	110	220	--	--	091662-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1300	110	220	--	--	091662-001
	Total Organics[c]	11450	NA	NA	NA	NA	091662-001
CWL-D1-100 26-Jan-12	Chloroform	560	110	220	--	--	091664-001
	1,1-Dichloroethene	480	110	220	--	--	091664-001
	Tetrachloroethene	1200	110	220	--	--	091664-001
	Trichloroethene	10000	110	220	--	--	091664-001
	Trichlorofluoromethane	300	110	220	--	--	091664-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1300	110	220	--	--	091664-001
	Total Organics[c]	13840	NA	NA	NA	NA	091664-001

Refer to footnotes at end of table.

Table 5-1 *(Continued)*
Summary of Detected Volatile Organic Compounds
Chemical Waste Landfill Soil-Gas Monitoring
Analytical Method TO-14A[a]
Calendar Year 2012

Well ID/Sample Port	Analyte	Result (ppbv)	MDL (ppbv)	RL (ppbv)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample Number
CWL-D1-160	Chloroform	530	220	440	--	--	091665-001
26-Jan-12	1,1-Dichloroethene	760	220	440	--	--	091665-001
	Tetrachloroethene	790	220	440	--	--	091665-001
	Trichloroethene	14000	220	440	--	--	091665-001
	Trichlorofluoromethane	400	220	440	J	--	091665-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	2000	220	440	--	--	091665-001
	Total Organics[c]	18480	NA	NA	NA	NA	091665-001
CWL-D1-160 (Duplicate)	Chloroform	490	220	440	--	--	091666-001
26-Jan-12	1,1-Dichloroethene	700	220	440	--	--	091666-001
	Tetrachloroethene	710	220	440	--	--	091666-001
	Trichloroethene	14000	220	440	--	--	091666-001
	Trichlorofluoromethane	280	220	440	J	--	091666-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	2000	220	440	--	--	091666-001
	Total Organics[c]	18180	NA	NA	NA	NA	091666-001
CWL-D1-240	Tetrachloroethene	460	310	620	J	--	091667-001
26-Jan-12	Trichloroethene	22000	310	620	--	--	091667-001
	Total Organics	22460	NA	NA	NA	NA	091667-001
CWL-D1-350	1,1-Dichloroethene	900	140	280	--	--	091668-001
26-Jan-12	Trichloroethene	13000	140	280	--	--	091668-001
	Trichlorofluoromethane	460	140	280	--	--	091668-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	2200	140	280	--	--	091668-001
	Total Organics[c]	16560	NA	NA	NA	NA	091668-001
CWL-D1-470	Dichlorodifluoromethane	10	6.2	12	J	--	091669-001
26-Jan-12	1,1-Dichloroethene	55	6.2	12	--	--	091669-001
	Methylene Chloride	12	6.2	12	--	--	091669-001
	Tetrachloroethene	10	6.2	12	J	--	091669-001
	Trichloroethene	510[d]	6.2	12	--	--	091669-001
	Trichlorofluoromethane	51	6.2	12	--	--	091669-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	220	6.2	12	--	--	091669-001
	Total Organics[c]	868	NA	NA	NA	NA	091669-001
CWL-D2-120	Chloroform	550	240	470	--	--	091671-001
27-Jan-12	1,1-Dichloroethene	840	240	470	--	--	091671-001
	Tetrachloroethene	540	240	470	--	--	091671-001
	Trichloroethene	16000	240	470	--	--	091671-001
	Trichlorofluoromethane	470	240	470	--	--	091671-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	2300	240	470	--	--	091671-001
	Total Organics[c]	20700	NA	NA	NA	NA	091671-001

Refer to footnotes at end of table.

Table 5-1 *(Continued)*
Summary of Detected Volatile Organic Compounds
Chemical Waste Landfill Soil-Gas Monitoring
Analytical Method TO-14A[a]
Calendar Year 2012

Well ID/Sample Port	Analyte	Result (ppbv)	MDL (ppbv)	RL (ppbv)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample Number
CWL-D2-240	Chloroform	470	270	530	J	--	091672-001
27-Jan-12	1,1-Dichloroethene	950	270	530	--	--	091672-001
	Tetrachloroethene	470	270	530	J	--	091672-001
	Trichloroethene	18000	270	530	--	--	091672-001
	Trichlorofluoromethane	510	270	530	J	--	091672-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	2500	270	530	--	--	091672-001
	Total Organics[c]	22900	NA	NA	NA	NA	091672-001
CWL-D2-350	Chloroform	220	130	250	J	--	091673-001
27-Jan-12	1,1-Dichloroethene	260	130	250	--	--	091673-001
	Methylene Chloride	130	130	250	J	--	091673-001
	Trichloroethene	11000	130	250	--	--	091673-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1700	130	250	--	--	091673-001
	Total Organics[c]	13310	NA	NA	NA	NA	091673-001
CWL-D2-440	Dichlorodifluoromethane	24	22	44	J	--	091674-001
27-Jan-12	1,1-Dichloroethene	170	22	44	--	--	091674-001
	Tetrachloroethene	52	22	44	--	--	091674-001
	Trichloroethene	1800	22	44	--	--	091674-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	550	22	44	--	--	091674-001
	Total Organics[c]	2596	NA	NA	NA	NA	091674-001
CWL-D2-470	Chloroform	170	15	30	--	--	091675-001
27-Jan-12	Dichlorodifluoromethane	30	15	30	--	--	091675-001
	1,1-Dichloroethene	290	15	30	--	--	091675-001
	1,2-Dichloropropane	44	15	38	--	--	091675-001
	Tetrachloroethene	190	15	30	--	--	091675-001
	Trichloroethene	4100[d]	85	170	--	--	091675-001
	Trichlorofluoromethane	190	15	30	--	--	091675-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	770[d]	15	30	--	--	091675-001
	Total Organics[c]	5784	NA	NA	NA	NA	091675-001
CWL-D3-120	Chloroform	190	84	170	--	--	091677-001
30-Jan-12	1,1-Dichloroethene	370	84	170	--	--	091677-001
	Tetrachloroethene	170	84	170	--	--	091677-001
	Trichloroethene	7000	84	170	--	--	091677-001
	Trichlorofluoromethane	260	84	170	--	--	091677-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1200	84	170	--	--	091677-001
	Total Organics[c]	9190	NA	NA	NA	NA	091677-001

Refer to footnotes at end of table.

Table 5-1 *(Continued)*
Summary of Detected Volatile Organic Compounds
Chemical Waste Landfill Soil-Gas Monitoring
Analytical Method TO-14A[a]
Calendar Year 2012

Well ID/Sample Port	Analyte	Result (ppbv)	MDL (ppbv)	RL (ppbv)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample Number
CWL-D3-170	Chloroform	220	110	220	--	--	091678-001
30-Jan-12	1,1-Dichloroethene	480	110	220	--	--	091678-001
	1,2-Dichloropropane	150	110	220	J	--	091678-001
	Tetrachloroethene	180	110	270	J	--	091678-001
	Trichloroethene	7900	110	220	--	--	091678-001
	Trichlorofluoromethane	340	110	220	--	--	091678-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1300	110	220	--	--	091678-001
	Total Organics[c]	10570	NA	NA	NA	NA	091678-001
CWL-D3-350	Chloroform	200	120	250	J	--	091679-001
30-Jan-12	1,1-Dichloroethene	590	120	250	--	--	091679-001
	1,2-Dichloropropane	180	120	310	J	--	091679-001
	Methylene Chloride	960	120	250	--	--	091679-001
	Tetrachloroethene	190	120	250	J	--	091679-001
	Trichloroethene	8800	120	250	--	--	091679-001
	Trichlorofluoromethane	380	120	250	--	--	091679-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1600	120	250	--	--	091679-001
	Total Organics[c]	12900	NA	NA	NA	NA	091679-001
CWL-D3-440	Chloroform	150	97	190	J	--	091962-001
29-Mar-12	1,1-Dichloroethene	370	97	190	--	--	091962-001
	Methylene Chloride	780	97	190	--	--	091962-001
	Tetrachloroethene	170	97	190	J	--	091962-001
	Trichloroethene	6800	97	190	--	--	091962-001
	Trichlorofluoromethane	320	97	190	--	--	091962-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	1100	97	190	--	--	091962-001
	Total Organics[c]	9690	NA	NA	NA	NA	091962-001
CWL-D3-480	Acetone	10	5.4	13	J	--	091681-001
30-Jan-12	Chloroform	13	2.7	5.4	--	--	091681-001
	1,1-Dichloroethene	13	2.7	5.4	--	--	091681-001
	1,2-Dichloropropane	3.0	2.7	6.7	J	--	091681-001
	Methylene Chloride	3.6	2.7	5.4	J	--	091681-001
	Trichloroethene	210	2.7	5.4	--	--	091681-001
	Trichlorofluoromethane	11	2.7	5.4	--	--	091681-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	35	2.7	5.4	--	--	091681-001
	Total Organics[c]	298.6	NA	NA	NA	NA	091681-001

Refer to footnotes at end of table.

Table 5-1 *(Concluded)*
Summary of Detected Volatile Organic Compounds
Chemical Waste Landfill Soil-Gas Monitoring
Analytical Method TO-14A[a]
Calendar Year 2012

Well ID/Sample Port	Analyte	Result (ppbv)	MDL (ppbv)	RL (ppbv)	Laboratory Qualifier[b]	Validation Qualifier[b]	Sample Number
CWL-D3-480 (Duplicate) 30-Jan-12	Acetone	27	4.0	10	--	--	091682-001
	Chloroethane	5.6	2.0	4.0	--	--	091682-001
	Chloroform	8.7	2.0	4.0	--	--	091682-001
	1,1-Dichloroethene	8.6	2.0	4.0	--	--	091682-001
	Methylene Chloride	4.5	2.0	4.0	--	--	091682-001
	Tetrachloroethene	4.3	2.0	4.0	--	--	091682-001
	Toluene	82	2.0	4.0	--	--	091682-001
	Trichloroethene	130	2.0	4.0	--	--	091682-001
	Trichlorofluoromethane	7.3	2.0	4.0	--	--	091682-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	24	2.0	4.0	--	--	091682-001
	m,p-Xylene	2.5	2.0	4.0	J	--	091682-001
	Total Organics[c]	304.5	NA	NA	NA	NA	091682-001
CWL-D3-480 (Re-sample) 07-May-12	Chloroform	3.4	2.0	4.0	J	--	092339-001
	1,1-Dichloroethene	4.3	2.0	4.0	--	--	092339-001
	4-Methyl-2-pentanone	2.0	2.0	10	J	--	092339-001
	Tetrachloroethene	2.1	2.0	4.0	J	--	092339-001
	Trichloroethene	67	2.0	4.0	--	--	092339-001
	Trichlorofluoromethane	4.2	2.0	4.0	--	--	092339-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	12	2.0	4.0	--	--	092339-001
	Total Organics[c]	90.8	NA	NA	NA	NA	092339-001
CWL-D3-480 (Re-sample Duplicate)07-May-12	Chloroform	3.2	2.0	4.0	J	--	092340-001
	Trichloroethene	61	2.0	4.0	--	--	092340-001
	Trichlorofluoromethane	3.7	2.0	4.0	J	--	092340-001
	1,1,2-Trichloro-1,2,2-trifluoroethane	11	2.0	4.0	--	--	092340-001
	Total Organics[c]	78.9	NA	NA	NA	NA	092340-001

Notes:
[a]Analytical Method EPA 1999, "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-14A" Center for Environmental Research Information, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.
[b]Laboratory/Validation Qualifier - Blank (--) cell = all quality control samples met acceptance criteria. "J" and "U," see below.
[c]Total Organics -- sum of validated detected organic compounds.
[d]Detected value >500 ppbv in deepest well ports. Upper and lower confidence limits about the mean at a 95% confidence level are presented in Section 5.3.
EPA = U.S. Environmental Protection Agency.
J = Estimated value. Analyte detected at a level below the practical quantitation limit or reporting limit (RL) and greater than or equal to the MDL.
MDL = Method detection limit. The minimum concentration that can be measured and reported with 99% confidence that the analyte is present (i.e., greater than zero).
NA = Not applicable.
ppbv = parts per billion by volume basis
RL = Reporting limit. Minimum concentration that can be reported with a statistically established degree of confidence.

Table 5-2
Summary of Duplicate Samples
Chemical Waste Landfill Soil-Gas Monitoring
Calendar Year 2012

Well ID / Parameter	Environmental Sample (R1)	Duplicate Sample (R2)	RPD[a]
	(ppbv)		
January 2012 Duplicate Sample Results			
CWL-UI2-36			
Chloroform	550	510	8
Tetrachloroethene	180	170	6
Trichloroethene	3100	3000	3
Trichlorofluoromethane	180	140	**25**
1,1,2-Trichloro-1,2,2-trifluoroethane	630	580	8
CWL-D1-160			
Chloroform	530	490	8
1,1-Dichloroethene	760	700	8
Tetrachloroethene	790	710	11
Trichloroethene	14000	14000	< 1
1,1,2-Trichloro-1,2,2-trifluoroethane	2000	2000	< 1
CWL-D3-480			
Chloroform	13	8.7	**40**
1,1-Dichloroethene	13	8.6	**41**
Trichloroethene	210	130	**47**
Trichlorofluoromethane	11	7.3	**40**
1,1,2-Trichloro-1,2,2-trifluoroethane	35	24	**37**
May 2012 Duplicate Resample Results			
CWL-UI2-36 (Re-sample)			
Chloroform	600	570	5
Tetrachloroethene	190	190	< 1
Trichloroethene	3200	3200	< 1
Trichlorofluoromethane	220	210	5
1,1,2-Trichloro-1,2,2-trifluoroethane	790	760	4
CWL-D3-480 (Re-sample)			
Trichloroethene	67	61	9
1,1,2-Trichloro-1,2,2-trifluoroethane	12	11	9

[a]RPD = Relative percent difference is calculated with the following equation and rounded to nearest whole number. Bolded values exceed acceptance criterion of less than 20%.

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

where: R_1 = Analysis result.
R_2 = Duplicate analysis result.

ppbv = parts per billion by volume

limit (RL) (i.e., detections below the RL that are qualified as "estimated" are not used for RPD calculations). If a detected compound in one sample is not detected in the corresponding duplicate or environmental sample, no RPD was calculated. In accordance with PCCP Attachment3, Section 3.6, the acceptance criterion for soil-gas RPDs is 20% or less and resampling is required if this criterion is exceeded.

The duplicate sample results from CWL-D1-160 show good agreement; all RPD values are less than 20. RPDs for various VOCs were outside acceptable QC limits in CWL-UI2-36 and CWL-D3-480 samples (Table 5-2, January 2012 Duplicate Sample Results). In May 2012, SNL/NM personnel resampled CWL-UI2-36 and CWL-D3-480. RPD values for the resamples (environmental and duplicate pairs) were all within acceptable limits (Table 5-2, May 2012 Duplicate Sample Results).

A total of eight field blank samples were submitted with CY 2012 samples. No VOCs were detected above laboratory MDLs except for methylene chloride. Methylene chloride was detected in the May 2012 field blank sample at a concentration of 2.1 ppbv. No corrective action was required since the compound was reported in associated environmental samples at concentrations greater than ten times the field blank result.

5.2.3 Data Quality

Field QC sample results met the sampling DQOs and validated the adequacy of the field sampling procedures and protocol. Internal laboratory QC samples, including method blanks and duplicate laboratory control samples, were analyzed concurrently with CWL soil-gas samples. The data were reviewed and qualified in accordance with AOP 00-03, "Data Validation Procedure for Chemical and Radiochemical Data" (SNL/NM May 2011).

No significant data quality problems were noted for project contaminants of concern. The compound benzyl chloride was qualified during data validation as unusable in the CWL-D3-440 sample. However, benzyl chloride is not a CWL soil-gas contaminant of concern and was not detected in any CY 2012 soil-gas samples.

5.2.4 Variances and Non-Conformances

There were no variances, one nonconformance, and one project-specific issue noted during the CY 2012 soil-gas activities. The nonconformance involved RPDs for various VOCs that were outside the acceptable QC limit in January 2012 duplicate samples from CWL-UI2-36 and CWL-D3-480. In May 2012, these locations were resampled in accordance with PCCP requirements and all RPD values were within acceptable limits.

The one project-specific issue involved the obstructed sampling port (CWL-D3-440) discovered in January 2012 by sampling personnel. The port could not be sampled in January, most likely due to an obstruction in the screen interval. In March 2012 after receiving direction from NMED, the sample port was opened using pressurized ultra-pure grade nitrogen gas, which cleared the obstruction within the sampling port screen. The environmental sample was collected seven-days afterwards in accordance with NMED direction received on March 5, 2012 (SNL/NM March 2012).

5.3 Data Evaluation

Soil-gas monitoring is required to determine whether the groundwater beneath the CWL is adequately protected in support of the CWL groundwater monitoring program. In accordance with PCCP Attachment 1, Section 1.8.2.2, statistical evaluation of soil-gas results for specific VOCs that exceed 0.50 ppmv from the three deepest sampling ports of wells CWL-D1 through CWL-D3 (i.e., CWL-D1-470, CWL-D2-470, and CWL-D3-480) are required annually, and include the following:

- calculate the UCL and LCL about the mean at a 95% confidence level using current data and historic data since completion of the VE VCM, and
- compare the LCL to the trigger level of 20 ppmv.

For the first 5 years after the effective date of the PCCP (June 2, 2011), historical soil-gas monitoring results are used to augment the statistical analysis. After June 2, 2016, only soil-gas data collected under the PCCP will be used. Historical soil-gas data used and presented in Section 5.4 includes results from June 1998, June 1999, August 2001, June 2004, and September 2004. Although the VE VCM was completed in July 1998, the June 1998 data set is included as it is representative of the conditions when the VE system was shut down a month later.

5.3.1 Statistical Assessment Requirements

Based upon the soil-gas monitoring results presented in Table 5-1, TCE in samples from CWL-D1-470 and CWL-D2-470 and Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane) in the sample from CWL-D2-470 exceeded the threshold value of 0.50 ppmv. As a result, confidence intervals (UCLs and LCLs) are calculated and used to compare to the trigger level of 20 ppmv. If a result is below the analytical laboratory detection limit, the MDL for the constituent is used for statistical analysis.

5.3.2 Statistical Assessment Results

CY 2012 soil-gas statistical assessment results are presented in Table 5-3. The LCLs for TCE and Freon 113 are below the trigger level of 20 ppmv. The highest LCL value was 1.64 ppmv for TCE at CWL-D2-470.

5.4 Historic Data Evaluation

In accordance with PCCP Attachment 1, Section 1.12 and Attachment 3, Section 3.11, current soil-gas monitoring results are compared and evaluated with respect to historic results since completion of the VE VCM. This allows for long-term trends to be defined and provides for more meaningful interpretations of current results with respect to historic data. Tables 5-4 and 5-5 present TCE and Total VOCs soil-gas monitoring results, respectively, for the post-closure care monitoring network. Data sets included range from June 1998 (representative of the end of the VE VCM) to January 2012.

Table 5-3
Chemical Waste Landfill Soil-Gas Monitoring
Statistical Assessment Results Summary
Calendar Year 2012

Soil-Gas Constituent Exceeding Threshold Concentration[a]	Minimum[b] (ppmv)	Maximum[b] (ppmv)	Mean[c] (ppmv)	Standard Deviation[c]	LCL[c] (ppmv)	UCL[c] (ppmv)	Distribution Type[c]	Trigger Level[a] (ppmv)	Trigger Level Exceeded[a]?
TCE (0.51 ppmv) CWL-D1-470	0.077	0.51	0.26	0.14	0.14	0.37	Normal	20	No
TCE (4.1 ppmv) CWL-D2-470	0.94	5.8	3.26	1.97	1.64	4.88	Normal	20	No
1,1,2-Trichloro-1,2,2-trifluoroethane (0.77 ppmv) CWL-D2-470	0.39	1.2	0.76	0.33	0.46	1.08	Normal	20	No

Notes:

[a]CWL Permit Attachment 1, Section 1.8.2.2, defines the threshold concentration (0.50 ppmv) and trigger level (20 ppmv). The 0.50 ppmv threshold concentration applies to only soil-gas constituents detected in the three deepest sampling ports of wells CWL-D1 through CWL-D3.
[b]Minimum and maximum results determined from historical data, including the CY 2012 results.
[c]Mean, standard deviation, LCL, UCL, and Distribution Type determined using PRO-UCL statistical program.
[d]Exceedance determined by comparing the constituent LCL against the trigger level of 20 ppmv.
LCL = Lower confidence limit.
ppmv = Parts per million by volume.
TCE = Trichloroethene.
UCL = Upper confidence limit.

Table 5-4
Historic Soil-Gas Monitoring Summary – TCE Concentrations (ppmv)
EPA Method TO-14A[a]
Chemical Waste Landfill

Well ID & Sample Port Depth[b]	June 1998	June 1999	August 2001	June 2004	September 2004	January 2012
CWL-UI1-40	4.5	16.0 / 14.0[c]	7.9	3.8	4.0	5.2
CWL-UI1-80	0.19	4.9	6.7	5.9	6.1	6.5
CWL-UI1-120	3.0	5.9	9.1	6.0	14.0	7.7
CWL-UI2-36	0.037	0.70 / 0.64[c]	ND	1.6	ND	3.1
CWL-UI2-80	0.091	1.0	2.4	3.4	4.1	5.6
CWL-UI2-136	5.5	1.9	4.6	3.0	1.9	8.5
CWL-D1-100	0.220	2.5	7.1	9.8	13.0	10.0
CWL-D1-160	120.0	14.0	21.0	25.0	29.0	14.0
CWL-D1-240	160.0 / 130.0[c]	44.0	44.0	34.0	34.0	22.0
CWL-D1-350	0.013	11.0	19.0	13.0	22.0	13.0
CWL-D1-470	0.077	0.17	0.25	0.25	0.27	0.51
CWL-D2-120	3.1	21.0	20.0	22.0	25.0	16.0
CWL-D2-240	ND	40.0 / 35.0[c]	38.0	26.0	13.0	18.0
CWL-D2-350	0.064	12.0	18.0	11.0	17.0	11.0
CWL-D2-440	0.082	1.0	7.6	2.5	5.9	1.8
CWL-D2-470	ND	0.94	5.8	3.1	4.6	4.1
CWL-D3-120	0.009	1.1	4.0	6.0	4.9	7.0
CWL-D3-170	ND	2.5	9.9	4.5	6.6	7.9
CWL-D3-350	ND	1.6	2.4	2.2	1.5	8.8
CWL-D3-440	ND	1.8	0.26	0.75	3.4	6.8
CWL-D3-480	ND	1.9	1.2	0.2	2.1	0.21

Notes:
[a]Analytical Method EPA 1999, "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-14A" Center for Environmental Research Information, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.
[b]Port depth is in feet below ground surface.
[c]Duplicate sample result
ND = not detected
EPA = U.S. Environmental Protection Agency
ppmv = parts per million by volume
TCE = trichloroethene

Table 5-5
Historic Soil-Gas Monitoring Summary – Total Volatile Organic Compound Concentrations[a] (ppmv)
EPA Method TO-14A[b]
Chemical Waste Landfill

Well ID & Sample Port Depth[c]	June 1998	June 1999	August 2001	June 2004	September 2004	January 2012
CWL-UI1-40	112	246	141	11.78	11.47	11.76
CWL-UI1-80	0.22	9.63	13	10.61	10.67	10.18
CWL-UI1-120	6.32	9.94	45.42	9.36	21.41	11.07
CWL-UI2-36	17.6	2117	1800	813.7	850.0	4.64
CWL-UI2-80	0.126	1.65	4.37	5.52	6.90	7.85
CWL-UI2-136	10.5	4.21	7.98	4.42	2.85	11.45
CWL-D1-100	0.248	4.93	11.9	14.59	18.22	13.84
CWL-D1-160	167	21.4	30.1	33.32	38.41	18.48
CWL-D1-240	261	78.4	61.5	45.27	44.74	22.46
CWL-D1-350	0.02	20.7	31.7	18.73	30.53	16.56
CWL-D1-470	0.105	0.231	0.921	0.612	0.82	0.868
CWL-D2-120	5.4	33.0	29.4	29.26	34.23	20.70
CWL-D2-240	0.047	101	52.9	34.72	17.62	22.90
CWL-D2-350	0.091	22.9	25.9	15.42	23.41	13.31
CWL-D2-440	0.453	4.38	11.8	3.85	9.29	2.60
CWL-D2-470	0.058	6.95	8.40	4.17	6.60	5.784
CWL-D3-120	0.009	2.17	6.20	8.39	7.10	9.19
CWL-D3-170	0.037	5.01	15.0	6.11	9.40	10.57
CWL-D3-350	0.106	2.76	3.98	3.39	2.34	12.90
CWL-D3-440	0.017	4.04	0.519	0.96	5.14	9.69
CWL-D3-480	0.001	4.47	1.85	0.31	3.30	0.2986

Notes:
[a]The total VOC concentration is the sum of all constituents in the EPA Compendium.
[b]Analytical Method EPA 1999, "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-14A" Center for Environmental Research Information, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.
[c]Port depth is in feet below ground surface.
EPA = U.S. Environmental Protection Agency
ppmv = parts per million by volume
VOC = volatile organic compound

Consistent with pre-VE VCM characterization data, the highest concentrations of TCE in soil gas remain in the central part of the vadose zone, approximately 240 feet bgs (CWL-D1 and CWL-D2 results for the 240 foot bgs depth, 22.0 and 18.0 ppmv respectively). Consistent with the detailed conceptual site model presented in Annex E of the CWL Corrective Measures Study Report (SNL/NM December 2004), concentrations in this central portion of the plume are generally decreasing over time as VOC soil gas slowly diffuses in three dimensions (i.e., away from this central "core" of the VOC soil-gas plume). As this slow diffusion occurs, concentrations at other depths will sometimes increase. When the September 2004 results are compared to the January 2012 results for the CWL-D1 through CWL-D3 sampling ports (5 sampling ports each, for a total of 15 ports from 100 to 480 feet bgs), nine sampling ports show decreasing levels, whereas six ports show increasing levels. Only one of the three deep sampling ports (CWL-D1-470) had a higher concentration in January 2012 relative to September 2004. These trends are directly mimicked by the total VOC results.

Figures 5-1 through 5-5 show the concentration of TCE over time by sampling port for CWL-UI1, CWL-UI2, CWL-D1, CWL-D2, and CWL-D3, respectively. Figures 5-6 through 5-10 show the concentration of total VOCs over time by sampling port for CWL-UI1, CWL-UI2, CWL-D1, CWL-D2, and CWL-D3, respectively. These figures are graphical representations of the data presented in Tables 5-4 and 5-5. The total VOC plots for CWL-UI1 and CWL-UI2 (Figures 5-6 and 5-7) look very different than the corresponding TCE plots (Figures 5-1 and 5-2). This is because for these locations and the shallower depths represented (36 to 136 feet bgs), acetone used to occur at very high concentrations, especially in the shallowest two ports (36 and 40 feet bgs) (SNL/NM December 2004). Concentrations of total VOCs have decreased dramatically over time in these shallow ports, most likely reflecting diffusion to the surface. Concentrations of TCE in these shallower soil-gas wells has stayed relatively low or slightly increased, as reflected in Table 5-4 and Figures 5-1 and 5-2. These trends at CWL-UI1 and CWL-UI2 are also consistent with upward diffusion of TCE soil gas from the former plume "core" located approximately 250 feet bgs.

The majority of the CWL residual soil-gas plume is represented by the CWL-D1 through D3 wells that have significantly deeper sampling ports, ranging from 110 to 480 feet bgs. TCE is the dominant and primary VOC of concern. Concentrations are generally steady or decreasing over time (Figures 5-3 and 5-4), except at the CWL-D3 location (Figure 5-5). All sampling ports at CWL-D3 show an increasing trend except the deepest port at 480 feet bgs. Of interest is the fact that TCE in groundwater is currently only being detected in CWL-MW10, which is the closest groundwater monitoring well to CWL-D3 (see Figure 2-4). Because of the concern that VOC soil gas could potentially enter a groundwater well through the upper unsaturated portion of the well screen or at casing joints that may not be air tight and contaminate groundwater samples, passive soil-gas venting devices (i.e., Baroballs™) were installed on all groundwater monitoring wells in March 2012.

Overall, the CY 2012 data set is consistent with historic post-VE VCM soil-gas monitoring results and suggests the residual VOC soil-gas plume beneath the CWL is slowly dissipating in three dimensions through diffusion in the vadose zone. These data and conclusions are consistent with the conceptual site model presented in Annex E of the CWL Corrective Measures Study Report (SNL/NM December 2004).

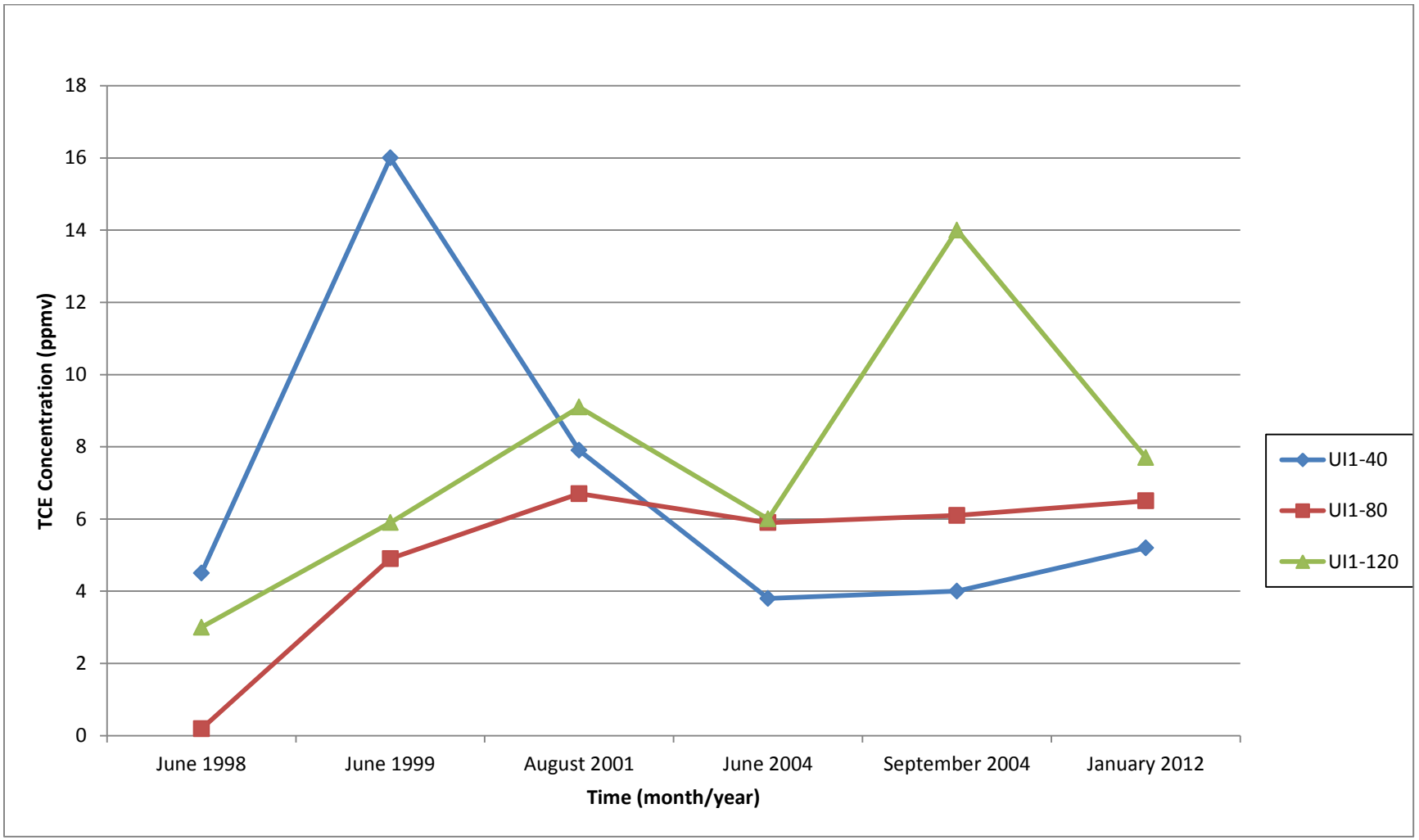

Figure 5-1
Historic Total TCE Compound Concentrations vs. Time
Chemical Waste Landfill Well UI-1 Ports

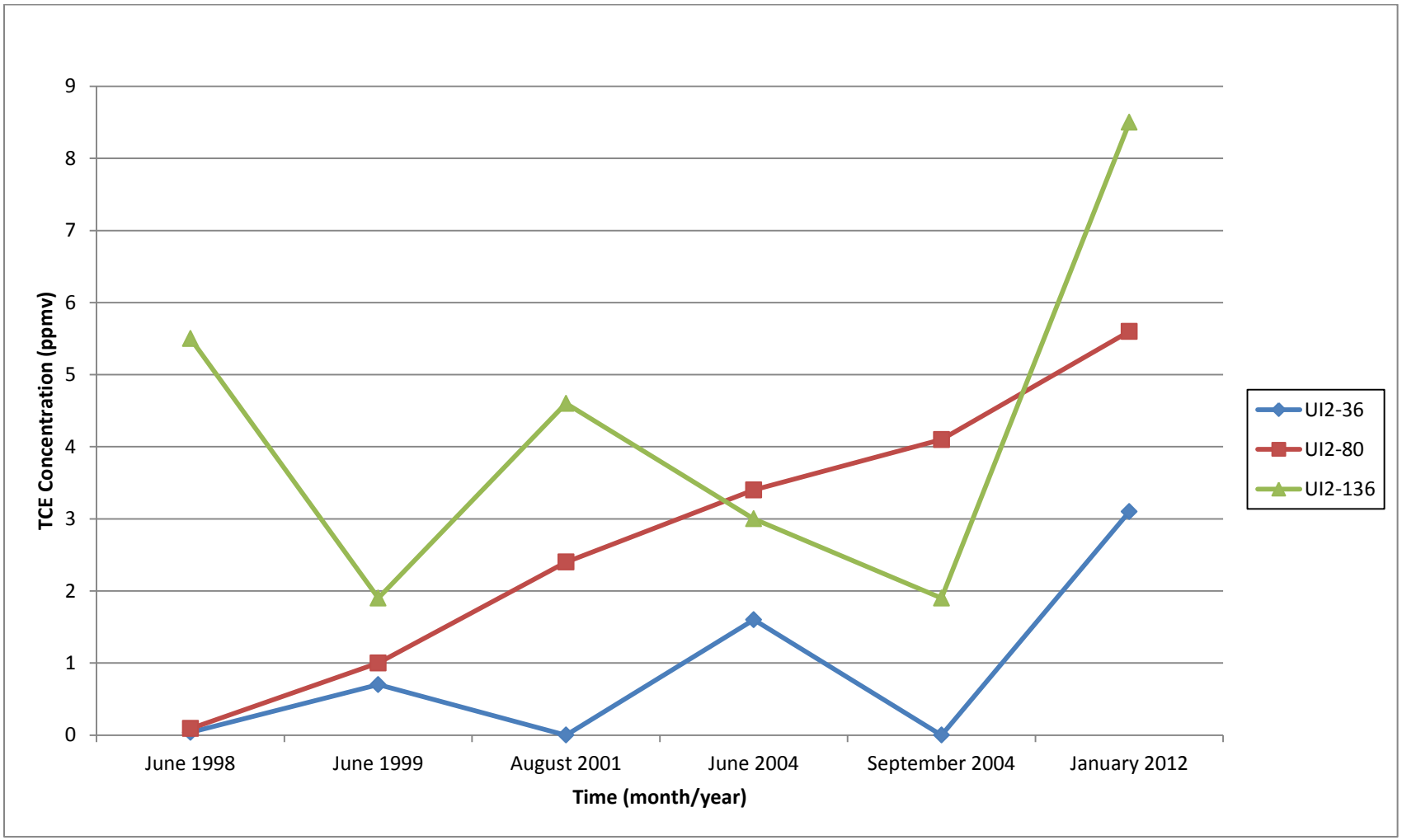

Figure 5-2
Historic Total TCE Compound Concentrations vs. Time
Chemical Waste Landfill Well UI-2 Ports

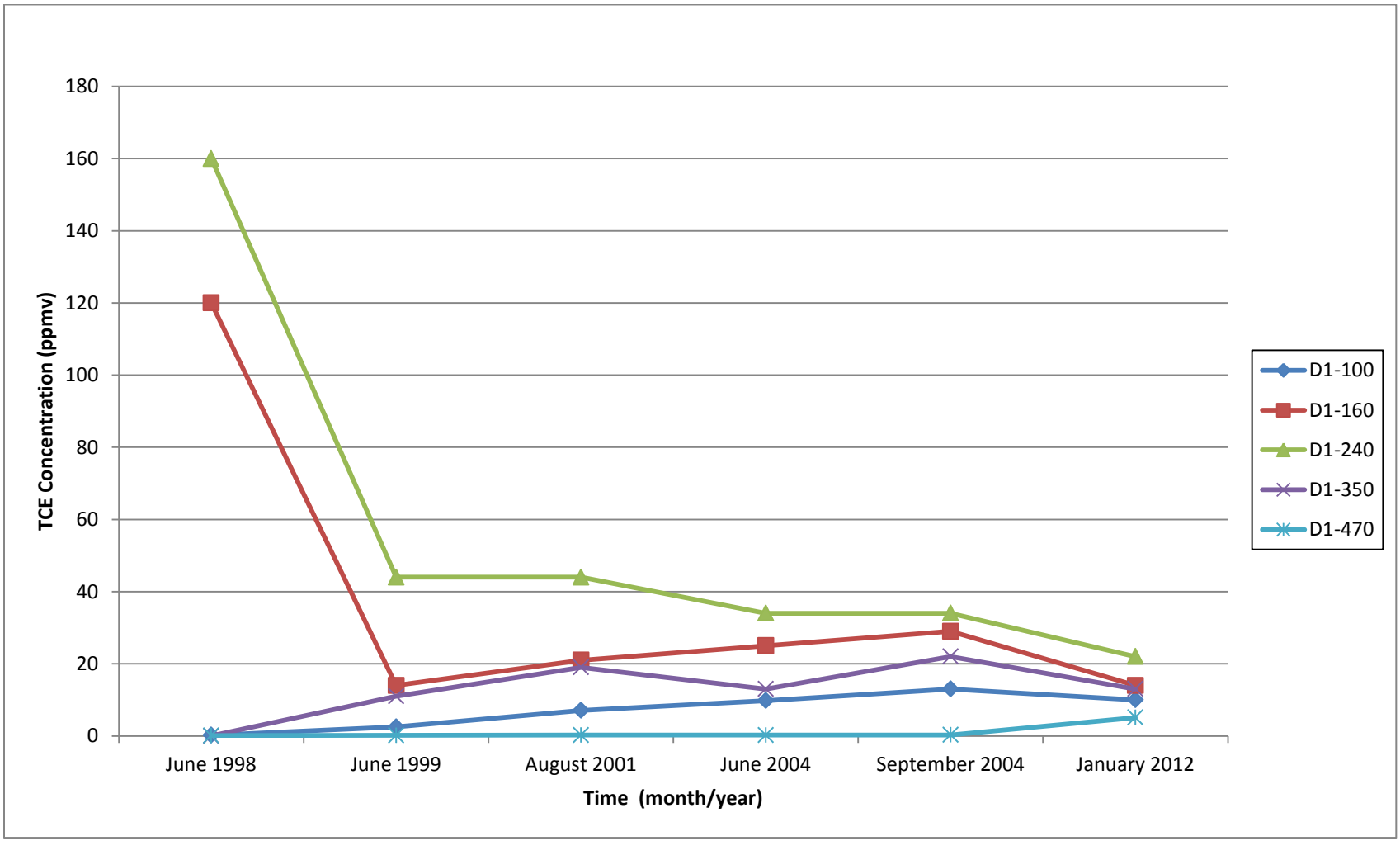

Figure 5-3
Historic Total TCE Compound Concentrations vs. Time
Chemical Waste Landfill Well D1 Ports

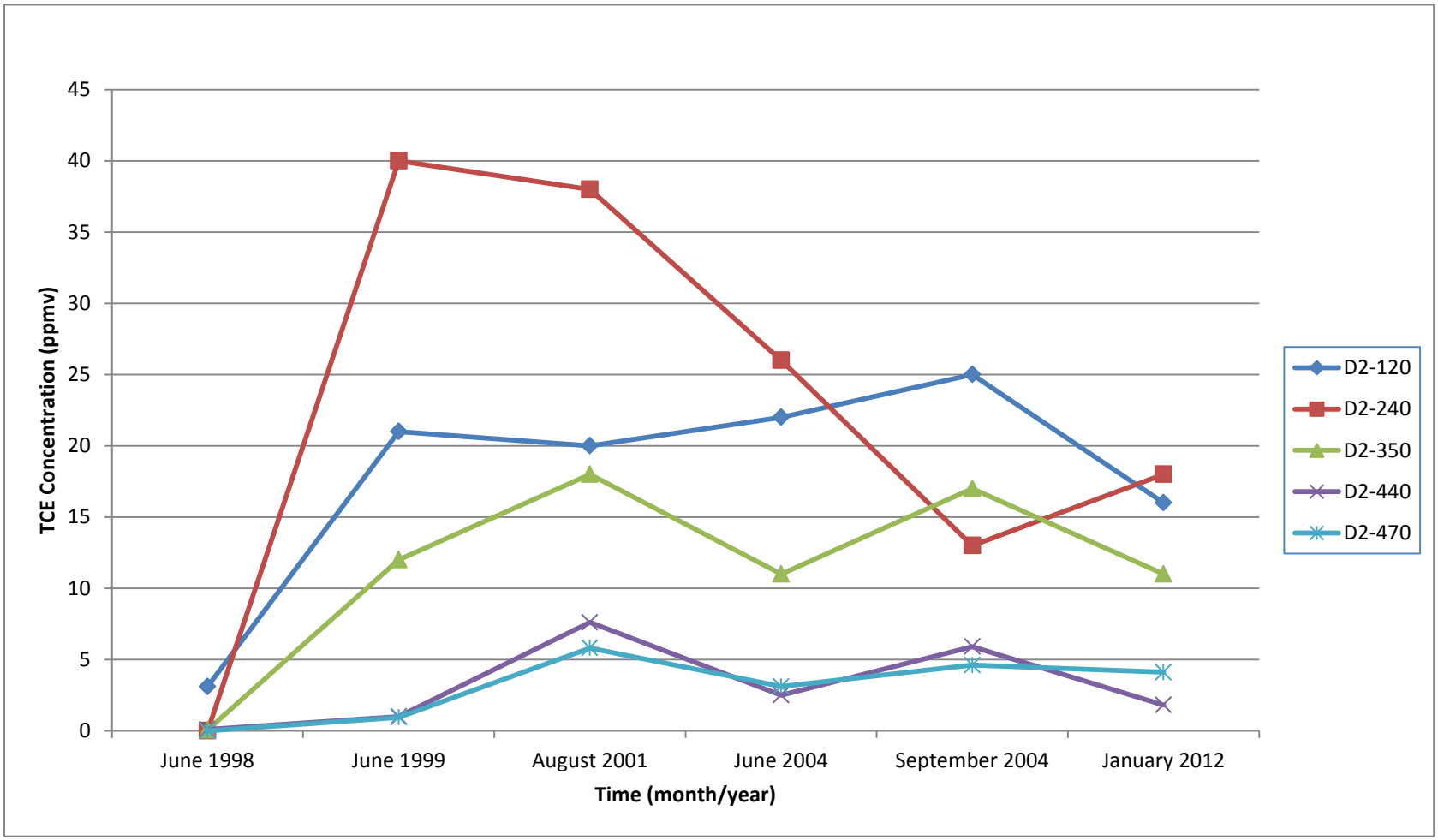

Figure 5-4
Historic Total TCE Compound Concentrations vs. Time
Chemical Waste Landfill Well D2 Ports

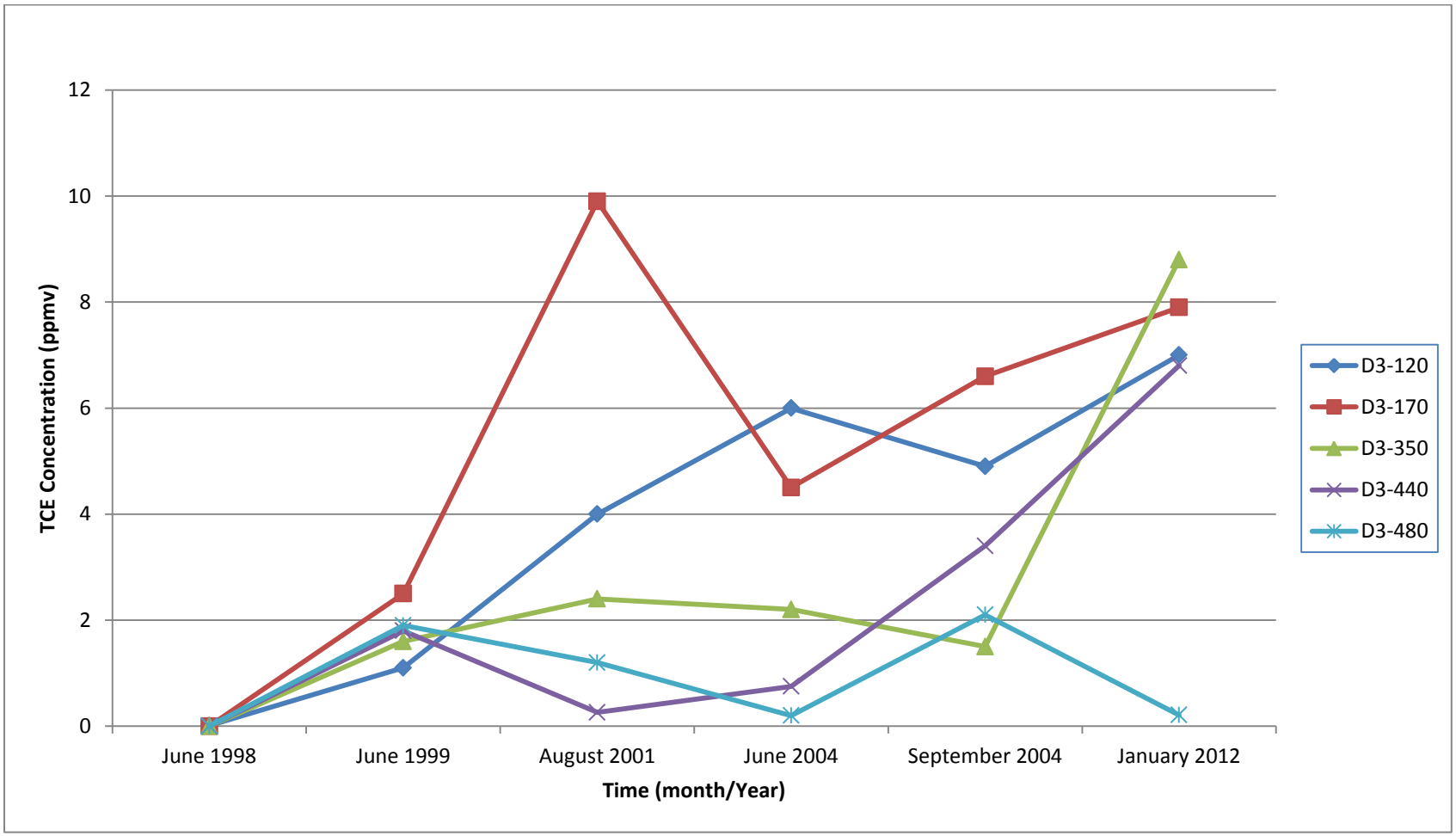

Figure 5-5
Historic Total TCE Compound Concentrations vs. Time
Chemical Waste Landfill Well D3 Ports

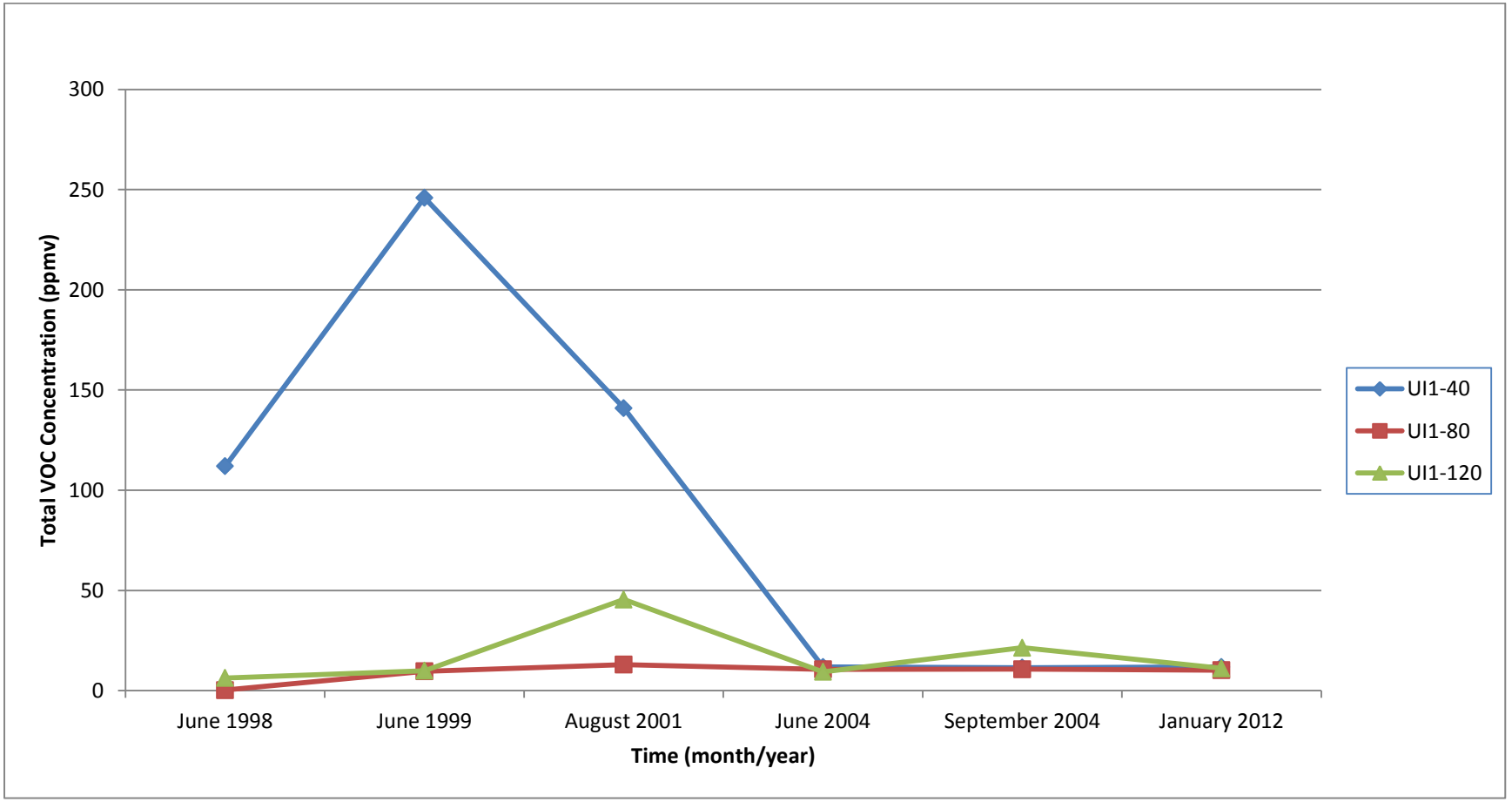

Figure 5-6
Historic Total VOC Compound Concentrations vs. Time
Chemical Waste Landfill Well UI-1 Ports

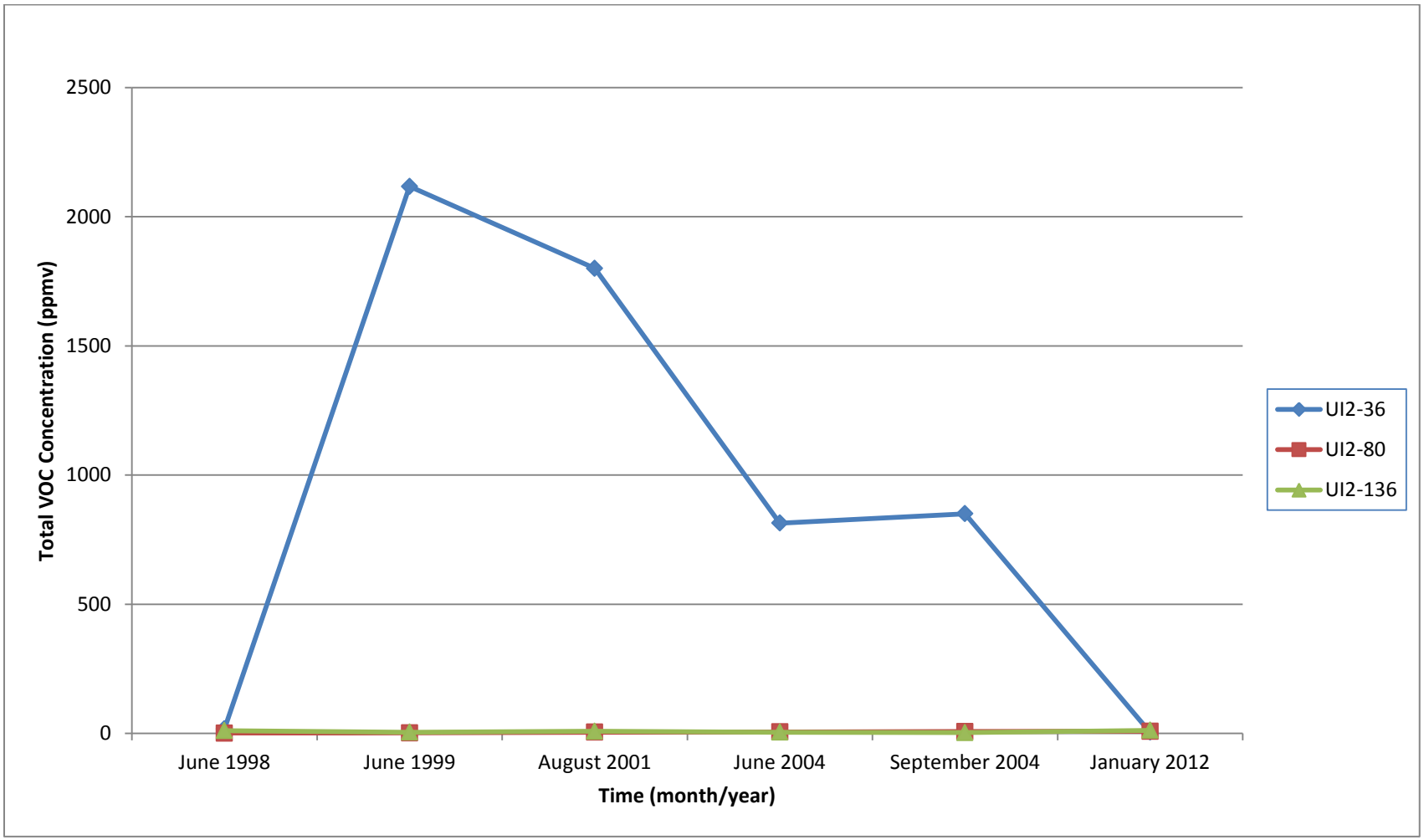

Figure 5-7
Historic Total VOC Compound Concentrations vs. Time
Chemical Waste Landfill Well UI-2 Ports

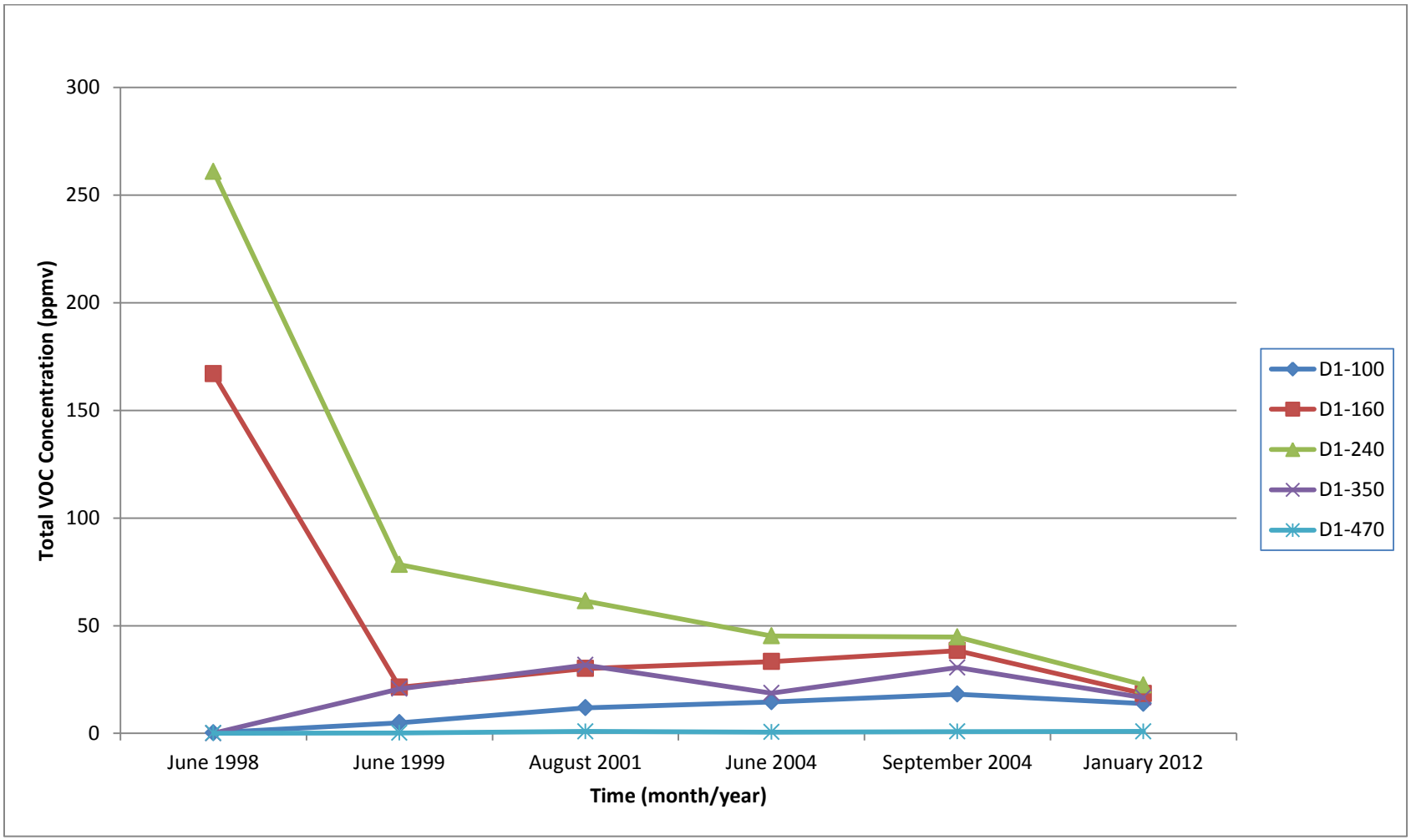

Figure 5-8
Historic Total VOC Compound Concentrations vs. Time
Chemical Waste Landfill Well D1 Ports

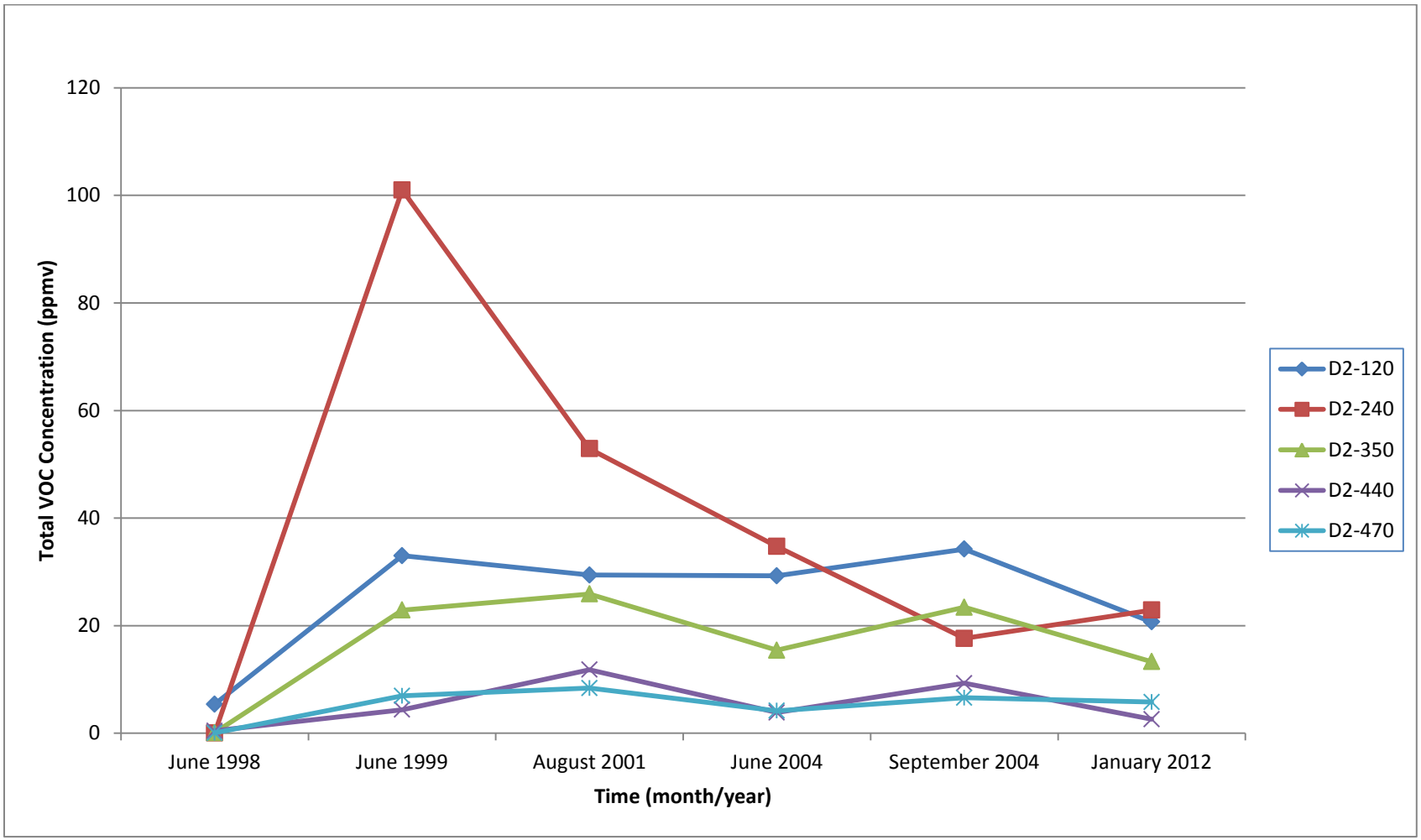

Figure 5-9
Historic Total VOC Compound Concentrations vs. Time
Chemical Waste Landfill Well D2 Ports

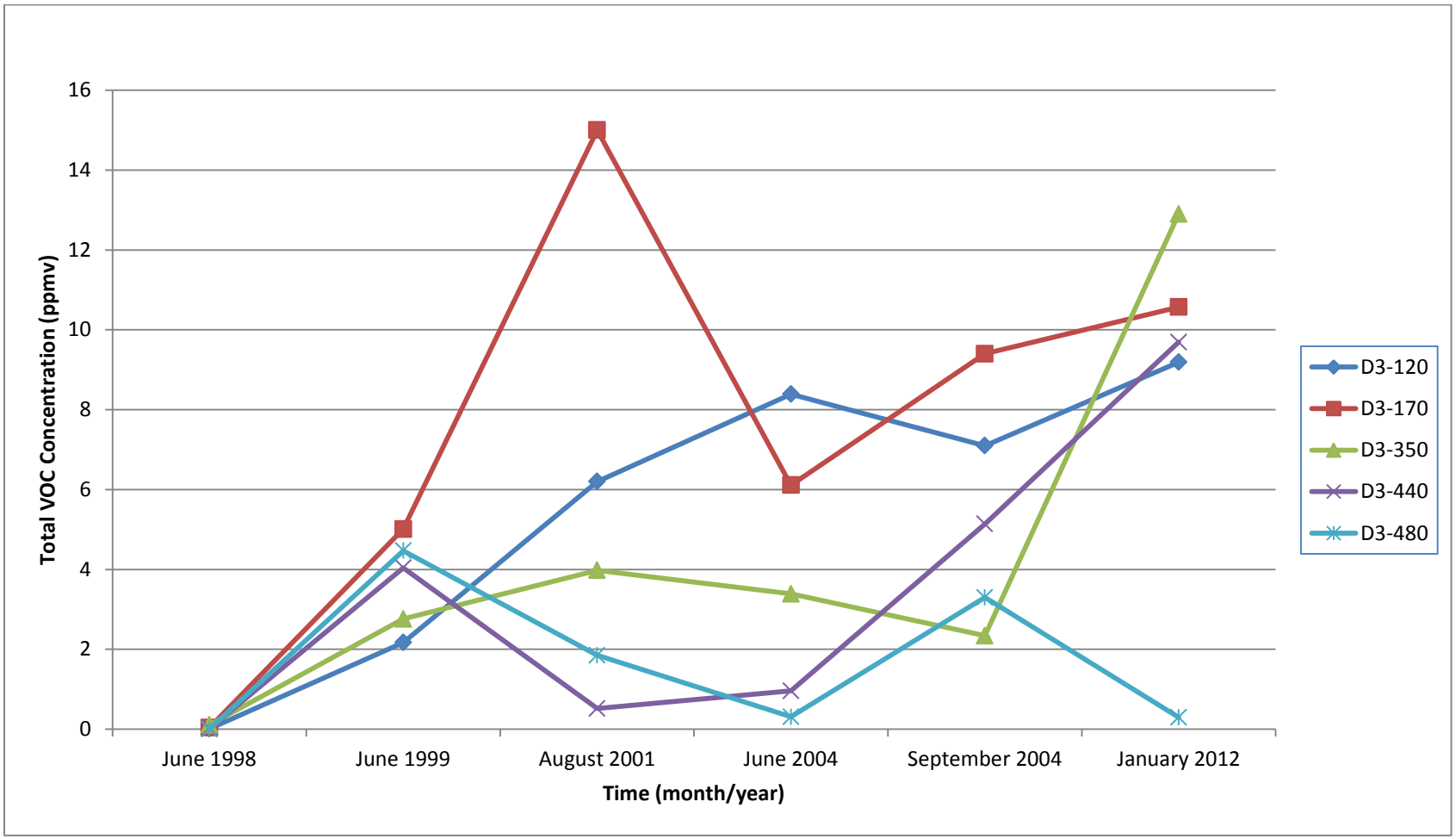

Figure 5-10
Historic Total VOC Compound Concentrations vs. Time
Chemical Waste Landfill Well D3 Ports

6.0 INSPECTION, MAINTENANCE, AND REPAIR RESULTS

This chapter presents as summary of CY 2012 inspection, maintenance, and repair activities. Requirements for inspection, maintenance, and repair are presented in Section 3.2 of this report. The CWL post-closure care systems and features that require periodic inspection, maintenance, and/or repair include:

- Final Cover System (vegetation and cover)
- Surface-water diversion structures
- Compliance monitoring system (groundwater and soil-gas monitoring networks and sampling equipment)
- Perimeter security fence (including signs, gates, locks, and survey monuments)

A schedule for implementing inspections and prescribed maintenance is provided in CWL PCCP Attachment 1, Section 1.10, Table 1-6. CY 2012 inspections are summarized in the following sections and results are documented on the CWL Post-Closure Inspection Forms/Checklists provided in Annex C of this report, in conformance with the requirements in CWL PCCP Attachment 1, Section 1.9 and 1.10 (NMED October 2009 and subsequent revisions).

6.1 Final Cover System

The Final Cover System includes the ET Cover vegetation and the cover surface. ET Cover vegetation is inspected by the staff biologist and documented on the Biology Inspection Form/Checklist for the CWL Cover. The ET Cover surface is inspected by a field technician along with the storm-water diversion structures and security fence, and documented on the Post-Closure Inspection Form/Inspection Checklist.

6.1.1 Vegetation Monitoring and Inspection

Based upon results from ET Cover vegetation inspection conducted in CY 2011, it was determined that the three criteria for successful revegetation had been met (CWL PCCP Attachment 1, Section 1.9). This determination transitioned the frequency of cover vegetation monitoring to an annual basis.

The annual Biology Inspection of the ET Cover vegetation was conducted on September 18, 2012 by the SNL/NM staff biologist. The inspection was conducted at the end of the New Mexico growing season so an accurate determination of living plants at the site could be performed. Although 2011 through 2012 meteorological conditions (i.e., lack of significant rainfall events that fully saturate the soil) caused significant vegetation stresses, the ET Cover foliar coverage and vegetation continue to meet PCCP requirements for successful revegetation.

No mammal burrows were noted during the annual biology inspection, but ant hills/burrows were observed. Four-wing saltbush (*Atriplex canescens*) seedlings were observed during the September inspection, along with other undesirable annual "weedy" species, but their combined percentage of the total foliar coverage was very small (less than 5 percent).

The 2012 Chemical Waste Landfill Biology Report (Biology Report) is presented in Annex D of this report. It provides background information on ET Cover revegetation efforts, a summary of 2012 cover maintenance activities and local climate trends, additional details on the September Biology Inspection, ET Cover photographs, and recommendations. Cover maintenance was performed in September and involved the removal of snakeweed, Russian thistle, and other annual weedy species. Removal of four-wing saltbush (potentially deep-rooted shrub) will be performed in early CY 2013 to achieve the greatest plant mortality rate. Weeding/ET Cover maintenance events are currently not being performed because they are required by the PCCP; instead they are being performed at the direction of the staff biologist to promote the overall long-term health of the desired native grasses.

The following recommendations are included in the Biology Report:

- Removal of four-wing saltbush and undesirable annual weedy species will continue to occur as a voluntary, best management practice. Removal of the four-wing saltbush will be performed during the winter months to ensure the most effective results, as directed by the staff biologist.

6.1.2 Cover Inspection

Quarterly cover surface inspections were performed by a field technician in March, June, September, and December of 2012. No inspection parameters required repairs.

6.2 Storm-Water Diversion Structure Inspection

Quarterly inspections of storm-water diversion structures by a field technician were performed in March, June, September, and December of 2012. During the June inspection, tumbleweeds were noted blocking drainage channels on the southeast, southwest, and northwest corners of the site. The required repairs were made and verified on August 13, within 60 days of the June 20 inspection date.

6.3 Monitoring Well Network Inspection

Semi-annual inspection of the groundwater monitoring network and sampling equipment was performed by a field technician in January and July of 2012. In January the annual inspection for the soil-gas monitoring wells and sampling equipment was also performed. No inspection parameters required repairs but 2-inch well plugs on soil-gas monitoring wells CWL-UI-2 and CWL-D3 were replaced with 2-inch Baroballs™ (i.e., passive venting devices) in January 2012. Baroball™ assemblies were installed on all groundwater monitoring wells in March 2012 after notification to NMED on March 5 (see Section 7.2).

6.4 Security Fence Inspection

Quarterly inspections of the security fence, access controls (gates, locks, signs), and survey monuments were performed by a field technician in March, June, September, and December of 2012. No repairs were needed.

6.5 Emergency Equipment Inspection

For the CWL, inspection of emergency equipment listed in CWL PCCP Attachment 6, Table 6-4, is required on a quarterly frequency. This equipment is inspected weekly and documented on the CAMU 90-Day Area inspection forms. Any repairs or replacement of equipment are performed, as necessary, to maintain compliance with requirements for emergency equipment.

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7.0 REGULATORY ACTIVITIES

On June 2, 2011, the NMED approved closure of the CWL and the PCCP became the governing regulatory document for the CWL (Kieling June 2011). Regulatory activities in CY 2012 consisted of NMED approval of the November 2011 PCCP modification request (Kieling February 2012), a telephone conference with NMED to request direction and provide notification on PCCP-related issues, and completion of CWL well decommissioning work approved by NMED in December 2011. These activities are summarized below in Sections 7.1 through 7.3, respectively.

7.1 Permit Modification Request Approvals

Class 1 modifications that affected PCCP Attachment 6 (Contingency Plan) of the CWL PCCP were submitted to NMED on November 17, 2011, and took effect on November 16, 2011. The notifications were comprised of the following updates and revisions:

- Updating the list of figures in the permit, and
- Correcting a typographical error in the telephone number for an emergency coordinator.

The November 17, 2011 Class 1 modification request also addressed several operational changes at the CWL that affect Attachments 1 through 5 of the CWL PCCP (NMED October 2009) as summarized below.

- Attachment 1 Post-Closure Care Plan for the CWL: Allowing use of equivalent soil-gas passive venting devices; allowing use of an alternate method for analysis of soil-gas samples; clarifying the cover inspection and repair specifications; and updating three figures.
- Attachment 2 Groundwater Sampling and Analysis Plan: revising groundwater purging and stability requirements; and adding well completions diagrams for the four groundwater monitoring wells installed after the PCCP was issued.
- Attachment 3 Soil-Gas Sampling and Analysis Plan: updating the list of operating procedures; clarifying soil-gas purging requirements; and allowing use of an alternate method for analysis of soil-gas samples.
- Attachment 4 Inspection Forms: reformatting the forms; clarifying items to be inspected; and revising the inspection criteria for consistency with other parts of the PCCP.
- Attachment 5 Personnel Training Program: correcting a typographical error.

This Class 1 modification request was approved by NMED on February 20, 2012; the changes became effective immediately upon approval. Changes relative to groundwater monitoring and soil-gas monitoring were implemented during the July groundwater monitoring event and the March and May soil-gas sampling events.

7.2 March 5, 2012 Phone Conference with NMED

DOE and Sandia requested a telephone conference with NMED to request direction regarding a rehabilitation plan for sampling port CWL-D3-440. A sample could not be obtained from this soil-gas sampling port in January, most likely due to an obstruction blocking the sampling port screen. The SNL/NM groundwater sampling team leader proposed using pressurized ultra-pure grade nitrogen to attempt to re-open the sampling port screen. After discussion, NMED staff agreed to the rehabilitation plan and directed DOE and Sandia to collect the environmental sample approximately one week later to allow time for any injected nitrogen to dissipate in the subsurface.

Based upon the TCE detection in the preliminary results from the January groundwater sample from CWL-MW10 (4.68 µg/L), DOE and Sandia notified NMED that they intended to install passive venting devices (i.e., Baroball™ devices) on all groundwater monitoring wells in accordance with PCCP Attachment 1, Section 1.4.2. The devices were installed on all groundwater monitoring wells on March 9, 2012.

Additional discussion included ongoing monitoring and inspection activities, delivery of the CY 2011 CWL Annual Report by the end of March 2012, and the recent NMED approval (Kieling February 2012) of the CWL PCCP modification request (Wagner November 2011).

7.3 Monitoring Well Decommissioning

A monitoring well plugging and abandonment (P&A) plan for seven groundwater monitoring wells and one soil-gas monitoring well located at the CWL was submitted to the NMED on October 18, 2011 (SNL/NM October 2011). The wells are no longer needed as they are obsolete, dry, or otherwise not suited for compliance monitoring. The P&A plan was approved by NMED on December 12, 2011 (Kieling December 2011) and included the rationale, methods, and procedures for decommissioning the wells. The eight CWL monitoring wells (CWL-BW3, CWL-MW1A, CWL-MW2BL, CWL-MW2BU, CWL-MW3A, CWL-MW7, CWL-MW8 and CWL-UI3) were decommissioned in November 2012. A report on the decommissioning work will be submitted to the New Mexico Office of the State Engineer and NMED in 2013.

8.0 SUMMARY AND CONCLUSIONS

A summary of CY 2012 activities and results is provided in this Chapter, along with conclusions.

8.1 Groundwater and Soil-Gas Monitoring

Two semi-annual groundwater monitoring events were conducted in January and July 2012. Groundwater samples were collected and analyzed in accordance with PCCP Attachment 1, Section 1.8 and Attachment 2 requirements. There were no variances, non-conformances, or project-specific issues related to the sampling activities. No results were above respective concentration limits.

Statistical assessment was conducted on the results from replacement well CWL-BW5 and former well CWL-BW4A. There was no statistically significant evidence of increasing contamination and no hazardous constituent 95% LCLs exceeded their respective concentration limits. Groundwater surface elevation, hydraulic gradient, flow direction, and groundwater flow rate have been determined and are consistent with historical results.

In January 2012 the first soil-gas monitoring event was conducted under the CWL PCCP. Samples collected from all wells were analyzed for VOCs by analytical method EPA TO-14. Additional soil-gas sampling was required in March (to sample CWL-D3-440 sampling port that was reopened using pressurized ultra-pure grade nitrogen) and May (duplicate pair resampling due to January sample pairs not meeting the RPD acceptance criterion for specific constituents). TCE was detected in all samples at concentrations ranging from 0.061 ppmv to 22.00 ppmv. No LCLs exceeded the trigger level of 20 ppmv. The 20 ppmv soil-gas trigger level only applies to LCLs calculated for results from the deepest sampling ports of wells CWL-D1 through CWL-D3. Results were consistent with historic monitoring results and suggest the residual VOC soil-gas plume beneath the CWL is slowly dissipating in three dimensions through diffusion in the vadose zone. These data and conclusions are consistent with the conceptual site model presented in Annex E of the CWL Corrective Measures Study Report (SNL/NM December 2004).

8.2 Inspections

Inspections of the CWL final cover system, storm-water diversion structures, compliance monitoring system, and security fence were performed in accordance with CWL PCCP requirements. One repair associated with clearing debris (wind-blown tumbleweeds) from storm water drainage channels was completed within the required 60-day time frame.

Based upon the September biology inspection, the ET Cover continues to meet successful revegetation criteria. Removal of four-wing saltbush and undesirable annual weedy species will continue to occur as a voluntary, best management practice as directed by the staff biologist.

8.3 Regulatory Activities

Regulatory activities in CY 2012 included NMED approval of the November 2011 Class 1 Permit modification request, a telephone conference with NMED to request direction and provide notification on PCCP-related issues, and completion of decommissioning activities (8 monitoring wells).

8.4 Conclusions

All PCCP monitoring and inspection requirements have been performed and documented for CY 2012, which represents the first full year of PCCP implementation (Permit became effective on June 2, 2011 mid-way through the calendar year). This CWL Annual Post-Closure Care Report presents monitoring and inspection activities and results as required by the PCCP Attachment 1, Section 1.12.

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