

Exhibit 2

October 2009 Closure Plan Amendment As Changed

Chapter 12

12. REMEDIATION, CLOSURE, AND POST-CLOSURE CARE

Since approval of the Chemical Waste Landfill (CWL) Closure Plan on February 22, 1993, the approach to closure of the CWL has been modified to include a Voluntary Corrective Measure (VCM) program. This chapter of the Closure Plan was revised in September 2002 and again in February 2003 to incorporate the VCM part of the Corrective Action program and to include an updated discussion of the Corrective Measure Study (CMS) process, including CMS planning and the CMS Report. Updated requirements associated with final site closure and post-closure care were also presented in these earlier revisions. This revision of Chapter 12 was initiated in December 2004 (Wagner December 2004) in response to NMED direction (Kieling December 2003) and was included in the permit modification for final remedy selection and post-closure care conditions (Kieling May 2007). This revision documents the scope, submittal, and permitting requirements needed to complete remediation of, certify closure for, and establish post-closure conditions for the CWL consistent with NMED direction provided in February 2006 (Kieling February 2006). Figure 12-1 summarizes the CWL closure process.

12.1 Voluntary Corrective Measures Program

This Closure Plan was amended through a Class 1 modification requiring prior approval to include the VCM program. The VCM program is described in Appendix S that was approved on March 7, 1997. Appendix S provides a description of two VCMs; a vapor extraction (VE) VCM and a landfill excavation (LE) VCM, which have been completed at the CWL. Figure 12-1 shows how the VCMs, that were intended to be consistent with final remediation of the CWL, have been integrated into the closure process. The main objectives for these VCMs were to reduce and control the VOC soil gas plume, to prevent further degradation of groundwater beneath the CWL, and to remove wastes from the buried pits such that post-VCM site conditions are protective of human health and the environment. The VE VCM was completed in July 1998, and the LE VCM was completed in September 2005. The CWL has been excavated and the remaining soils and backfill meet NMED-approved risk-based criteria for industrial land use as per the NMED approval of the LE VCM Final Report in December 2003 (Moats December 2003).

Beginning in November 1996 and continuing to the present, quarterly reports have been prepared documenting the performance of these two VCMs. Additional information on the VE and LE VCMs can be found in the VE VCM Final Report (SNL/NM May 2000), and the LE VCM Final Report (SNL/NM April 2003).

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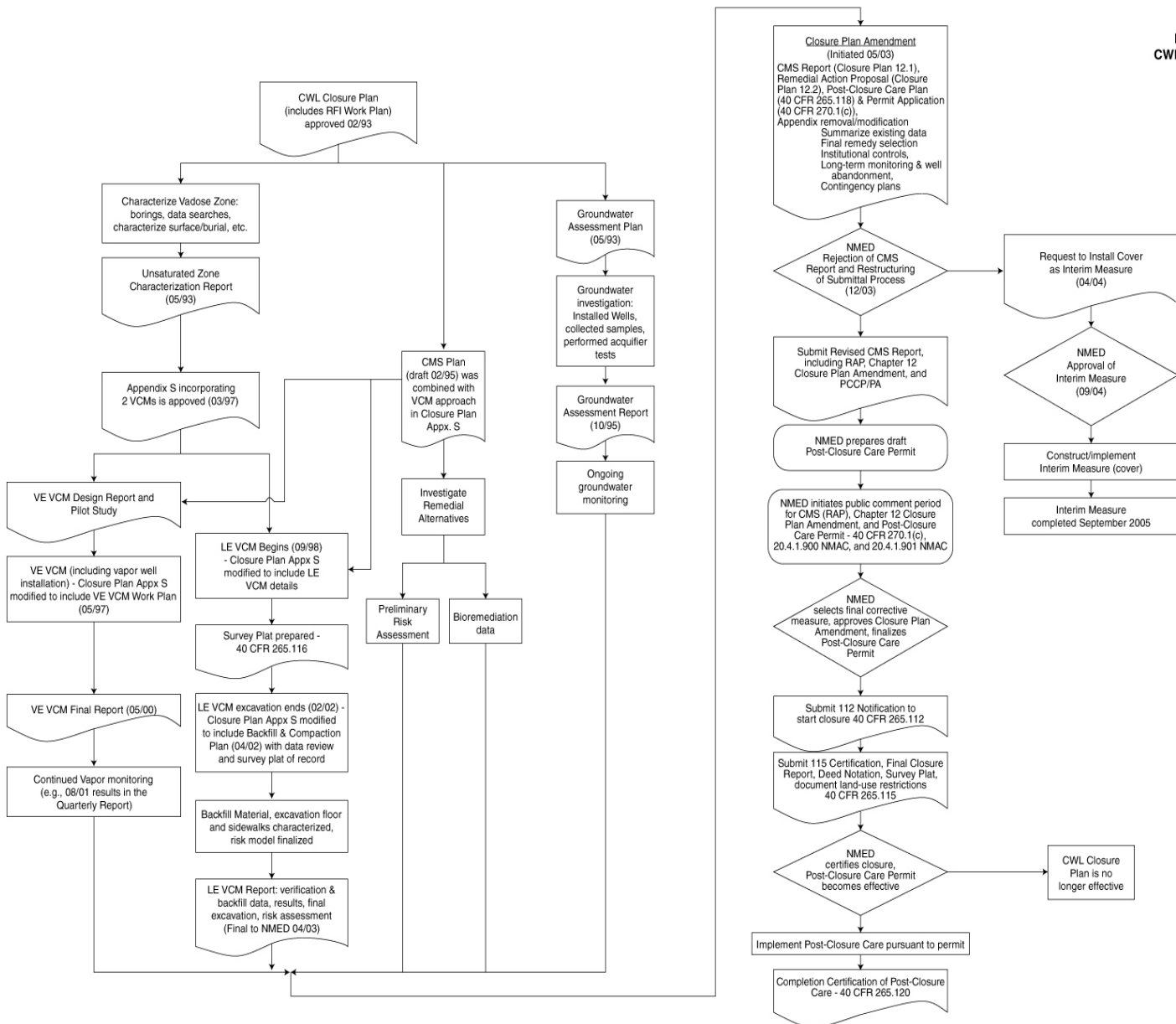


Figure 12-1
CWL Closure Path

12.2 LE VCM Final Report and Backfill Plan

The LE VCM Final Report was submitted to the NMED in April 2003. NMED issued a request for supplemental information in August 2003 (Moats August 2003), and DOE and Sandia responded in October 2003 (Boardman October 2003). The LE VCM Final Report was approved by the NMED in December 2003 without conditions (Moats December 2003). The LE VCM Final Report includes information associated with excavation and waste management; analytical results from the excavation and backfill material verification soil samples; and results of the final risk-screening assessment.

The Site Operational Boundary Closure Addendum to the LE VCM Final Report was submitted to the NMED in August 2005 (SNL/NM August 2005) and approved by the NMED on October 25, 2005 (Bearzi October 2005). With the submittal of the Waste Management Addendum to the LE VCM Final Report in the February 22, 2006 CWL Quarterly Closure Progress Report (SNL/NM February 2006), as Appendix B, all LE VCM regulatory deliverables have been submitted. The following information was not previously submitted to the NMED, and will be included in the Final Closure Report.

- analytical results for site operational boundary and backfill/cover materials that were not included in the LE VCM Final Report
- an updated risk assessment integrating all relevant analytical results representing end state conditions of the CWL.

The Backfill and Compaction Plan (Addendum C to Appendix S of the Closure Plan) for the LE VCM was approved by the NMED on June 26, 2002 with three conditions (Bearzi June 2002). The NMED approval letter also required submittal of a final risk-screening assessment, which was provided later in the LE VCM Final Report. The three conditions of approval were integrated into Revision 1 of the Backfill and Compaction Plan that was submitted to NMED in August 2002 (Zamorski August 2002).

12.3 Chemical Waste Landfill Closure and Post-Closure Care Process

On May 20, 2003, DOE and Sandia submitted a compilation of documents (Boardman May 2003) containing the CWL CMS Report, RAP, and PCCP/PA transmitted as a Class 3 amendment to this Closure Plan as set forth in the amended Chapter 12 of the Closure Plan (SNL/NM February 2003). On December 12, 2003, the NMED rejected the CWL CMS Report and postponed the review of the PCCP/PA and RAP pending the approval of a revised CMS Report, and redefined the steps to closure (Kielsing December 2003). The modified closure process and the modified post-closure care process are reflected in Figure 12-1 and are described in this section.

The revised CMS Report was submitted to the NMED in December 2004 (SNL/NM December 2004). The CMS Report contains information to support an NMED determination as to whether site conditions, as achieved by the two VCMs, are adequately protective of human health and the environment. The CMS Report also contains a recommendation for a final corrective measures alternative for NMED's consideration and approval.

DOE and Sandia also submitted a revised PCCP/PA under 20.1.4.900 NMAC incorporating 40 CFR 270.1(c), addressing information requirements of 20.1.4.900 NMAC incorporating 40 CFR 270.28 (SNL/NM September 2005). Upon NMED issuance of a post-closure care permit (required by 20.4.1.900 NMAC incorporating 40 CFR 270.1(c)), and after NMED certification of closure, the post-closure care permit shall be considered the sole source of operating conditions for the CWL post-closure care period. The CWL Closure Plan will no longer be effective.

The CWL Closure Plan and post-closure care permit lay the groundwork for final CWL closure and post-closure care activities, respectively. The Final Closure Report will document closure of the CWL, including completion of all final corrective measures. Table 12-1 lists the main closure and post-closure care documents and provides descriptive summaries of each document and schedule information. After approval of the Closure Plan amendment, the final corrective measure selected by the NMED shall be implemented within 30 days of said approval.

Post-closure care will begin after NMED approval of the Final Closure Report and NMED certification of closure, and will be conducted in accordance with the post-closure care permit to be issued by the NMED. Table 12-2 lists the regulatory notifications and certifications required as part of the closure and post-closure process, which are also shown on Figure 12-1.

Table 12-1 Closure Reporting Requirements

Submittal	Regulatory Driver	Scope and CWL Reference	Due Date
CMS Report, including the Remedial Action Proposal (RAP)	Closure Plan and 40 CFR 265.112	The CMS Report summarizes historic investigations, presents the results of two completed VCMs, and documents current site conditions based upon recent monitoring analytical results. The recommended final corrective measures alternative and evaluation process are also presented.	Submitted. Public noticed May 21, 2007 (Kielling May 2007)
		The RAP is included as an annex to the CMS Report and documents the at-grade vegetative soil cover design that was approved by the NMED as an interim measure (Kielling September 2004). The RAP includes a detailed conceptual engineering design and supporting documentation so the adequacy of the design relative to design criteria/objectives can be assessed. This document will remove/replace Appendices J and K of the Closure Plan.	
Post-Closure Care Plan and Permit Application	40 CFR 270.1(c)	PCCP/PA was submitted under 40 CFR 270.1(c). The PCCP/PA addresses the information requirements of 40 CFR 270.28.	Submitted. Draft permit prepared by NMED and public noticed May 21, 2007 (Kielling May 2007)
Final Closure Report	Closure Plan and 40 CFR 265.115	The Final Closure Report shall document completion of closure activities and corrective measures.	Within 60 days of completion of closure activities

Table 12-2 Closure and Post-Closure Notifications and Certifications

Notification/ Certification	Regulatory Driver	Scope and CWL Reference	Schedule/ Timing
112 Notification	40 CFR 265.112 (d)(1)	Notification to start closure.	At least 60 days prior to the beginning of final closure
115 Notifications	40 CFR 265.115	Notifications for certification of completion of closure. As per Section 1.2.1.2 of the Closure Plan these certifications shall be submitted with the Final Report.	Within 60 days of completion of closure activities and corrective measures.
116 and 119 Notice	40 CFR Part 265.116 (survey plat) and 119 (deed notation)	Submit to County Zoning Authority a notation on the property deed. Submit survey plat as per 40 CFR 265.116 to county zoning authority, DOE property management, NMED and EPA. Document land-use restrictions. Send notification to NMED that the property deed notation has been submitted.	No later than 60 days after certification of closure.
Certification of Post-Closure Care Completion	40 CFR 264.120	Notification for completion of post-closure care.	Within 60 days of completion of post-closure care.

12.3.1 Corrective Measures Study Report

A CMS Report has been completed for the CWL and summarizes historic investigations, presents the results of two completed VCMs, and documents current site conditions based upon recent monitoring analytical results (SNL/NM December 2004). After seeking public comment, the NMED will make a final determination regarding whether or not additional remediation of the CWL is necessary to assure protection of human health and the environment.

Section 1.0 of the CMS Report provides introductory information including site operational and regulatory history. A comprehensive summary of site investigations and the two VCMs are also provided, focusing on groundwater (e.g. chromium and solvent contamination) and the vadose zone VOC soil gas plume.

A detailed, updated conceptual site model is presented in Section 1.0 of the CMS Report. Section 2.0 documents the identification, screening, and selection of the final corrective measures alternative based upon conditions established in Section 1.0, and presents the DOE/Sandia preferred corrective measures alternative. Section 3.0 provides an overview of the PCCP/PA and the associated monitoring program that is intended to address future uncertainty. Section 4.0 presents a brief summary of the path to closure, which is modified by this revision of Chapter 12. Several annexes are included as part of the CMS Report and contain important supporting documentation from past and recent investigations, VCMs, and monitoring activities.

12.3.2 Remedial Action Proposal

The RAP is included as an annex to the CMS Report and documents the at-grade vegetative soil cover design that was approved by the NMED as an interim measure (Kieling September 2004). A detailed conceptual engineering design and supporting documentation are presented so the adequacy of the design and related features can be assessed, including the following design criteria:

- Minimize infiltration and percolation of water through the former landfill,
- Minimize future maintenance,
- Assure adequate drainage and minimize erosion,
- Minimize damage to cover integrity caused by any settling and subsidence, and
- Ensure that the hydraulic conductivity of the cover shall be less than or equal to that of natural soil situated immediately adjacent to the bottom of the landfill.

12.3.3 Post-Closure Care Plan and Permit Application

The PCCP/PA (SNL/NM September 2005) was prepared for submittal under 20.1.4.900 NMAC incorporating 40 CFR 270.1(c). The PCCP/PA addresses the information requirements of 20.1.4.900 NMAC incorporating 40 CFR 270.28 and contains information required for the post-closure period. The NMED has prepared a draft post-closure care permit (Kieling May 2007) from the PCCP/PA; when final, the permit shall supersede the Closure Plan as the governing regulatory document for the CWL after NMED certifies closure of the CWL.

12.4 Final Closure Report

A Final Closure Report is required to document the completion of closure activities and corrective measures.

The Final Closure Report will describe the closure activities performed and include a description of the “end state” of the site. The general topics to be covered in this report include:

- Survey plat,
- Quality Assurance/Quality Control summary of the final cover, including final as-built engineering drawing(s),
- Backfill and compaction completion report (as defined in Addendum C to Appendix S of the Closure Plan),
- Summary of wastes removed from the CWL,
- Summary of remaining residual contamination and the associated risks,
- End-state conditions,
- Any additional information as described in Section 12.2 of this Chapter that is not included as an addendum to the LE VCM Final Report, and
- Certification of the accuracy of the report.

The Final Closure Report will also describe any land use restrictions and remaining risks or hazards that the site may pose to the public and the environment.

References for Section 12

Bearzi, J.P. (New Mexico Environment Department), June 2002. Letter to M.J. Zamorski (U.S. Department of Energy) and R.J. Eagan (Sandia Corporation), “Approval with Conditions: Class 1 Modification: Backfill and Compaction Plan, Addendum C to Appendix S, Chemical Waste Landfill Closure Plan, April 2002, Sandia National Laboratories NM5890110518, HWB-SNL-02-003.” June 26, 2002.

Bearzi, J.P. (New Mexico Environment Department), October 2005. Letter to P. Wagner (U.S. Department of Energy) and P.B. Davies (Sandia Corporation), “Notice of Approval: Chemical Waste Landfill Site Operational Boundary Closure Addendum to the Landfill Excavation Corrective Measure Final Report; August 2005, Sandia National Laboratories, NM5890110518, HWB-SNL-05-021.” October 25, 2005.

Boardman, K. (U.S. Department of Energy), May 2003. Letter to J. Kielling, NMED, requesting a Class 3 amendment to CWL Closure Plan for approval of the Corrective Measures Study Report, the Remedial Action Proposal and the Post-Closure Care Plan and Permit Application, US Department of Energy, Albuquerque, New Mexico. May 20, 2003.

Boardman, K. (U.S. Department of Energy), October 2003. Letter to J.E. Kielling (New Mexico Environment Department), transmitting the responses to NMED comments on the Chemical Waste Landfill, Landfill Excavation Voluntary Corrective Measure Final Report. October 28, 2003.

Kieling, J. E. (New Mexico Environment Department), December 2003. Letter to Karen K.L. Boardman (U.S. Department of Energy) and Peter P.B. Davies (Sandia Corporation), “Chemical Waste Landfill, Corrective Measures Study, May 2003, Sandia National Laboratories NM5890110518, HWB-SNL-03-013.” December 12, 2003.

Kieling, J. E. (New Mexico Environment Department), September 2004. Letter to Patty P. Wagner (U.S. Department of Energy) and Peter P.B. Davies (Sandia Corporation), “Approval with Conditions of the Landfill Cover Interim Measure at the Chemical Waste Landfill, Sandia National Laboratories NM5890110518, HWB-SNL-04-027.” September 22, 2004.

Kieling, J.E. (New Mexico Environment Department), February 2006. Letter to P. Wagner (U.S. Department of Energy) and F. Figueroa (Sandia Corporation), “Fee Assessment and Revisions to Proposed Amendment of Chemical Waste Landfill Closure Plan, December 2004, Sandia National Laboratories, EPA ID# NM5890110518, HWB-SNL-05-017.” February 2, 2006.

Kieling, J. E. (New Mexico Environment Department), May 2007. Notice of Public Comment Period and Opportunity to Request a Public Hearing on a Closure Plan Amendment, Corrective Measures Study, and Draft Post-Closure Care Permit for the Chemical Waste Landfill at Sandia National Laboratories, May 21, 2007.

Moats, W. P. (New Mexico Environment Department), August 2003. Letter to Karen K.L. Boardman (U.S. Department of Energy) and Peter P.B. Davies (Sandia Corporation), “Request for Supplemental Information for the Chemical Waste Landfill – Landfill Excavation Voluntary Corrective Measure Final Report, April 2003.” August 29, 2003.

Moats, W. P. (New Mexico Environment Department), December 2003. Letter to Karen K.L. Boardman (U.S. Department of Energy) and Peter P.B. Davies (Sandia Corporation), “Approval of the Chemical Waste Landfill, Landfill Excavation Voluntary Corrective Measure Final Report, April 2003.” December 16, 2003.

Sandia National Laboratories/New Mexico (SNL/NM), May 2000. “Chemical Waste Landfill Vapor Extraction Voluntary Corrective Measures Final Report,” Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), February 2003. “Chemical Waste Landfill Closure Plan Amendment, Chapter 12,” Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), April 2003. “Chemical Waste Landfill – Landfill Excavation Voluntary Corrective Measure – Final Report,” Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), December 2004. “Chemical Waste Landfill – Revised Corrective Measures Study Report,” Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), August 2005. “Chemical Waste Landfill Site Operational Boundary Closure Addendum to the Landfill Excavation Voluntary Corrective Measure Final Report,” Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), September 2005. “Post-Closure Care Plan for the Chemical Waste Landfill,” Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), February 2006. “Chemical Waste Landfill Quarterly Closure Progress Report,” Sandia National Laboratories, Albuquerque, New Mexico.

Wagner P. (U.S. Department of Energy), December 2004. Letter to J. Bearzi, NMED, transmitting the revised Corrective Measures Study Report for the Chemical Waste Landfill and proposed changes to Chapter 12 of the Chemical Waste Landfill Closure Plan, US Department of Energy, Albuquerque, New Mexico. December 21, 2004.

Zamorski, M.J. (U.S. Department of Energy), February 2002. Letter to J. Bearzi (New Mexico Environment Department), “Comprehensive Part B Permit Request,” US Department of Energy, Albuquerque, New Mexico. February 4, 2002.

Zamorski, M.J. (U.S. Department of Energy), August 2002. Letter to J.E. Kieling (New Mexico Environment Department), providing responses to NMED conditions of approval for the Chemical Waste Landfill Backfill and Compaction Plan submitted on April 29, 2002 and transmitting a revised plan incorporating NMED conditions. August 27, 2002.

Exhibit 2

October 2009 Closure Plan Amendment As Changed

Appendix G, Revision 4, Section 1.0

1.0 Introduction

This sampling and analysis plan provides instructions for collecting and analyzing samples from groundwater monitoring wells located at the Chemical Waste Landfill (CWL) at Sandia National Laboratories, Albuquerque (SNL). This sampling and analysis plan has been developed in accordance with Resource Conservation and Recovery Act (RCRA) regulations for conducting groundwater assessment monitoring at hazardous waste landfills and is intended to ensure samples collected and analyzed from the groundwater monitoring wells are representative of the uppermost aquifer underlying the CWL. Specifically, this plan and associated field operating procedures comply with 40 Code of Federal Regulations (CFR), Part 265, Subpart F, Sections 91 through 94, and the New Mexico Hazardous Waste Management Regulation-5 (NMHWMR-5). Additionally, this plan has been amended to include the comments provided by the New Mexico Environment Department (NMED) resulting from their comprehensive monitoring evaluation (CME), conducted in March of 1990, and the requirements of the Department of Energy (DOE) Tiger Team Action Plan. This sampling and analysis plan supersedes Revision 2.0 of the Chemical Waste Landfill Sampling and Analysis Plan (1990).

1.1 Purpose

This sampling plan provides instructions for sample collection, data management, and reporting of annual and quarterly sampling data; identifies analytical parameters selected for assessing the quality of the groundwater; and establishes personnel responsibilities for the CWL groundwater monitoring program. Because quality assurance is an integral component of the groundwater sampling, analysis, and reporting process, quality assurance/quality control (QA/QC) elements and associated data acceptance criteria are included in this plan.

Detailed instructions for performing field activities that will be conducted in conjunction with this sampling and analysis plan are provided as field operating procedures, included in Sections 11.0 through 18.0. In this manner, sampling personnel have easy access to detailed field operating procedures, procedural aspects of the plan are separated from programmatic aspects, and plan revision is made easier. Detailed procedures are provided for each aspect of the groundwater sampling process, including water-level measurement, sampling equipment decontamination and installation, purge requirements, field water-quality measurements, and sample collection. Manufacturer operating guidelines and performance data for sampling equipment supplement these procedures. These procedures are not intended to replace proper field sampling expertise. Samples will be collected by trained personnel under the supervision and direction of qualified engineers, scientists, or other technical personnel. Training of sampling personnel shall be documented in accordance with the "SNL, Albuquerque, Environmental Protection Division 3202 Training Plan."

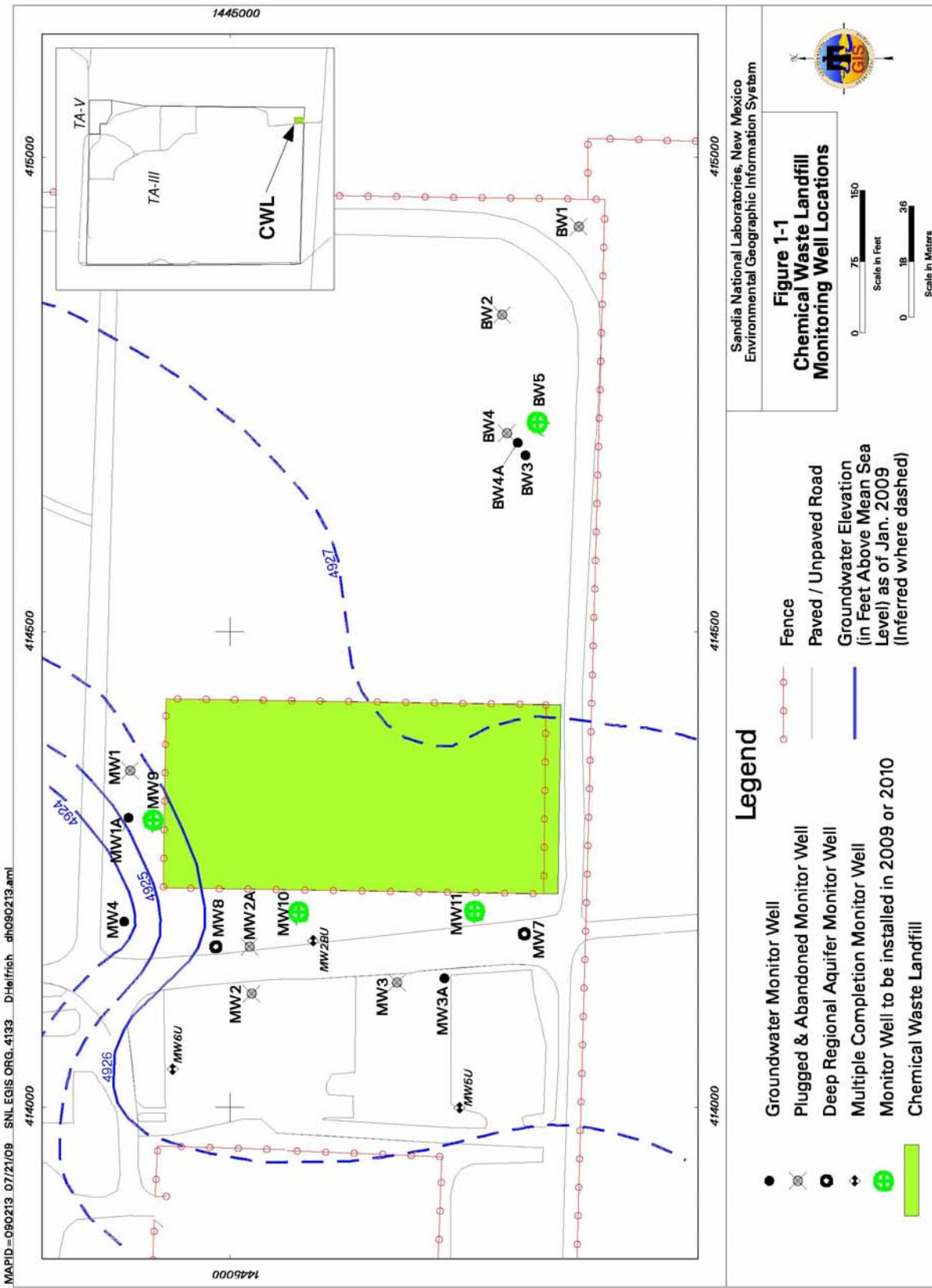
1.2 Site Description and History

The Chemical Waste Landfill is approximately 1.9 acres in areal extent and is located in the southwest corner of Technical Area III of Sandia National Laboratories, Albuquerque, New Mexico (Figure 1-1). Chemical waste disposal operations began at the CWL in 1962. Seven pits have been known to be used for disposal of acids, oxidizers and reducers, organic compounds and solvents, reactive, bulky materials, metals, and salts. Only one of the pits (for chromic acid), located on the south end of the CWL, was lined. No record of disposal practices was kept between 1962 and 1975, resulting in uncertainty concerning the actual types, amounts, and locations of waste at the site. However, it is inferred from reconnaissance studies (IT Corporation, 1985, and Weston, November 1984) of the CWL that the waste pits are rather uniformly distributed throughout the CWL. Results of a 1991 magnetometer survey confirmed these assumptions (SNL, 1991).

Five groundwater monitoring wells (MW1, MW2, MW3, BW1, and BW2) were installed at the CWL during the summer of 1985 using a mud-rotary drilling method. These wells were completed at various vertical depths within the aquifer, with screened intervals ranging from 70 to 460 feet. Well MW1 was lost as a useable well in July 1988, when a bailer and bailer recovery equipment were left permanently lodged in the well casing. In 1988, four additional monitoring wells (BW3, MW1A, MW2A, and MW3A) were installed at the CWL using air-rotary casing hammer techniques. The 1988 wells have 20-foot screened intervals located such that approximately 15 feet of screen are below the uppermost portion of the water table. An additional monitoring well, monitoring well MW4, was installed in April 1990 using a combination of auger and mud-rotary techniques. MW4 was constructed with a 20-foot screened interval similar to the 1988 wells.

Monitoring wells MW1A, MW2A and MW3A and background (upgradient) well BW3 were sampled from December 1988 through January 1990 on a quarterly basis in accordance with 40 CFR 265.92. Groundwater samples were analyzed for parameters characterizing the suitability of the groundwater as a drinking water supply (Appendix III of 40 CFR 265), parameters establishing groundwater quality, and parameters that are indicators of groundwater contamination. Well MW4 was initially sampled in June 1990 to establish background data for groundwater contamination indicators, groundwater quality parameters, drinking water supply parameters (Appendix III list), and supplemental Appendix IX parameters (IT corporation, November 1990b). Figure 1-1 shows the location of the ten CWL monitoring wells.

Semiannual groundwater sampling was performed for detection monitoring as required by 40 CFR 265.92 at the CWL during March 1990. Statistical analysis indicated some of the semiannual indicator parameters were statistically different from the established background conditions at CWL. Specifically, the measured pH was statistically lower than background conditions in wells BW3 and MW2A. Changes in pH may have been due to incomplete development of the monitor wells since both wells are low yielding and thus difficult to develop.



Resampling for groundwater indicator parameters at the CWL was conducted during May 1990 to verify the statistical difference. A statistical change was verified for pH in wells BW3, MW1A, and MW2A and for specific conductance in well BW3. In accordance with 40 CFR 265.94, the New Mexico Environmental Department was notified of the results of statistical changes in indicator parameters within seven days of confirmation.

In addition to analytical parameters identified above, Appendix IX parameters (40 CFR 264) were also analyzed during the first semiannual sampling conducted in March 1990. Analytical results for volatile organic compound (VOC) analyses in March 1990 indicated that the concentrations of trichloroethene (TCE) in monitoring well MW2A was at levels exceeding the regulatory limit for TCE in drinking water (5 micrograms per liter [$\mu\text{g/L}$]) (NMHWMR-6). Well MW2A was resampled in April 1990 to confirm TCE concentrations; results from the April resampling confirmed the presence of TCE in the groundwater (IT Corporation, June 1990).

Past sampling efforts at the CWL have detected varying concentrations of total and dissolved chromium in CWL monitoring well samples (IT Corporation, 1989-1991). It is believed the chromium is from natural sources and from crevice corrosion of the stainless steel sampling equipment and well screens, not from past disposal activities at the landfill (Stein et al., 1991).

Based on statistical analysis and results of chemical analyses, a quarterly groundwater quality assessment monitoring program was initiated at the CWL in May 1990, in accordance with RCRA groundwater assessment monitoring requirements (NMHWMR-6, 40 CFR 265.94). The groundwater quality assessment program includes annual sampling for Appendix IX parameters (40 CFR 264) and quarterly sampling for field measurement of pH and specific conductance and laboratory analysis of volatile organic compounds and dissolved and total chromium. A copy of the "Groundwater Quality Assessment Program for the Sandia Chemical Waste Landfill" (1990) is provided in Attachment B. Copies of reports referenced above are on file at the SNL Environmental Programs Department Records Center.

The CWL was excavated from September 1998 through February 2002 to remove the contents of the landfill and contaminated soil during the Landfill Excavation (LE) Voluntary Corrective Measure (VCM). Soil-vapor extraction was conducted prior to the LE VCM and removed a portion of the volatile organic compound (VOC) soil-gas plume in the vadose zone during the Vapor Extraction (VE) VCM. After excavation was completed, the CWL was backfilled with soil to a uniform depth of four feet below ground surface. Some of the soil used as backfill had been excavated from the landfill (this soil is referred to as replaceable soil). Concentrations of contaminants in the replaceable soil meet industrial risk levels, consistent with the projected future land use for the CWL site. Since completing the LE and VE VCMs, levels of contaminants in the groundwater have dropped to concentrations below applicable U. S. Environmental Protection Agency maximum contaminant levels (MCLs) and New Mexico Water Quality Control Commission water quality standards. Construction of the at-grade cover for the CWL was completed in September 2005. To complete the chromium groundwater evaluation, the NMED requested the installation of two additional deep regional

aquifer monitoring wells (MW7 and 8) that were installed in March and April 2003. The eight required sampling events were completed in 2005 and no constituents (VOCs or metals, including chromium and nickel) were detected above regulatory standards.

The 2009/2010 groundwater monitoring well network is presented below and shown in Figure 1-1, along with monitoring wells that have been plugged and abandoned. Monitoring wells

Well Name	Status/Comments
Compliance Monitoring Wells	
BW4A/BW5	Continue to attempt to sample BW4A until it is decommissioned and BW5 is installed and developed. BW5 will replace BW4A.
MW4/MW9	Continue to sample MW4 until it is decommissioned and MW9 is installed and developed. MW9 will replace MW4.
MW5U/MW10	Continue to sample MW5U until it is decommissioned and MW10 is installed and developed. MW10 will replace MW5U.
MW6U/MW11	Continue to sample MW6U until it is decommissioned and MW11 is installed and developed. MW11 will replace MW6U.
Monitoring Wells Removed from Sampling	
MW5L	Well is completed in the same borehole as MW5U and the well screen is below the water table. Currently sampled using a low-flow system due to 2-inch diameter well casing. Well will be decommissioned with MW5U.
MW6L	Well is completed in the same borehole as MW6U and the well screen is below the water table. Currently sampled using a low-flow system due to 2-inch diameter well casing. Well will be decommissioned with MW6U.
MW2BU/2BL	MW2BU (screened across the water table) currently sampled using low-flow system due to 2-inch diameter well casing. MW2BL well screen is below the water table.
Monitoring Wells Not Sampled	
MW7 and MW8	Screen intervals for both wells are below the water table.
MW1A and MW3A	Wells can not be sampled – dry since completion of Vapor Extraction in 1998.
BW3	Well is currently not sampled due to lack of sufficient water.
Historic Wells Previously Decommissioned	
BW-4	Decommissioned in 1994
MW-1	Decommissioned in 1997
MW-2	Decommissioned in 1997
MW-3	Decommissioned in 1997
BW-2	Decommissioned in 2003
BW1	Decommissioned in 2004
MW2A	Decommissioned in 2004

BW = Background Well.

MW = Monitoring Well.

VOC = Volatile organic compound.

with the screen intervals installed across the water table, with sufficient casing diameter (i.e., 4 inches or greater) to allow for conventional sampling per this SAP, and with sufficient water to produce a representative groundwater sample are retained for ongoing groundwater monitoring sampling and analysis.

Background well CWL-BW4A no longer contains sufficient water for sampling, and, therefore, will be plugged and abandoned and replaced by CWL-BW5 (Figure 1-1). CWL-MW4 has a stainless steel screen and, therefore, will also be plugged and abandoned and replaced by CWL-MW9 (Figure 1-1). CWL-MW5U/L and CWL-MW6U/L will be plugged and abandoned and replaced by new wells (CWL-MW10 and CWL-MW11) installed closer to the western boundary of the CWL per agreement with NMED (Figure 1-1). For the purpose of complying with the requirements of this Closure Plan and 40 CFR Part 265 Subpart F, the background well for the CWL shall be CWL-BW5, and the compliance wells (located at the point of compliance) shall be CWL-MW9, CWL-MW10, and CWL-MW11. Until the CWL Post-Closure Care Permit takes effect, the groundwater monitoring network shall be CWL-BW4A/BW5, CWL-MW4/MW9, CWL-MW5U/MW10 and CWL-MW6U/MW11. Plugging and abandonment and installation of the aforementioned wells shall be in accordance with the plan *Monitoring Well Plug and Abandonment Plan and Well Construction Plan, Decommissioning of Groundwater Monitoring Wells CWL-BW4, CWL-MW5U/L, CWL-MW6U/L, and CWL-BW4A, Installation of Groundwater Monitoring Wells CWL-MW9, CWL-MW10, CWL-MW11, and CWL-BW5*, dated July 2009, which is found as Attachment 1 of Appendix G of this Closure Plan.

1.3 Document Ownership

The Environmental Restoration Division 7723 is responsible for issuing and maintaining this document. Any comments or questions concerning this document should be addressed to the Division Supervisor.

1.4 Health and Safety

A health and safety plan (HASP) has been prepared to address all health and safety concerns associated with the sampling of potentially contaminated groundwater. Prior to conducting sampling related activities, field personnel will have read and agreed to the contents of the HASP by signing and dating the document. The HASP is prepared in conformance with SNL health and safety requirements (ES&H Manual) and 29 CFR 1910.120.

1.5 Applicable Documents

The SNL Environmental Programs Department Quality Plan (Revision 1) and supplemental quality plan implementing procedures are referenced throughout this document. Applicable portions of these documents are also incorporated directly so that this plan is a comprehensive, stand-alone document. Copies of these other applicable documents, as well as CWL monitoring reports, are available at the SNL Environmental Programs Department Records Center. The following is a list of documents referenced throughout this plan. These documents should be consulted during data generation.

Sandia National Laboratories (SNL), “Environmental Programs Department (7720) Quality Plan,” Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories (SNL), “Procedure for Validation of Chemical Measurement Data,” QA 11-01, Environmental Programs Department (7720), Sandia National Laboratories, Albuquerque, New Mexico

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Attachment 1 of Appendix G

**Sandia National Laboratories, New Mexico (SNL/NM)
Environmental Restoration Project**

**Monitoring Well Plug and Abandonment Plan
and
Well Construction Plan**

**Decommissioning of
Groundwater Monitoring Wells CWL-MW4, CWL-MW5U/L, CWL-MW6U/L, and
CWL-BW4A**

**Installation of Groundwater Monitoring Wells CWL-MW9, CWL-MW10, CWL-MW11,
and CWL-BW5**

Environmental Restoration Project

July 2009



**United States Department of Energy
Sandia Site Office**

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1. Project and Site Information

Task Description: Sandia National Laboratories/New Mexico (SNL/NM)
decommissioning with plugging and abandonment of four
groundwater monitoring wells, and installation of four new
groundwater monitoring wells

Case No.: 125778.10.11.01

Project Leader/Department No.: John Cochran/06765

Scheduled Start Date: November 9, 2009

Estimated Completion Date: December 21, 2009

Operations/Technical Area: Chemical Waste Landfill/Technical Area III

2. Regulatory Criteria

This Plug and Abandonment (P&A) Plan outlines the activities and procedures to decommission existing groundwater monitoring wells CWL-MW4, CWL-MW5U/L, CWL-MW6U/L, and CWL-BW4A with the installation of new groundwater monitoring wells CWL-MW9, CWL-MW10, CWL-MW11, and CWL-BW5, respectively.

The U.S. Department of Energy (DOE) and Sandia Corporation (Sandia) agreed to replace these four monitoring wells during recent negotiations with the New Mexico Environment Department/Hazardous Waste Bureau (NMED/HWB) on the Draft Chemical Waste Landfill (CWL) Post-Closure Care Permit. DOE/Sandia agreed to install new wells (CWL-MW9, CWL-MW10, CWL-MW11, and CWL-BW5) to replace CWL-MW4, CWL-MW5U/L, CWL-MW6U/L, and CWL-BW4A.

Section VIII.C of the Compliance Order on Consent (the Consent Order) discusses well abandonment (NMED April 2004):

“Wells shall be abandoned when they are no longer required in the monitoring network, no longer provide representative groundwater samples because of falling water levels or insufficient productivity, or become damaged beyond repair. The goal of well abandonment is to seal the well in such a manner that it cannot act as a conduit for the migration of contaminants from either the ground surface to the saturated zone or between saturated zones. Respondents shall prepare an abandonment plan for any and all wells that are to be plugged and abandoned, and shall submit the plan to the Department for approval. Respondents shall not abandon any groundwater monitoring well without prior written approval of the Department.”

Further regulatory requirements for well P&A procedures can be found in the New Mexico Office of the State Engineer (OSE) “Rules and Regulations Governing Well Driller Licensing; Construction, Repair and Plugging of Wells” (OSE August 2005):

“To plug a well, the entire well shall be filled from the bottom upwards to land surface using a tremie pipe. The well shall be plugged with neat cement slurry, bentonite based plugging material, or other sealing material approved by the state engineer for use in the plugging of non-artesian wells”

The OSE regulations also state that:

“Wells encountering contaminated water or soil may require coordination between the office of the state engineer and the New Mexico environment department (or other authorized agency or department) prior to the plugging of the well.”

And,

“A licensed well driller shall keep a record of each well plugged as the work progresses. The well driller shall file a complete plugging record with the state engineer and the permit holder no later than twenty (20) days after completion of the plugging. The plugging record shall be on a form prescribed by the state engineer . . .”

To meet these regulatory requirements, the following tasks will be completed at SNL/NM:

- Submit this P&A Plan to the NMED/HWB and OSE requesting to decommission CWL-MW4, CWL-MW5U/L, CWL-MW6U/L, and CWL-BW4A because two of the wells (MW4 and BW4A) no longer provide representative groundwater samples due to declining water levels, insufficient productivity, and/or corrosion of the stainless-steel screen; and the two other wells (MW5U/L and MW6U/L) are not optimally located for post-closure care monitoring and will need to be replaced in the next 4 to 6 years.
- Use a licensed well driller and approved materials to seal the wells so that the wells cannot act as a conduit for the migration of potential contaminants from the ground surface to the saturated zone.
- Upon completion of the P&A activities, submit a plugging record to the OSE and submit a P&A Report describing the field activities to the NMED/HWB.

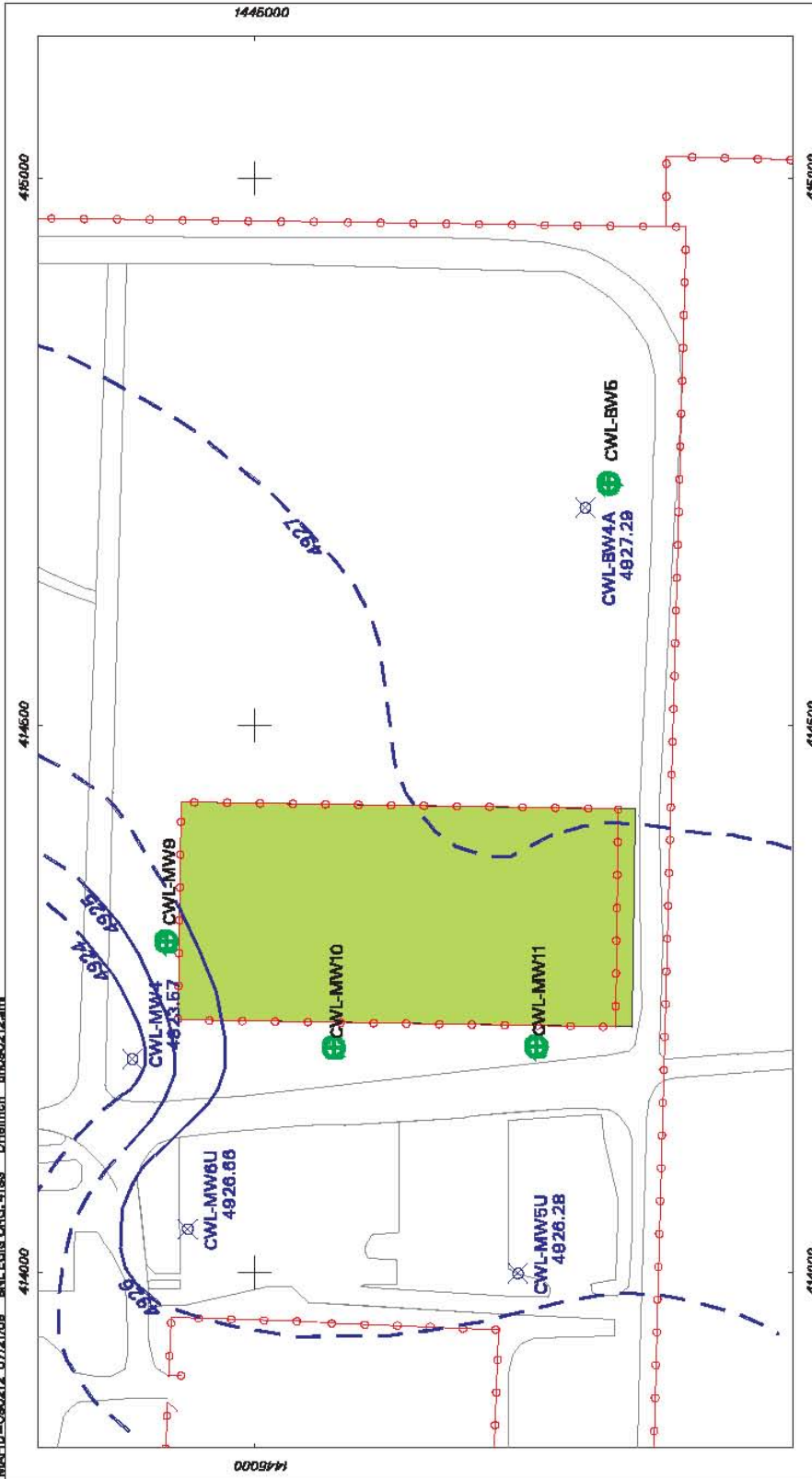
3. Existing Well Information

Groundwater monitoring wells CWL-MW4, CWL-MW5U/L, CWL-MW6U/L, and CWL-BW4A are proposed for decommissioning in this P&A Plan. These wells are located at the Chemical Waste Landfill (Figure 1); CWL-MW4 was installed with auger/mud rotary drilling techniques and CWL-MW5U/L, CWL-MW6U/L, CWL-BW4A were installed using air rotary/Stratex drilling techniques. There is no evidence for any of the wells that suggests the annular seal is compromised. The monitoring well completion diagrams are presented in Attachments 1 through 4. The pertinent well completion information is summarized below. Current water levels are from measurements taken in January 2009.

CWL-MW4 is a groundwater monitoring well installed in May 1990 and is completed in the regional aquifer with the following well completion details:

- Total depth of the well – 503 feet (ft) below ground surface (bgs), including a 5-foot sump
- Screened interval – 478 to 498 ft bgs.
- Construction materials – Polyvinyl chloride (PVC) riser pipe, stainless-steel screen, carbon-steel protective surface casing (conductor casing), and a concrete well pad.
- Current water level – approximately 495 ft bgs
- Water-bearing strata – Groundwater occurs in unconsolidated coarse sand (alluvial fan facies) of the upper Santa Fe Group that has relatively high hydraulic conductivities.

Reason for decommissioning – The stainless-steel screen construction and declining water levels in the regional aquifer.



Legend

- Monitoring Well Proposed for P&A
- Proposed new Monitoring Well
- Paved / Unpaved Road
- Fence
- Chemical Waste Landfill Footprint
- Scale in Feet: 0, 75, 150
- Scale in Meters: 0, 19, 38
- Groundwater Elevation (in Feet Above Mean Sea Level) as of Jan. 2009 (Inferred where dashed)

Sandia National Laboratories, New Mexico
Environmental Geographic Information System



Figure 1
Proposed and Post-Closure
Groundwater Monitoring Wells
and Proposed Replacement
Monitoring Wells

CWL-MW5U/L is a nested groundwater monitoring well pair installed in March-April 1994. CWL-MW5U is completed in the first water bearing zone and CWL-MW5L is completed in the second water bearing zone of the regional aquifer. The two wells are installed in the same borehole with the following well completion details, starting with the more deeply screened CWL-MW5L:

CWL-MW5L (deep monitoring well)

- Total depth of the well – 558 ft bgs, including a 5-ft sump.
- Screened interval – 533 to 553 ft bgs.
- Construction materials – PVC riser pipe and screen (~2-inch internal diameter), carbon-steel protective surface casing (conductor casing), and a concrete well pad.
- Current water level – approximately 495 ft bgs.
- Water-bearing strata – Groundwater occurs in unconsolidated sandy gravel/sand (alluvial fan facies) of the Santa Fe Group.
- Reason for decommissioning – Deeper aquifer monitoring is not required during the post-closure care period and well diameter is too small for conventional sampling equipment required by NMED.

CWL-MW5U (water table monitoring well)

- Total depth of the well – 502 ft bgs, including a 5-ft sump.
- Screened interval – 477 to 497 ft bgs.
- Construction materials – PVC riser pipe and screen (~5-inch internal diameter), carbon-steel protective surface casing (conductor casing), and a concrete well pad.
- Current water level – approximately 488 ft bgs.
- Water-bearing strata – Groundwater occurs in unconsolidated silty, clayey sand (alluvial fan facies) of the Santa Fe Group.
- Reason for decommissioning – Agreement with NMED with respect to the Revised Draft Post Closure Care Permit.

CWL-MW6U/L is a nested groundwater monitoring well pair installed in March-April 1994. CWL-MW6U is completed in the first water bearing zone and CWL-MW6L is completed in the second water bearing zone of the regional aquifer. The two wells are installed in the same borehole with the following well completion details, starting with the more deeply screened CWL-MW6L:

CWL-MW6L (deep monitoring well)

- Total depth of the well – 564 ft bgs, including a 5-ft sump.
- Screened interval – 539 to 559 ft bgs.
- Construction materials – PVC riser pipe and screen (~2-inch internal diameter), carbon-steel protective surface casing (conductor casing), and a concrete well pad.
- Current water level – approximately 497 ft bgs.
- Water-bearing strata – Groundwater occurs in unconsolidated silty, clayey sand/ gravelly sand (alluvial fan facies) of the Santa Fe Group.
- Reason for decommissioning – Deeper aquifer monitoring is not required during the post-closure care period and well diameter is too small for conventional sampling equipment required by NMED.

CWL-MW6U (water table monitoring well)

- Total depth of the well – 502 ft bgs, including a 5-ft sump.
- Screened interval – 477 to 497 ft bgs.
- Construction materials – PVC riser pipe and screen (~5-inch internal diameter), carbon-steel protective surface casing (conductor casing), and a concrete well pad.
- Current water level – approximately 488 ft bgs.
- Water-bearing strata – Groundwater occurs in unconsolidated sandy silt (alluvial fan facies) of the Santa Fe Group.
- Reason for decommissioning – Agreement with NMED with respect to the Revised Draft Post Closure Care Permit.

CWL-BW4A is a groundwater monitoring well installed in May 1994 and is also completed in the regional aquifer with the following well completion details:

- Total depth of the well – 510 ft bgs, including a 5-ft sump.
- Screened interval – 485 to 505 ft bgs.
- Construction materials – PVC riser pipe and screen, carbon-steel protective surface casing (conductor casing), and a concrete well pad.
- Current water level – approximately 502 ft bgs.
- Water-bearing strata – Groundwater occurs in unconsolidated clayey sand/fine sand (alluvial fan facies) of the upper Santa Fe Group that has relatively low hydraulic conductivities.
- Reason for decommissioning – Insufficient water remains in the well and surrounding borehole for sampling. During the October 2008 semi-annual sampling event, the well purged dry prior to groundwater reaching the surface. The well does not sufficiently recover to allow for a representative sample to be collected due to declining water levels in the regional aquifer.

4. Plugging and Abandonment

Based on the requirements established by the NMED/HWB and OSE and the recent negotiations between DOE/Sandia and NMED/HWB, groundwater monitoring wells CWL-MW4, CWL-MW5U/L, CWL-MW6U/L, and CWL-BW4A will be decommissioned. Applicable Field Operating Procedures (FOPs) and Administrative Operating Procedures (AOPs) are listed in Table 1; however, this site-specific P&A Plan shall be used as the primary guidance in the field.

Table 1. Applicable Operating Procedures

Number of Procedure^a	Title of Procedure
FOP 94-01	Safety Meetings, Inspections, and Pre-Entry Briefings Rev. 1, 12/16/96
FOP 94-05	Borehole Lithologic Logging, Rev. 0, 2/10/94
FOP 94-25	Documentation of Field Activities, Rev. 0, 11/4/94
FOP 94-26	General Equipment Decontamination, Rev. 1, 2/20/97
FOP 94-28	Health and Safety Monitoring of Organic Vapors (FID and PID), Rev. 2, 4/27/97
FOP 94-38	Drilling Methods and Drill Site Management, Rev. 0, 4/14/94
FOP 94-41	Well Development, Rev. 0, 11/21/94
FOP 94-42	Integration of the design, Installation, Rehabilitation, and Decommissioning of Environmental Restoration Wells, Rev. 1, 5/31/94
FOP 94-43	Decommissioning Of Wells, Rev 0, 5/31/94
FOP 94-45	Designing and Installing Groundwater Monitoring Wells, Rev. 0, 5/31/94
FOP 94-57	Decontaminating Drilling and Other Field Equipment, Rev. 0, 5/31/94
FOP 94-68	Field Change Control, Rev. 2 (in revision)
FOP 94-69	Personnel Decontamination (Level D, C, and B Protection), Rev. 1, 1/23/98
AOP 94-24	System and Performance Audits, Rev. 0, 1/12/95
AOP 94-25	Deficiency Reporting, Rev. 0, 1/12/95
AOP 95-16	Administrative Operating Procedure for Sample Management and Custody, Rev. 02, 3/28/07

Notes:

^a The most current version will be used.

AOP = Administrative Operating Procedure.

FOP = Field Operating Procedure.

Rev. =Revision

4.1. Goal

The goal for decommissioning monitoring wells CWL-MW4, CWL-MW5U/L, CWL-MW6U/L, and CWL-BW4A is to eliminate the potential of these wells to act as a conduit for the migration of potential contamination to groundwater. The well materials and annular seals are not believed to pose a threat to groundwater, and therefore will be backfilled in place with proper sealing materials.

4.2. Objective

The objective is to seal the monitoring wells in such a manner that there is reasonable certainty that the abandonment has adequately eliminated the potential for cross-communication between

the land surface, vadose zone, and the aquifer, and the potential for downward migration of potential contaminants through the borehole annulus to the aquifer. All grouting techniques and grout mixtures used during decommissioning will minimize grout intrusion into the native formation.

4.3. Implementation

General activities for the implementation of the P&A include:

- 1) Remove all monitoring well surface completion features,
- 2) Backfill the casing with well-plugging materials, and
- 3) Construct a new surface pad/monument.

SNL/NM personnel and the selected drilling contractor will remove all surface completion features, such as guard posts, concrete well pads, and surface protective casings. Care will be taken to prevent materials from falling down the well casings and possibly causing a downhole obstruction. The wells will be abandoned with casing left in place. The uppermost PVC casing will be unscrewed or cut off below the ground surface to allow a new concrete pad to be installed flush with the ground surface at all four locations after plugging and abandonment is complete.

For all wells the well screen and blank well casing will be sealed by lowering a tremie pipe to the base of the well casing (below the base of the screen) and injecting the plug material (bentonite grout) using a diaphragm or equivalent pump system. The tremie pipe will be pulled when the plug material is within 5 ft of the ground surface and allowed to set overnight. If the level of the plug material in the well casing drops overnight, additional bentonite grout will be added to again reach within 5 ft of ground level.

Once the wells have been properly plugged, the decommissioning process will be completed by placing concrete in the upper 5 ft of the well/borehole and installing a concrete slab on the surface of the abandoned well locations. The concrete pads will be approximately 1ft thick with a 2 ft by 2 ft area. A brass marker containing the well name and date of decommissioning will be set in each concrete pad.

5. Monitoring Well Installation

Monitoring wells that will be installed include CWL-MW9, CWL-MW10, CWL-MW11, and CWL-MWBW5.

5.1. Objective

Install 5-inch nominal diameter PVC-casing monitoring wells to provide representative groundwater samples. The monitoring well boreholes will be drilled using Air-Rotary Casing-Hammer (ARCH) drilling methods.

The locations for wells CWL-MW9, CWL-MW10, CWL-MW11, and CWL-BW5 were selected based upon consultations with the NMED. CWL-MW9 is located adjacent to the northern boundary of the CWL, approximately 70 ft east of the northwest corner. CWL-MW10 and CWL-MW11 are located along the western boundary of the CWL, approximately 140 feet south of the northwestern corner and 75 feet north of the southwestern corner, respectively. CWL-BW5 is located approximately 30 feet southeast of CWL-BW4A and is a hydraulically upgradient (i.e.,

background) monitoring well. CWL-MW9, CWL-MW10, and CWL-MW11 represent the hydraulically downgradient monitoring well network for the uppermost aquifer at the CWL. The proposed well locations are shown on Figure 1.

5.2. Implementation

Applicable FOPs and AOPs are listed in Table 1; however, this site-specific plan shall be used as the primary guidance in the field.

5.2.1. Borehole Drilling

For new wells CWL-MW9, CWL-MW10, CWL-MW11, and CWL-BW5, the ARCH drilling method will be able to penetrate highly variable lithologies such as cobbles, boulders, gravel, sand, clay, and caliche while maintaining an open, competent borehole (i.e., using casing to keep the borehole open). The geology of the boreholes will be logged during drilling. The total depth of the boreholes will be determined by the SNL/NM field geologist, but the depths are anticipated to be approximately 12 ft deeper than surrounding wells. The depth of the first encounter with regional groundwater and any perched groundwater will be logged during drilling. While taking into account the geologic conditions of the aquifer encountered during drilling, field personnel will coordinate with the driller for the purpose of selecting an appropriate drilling rate for completing the boreholes below the water table as determined from nearby monitoring wells. The technical rationale for and the drilling rate for each borehole will be documented in the field and in the monitoring well installation report. After reaching total depth, the cased boreholes will be logged using natural gamma and neutron wire-line geophysical methods.

Minimal water (but no other foams/liquids) in the form of “mist” may be introduced into the boreholes to aid in the removal of cuttings. Waste generation will be kept to a minimum. Borehole cuttings will be contained within an area adjacent to the well. Water produced from the wells during drilling or development will be contained in 55-gallon drums and placed on spill control pallets. Management and final disposition of cuttings and water will be performed as stipulated in the project Waste Management Plan.

The most recent groundwater level measurements for the CWL Study Area (January 2009) were used to determine the approximate completion depths for the four new wells. The 20-ft well screen for all of the wells will be set with approximately 5 ft of screen situated above the water table. Monitoring well CWL-MW9 is anticipated to be drilled to approximately 515 ft bgs. The anticipated depth to water at the CWL-MW9 location is approximately 495 ft bgs; therefore, the screen completion interval is expected to be approximately 490 to 510 ft bgs with a 5-ft sump placed below the screen. Monitoring wells CWL-MW10 and CWL-MW11 are anticipated to be drilled to approximately 507 ft bgs. The anticipated depth to water at these locations is approximately 487 ft bgs; therefore, the screen completion interval is expected to be approximately 482 to 502 ft bgs with a 5-ft sump placed below the screen. Monitoring well CWL BW5 is anticipated to be drilled to approximately 522 ft bgs. The anticipated depth to water at this location is approximately 502 ft bgs; therefore, the screen completion interval is expected to be approximately 497 to 517 ft bgs with a 5-ft sump placed below the screen.

5.2.2. Well Construction

The monitoring wells will be completed as specified in this plan. The water-table monitoring wells will be installed through the temporary steel drive casing (nominal 10-inch diameter), and

completed using 5-inch nominal diameter, flush threaded, PVC Schedule-80 water well casing. No solvents, cleaners, or lubricants will be used for construction of the monitoring wells. The casing will be delivered pre-cleaned and bagged, or steam-cleaned on site prior to installation. To preserve the integrity of the well materials, the well screen and riser pipe in all four wells will be suspended in the boreholes until the primary filter pack, bentonite pellet seal and annular seal are installed.

The regional aquifer in the area is being over-pumped and the water table is declining at a rate of approximately 0.6 to 1 ft/year (Figure 2). Anomalously low water levels (below trend line) may reflect measurements taken following a purging event.

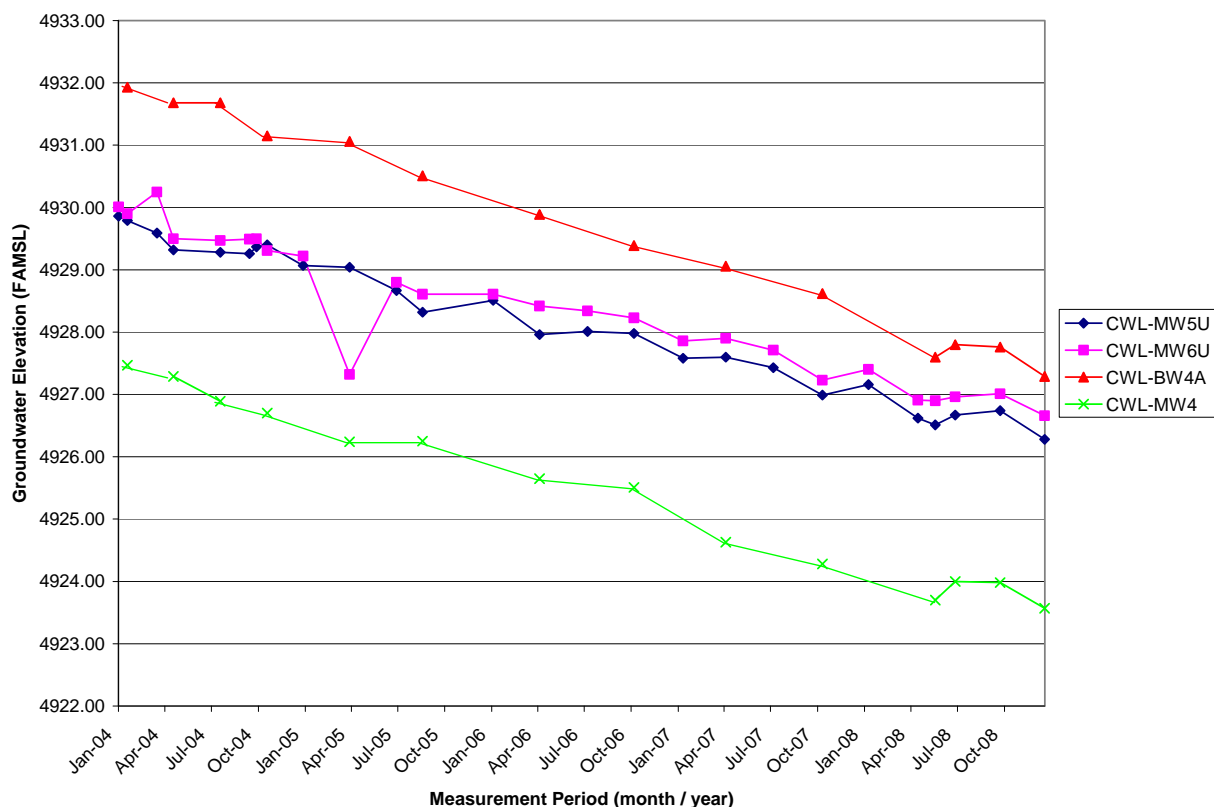


Figure 2.
Water Table Elevations Over Time at CWL-MW4, CWL-MW5U,
CWL-MW6U, and CWL-BW4A

To accommodate the rapidly declining water table, a 20-ft length of PVC screen with a 0.010-inch or 0.020-inch slot size will be used for the new wells. A 5-ft sump will be placed at the base of the screens and sealed with a threaded end cap. PVC centralizers will be placed at the base and top of the well screens and then at intervals not to exceed 100 ft up to the land surface. The screens for these wells will be placed so that the top of the screen is approximately 5 ft above the water-table.

The appropriate screen slot size and gradation of the filter pack material will be based on the gradation of the sediments in the screen interval as determined in the field by the geologist logging the boreholes. If the predominant water-bearing interval consists mostly of clay and silt, a 0.010-inch screen slot and a primary filter pack of clean 20-40 silica sand will be placed in the annulus. However, if the predominant water-bearing interval consists mostly of silt and sand, a 0.020-inch screen slot and a primary filter pack of clean 10-20 silica will be placed in the annulus.

The primary filter pack will extend from the bottom of the sump to at least 5 ft above the top of the screen. A 5-ft thick layer of clean 60 sand will be placed above the primary filter pack. Both sand packs will be tagged using a tag line to verify their depth. Preliminary well development using a surge block will be performed at this time to help settle the filter pack.

A 30-ft thick layer of 3/8-inch bentonite chips will be placed above the filter pack prior to emplacement of the bentonite-grout annular seal and hydrated. The bentonite pellets/chips will be allowed to set for a time adequate for hydration (at least 1 hour). The remaining annular space to ground surface will then be filled with bentonite grout. To prevent overloading, the bentonite grout will be installed in multiple lifts. Per NMED requirements (NMED June 2007), the first bentonite grout lift will be approximately 100 ft thick and will be allowed to set a minimum of 24 hours before installation of the next lift. Subsequent bentonite grout lifts will each be approximately 200 ft thick. The bentonite grout will be topped off to within 6-inches to 1-ft bgs.

The well casings will extend approximately 30 inches above ground surface with a water-tight cap. The monitoring wells will be completed with protective steel casing with a hinged locking cap. The protective casing will be primed and painted yellow. A 3-ft by 3-ft, sloped concrete pad will be constructed around each casing. The pad will contain a 3-inch brass cap stamped with the well identification. Three, 4-inch diameter concrete-filled, steel guard posts (also primed and painted yellow) will be placed around the pads, equidistant from the respective well.

5.2.3. Well Development

Well development will be initiated after at least 48 hours following final grout placement. The wells will be developed for approximately 10 hours, and will consist of pumping, surge-block, swabbing, and/or bailing techniques. During development, the groundwater field parameters (pH, specific conductivity, temperature, and turbidity) will be continuously monitored, and development will continue until parameters have stabilized. All development water will be contained in drums and will not be allowed to discharge to the ground surface. All waste will be disposed of according to applicable State and Federal regulations. The method of development, the volume of water added or removed, the parameters measured, the results of the measurements, and the time these activities take place will be documented in writing during well development. If required, only potable water shall be added to the wells during development.

During development of each water-table completion well, a minimum of five well bore volumes will be removed. After the minimum volume has been removed, development will continue until representative water is obtained. Representative water is assumed to be obtained when pH, temperature, and specific conductivity readings stabilize (less than 10% variability over three consecutive well bore volumes) and the water is visually clear of suspended solids with a target turbidity of less than five Nephelometric Turbidity Units (NTUs).

6. Equipment Decontamination

The drilling rig and related equipment will be decontaminated at the decontamination pad in Technical Area III prior to the beginning of drilling operations at each well and upon completion of the drilling program. Decontamination waste will be kept to a minimum and containerized in drums placed on spill control pallets at the decontamination pad. All waste will be disposed of according to applicable State and Federal regulations.

7. Health and Safety

Level D personal protective equipment is required for all drilling operations. Health and Safety records associated with drilling and development personnel will be maintained on site and will be available at the commencement of drilling activities. All field personnel will operate under a Sandia-approved Health and Safety Plan (HASP) and will have SNL/NM-required training including 40-Hr OSHA HAZWOPER and subsequent yearly refresher courses. An SNL/NM Subject Matter Expert will perform a safety inspection of the drill rig before drilling commences.

8. Pre-Field Activities

Pre-field activities that must be completed prior to drilling include:

- Preparation of the Statement of Work for drilling and monitoring well installation;
- SNL/NM digging permit request and approval;
- HASP preparation, review, and signatures;
- National Environmental Policy Act (NEPA) review and signatures;
- Sample bottle order for waste samples through Sample Management Office;
- Waste Management Plan preparation;
- Field checklist completion, review, and approval; and
- Readiness review meeting

9. Mobilization and Site Setup

SNL/NM personnel will ensure that containers for cuttings have been obtained and are ready for drilling operations, if required. Roll-off bins supplied by SNL/NM personnel will be used to collect drill cuttings for waste management purposes.

10. Reporting

Based on the requirements established by the NMED/HWB, OSE and SNL/NM FOPs, the field activities associated with decommissioning and installation of the monitoring wells will be documented.

10.1 Decommissioning Records

All decommissioning field activities will be documented in a field log book per guidance in FOP 94-25. Upon completion of decommissioning of the wells, the P&A Report will document all site activities and provide final as-built Groundwater Well Abandonment Diagrams (Attachment 5). The Well Plugging and Abandonment Form (Attachment 6) will be used to assure that all records are completed, approved, and submitted for proper records management. The following list of documents and records that are generated as part of the decommissioning process will be provided to the SNL/NM Well File Coordinator who, in turn, will submit them to the SNL/NM Customer-Funded Records Center:

- Monitoring Well Plugging and Abandonment Request
- Site-Specific Well Plugging and Abandonment Work Plan
- Site-Specific Well Plugging and Abandonment Report
- Plugging and Abandonment Documentation and Approval Checklist
- Waste Management Plan
- Field Log Book
- Detailed as-built Groundwater Well Abandonment Diagram (Attachment 3)
- Well Plugging and Abandonment Form (Attachment 4)

All decommissioning activities performed at SNL/NM will be accurately and concisely documented in a final P&A Report to be submitted to the NMED/HWB and the OSE within 90 days after the completion of all related field work, including new monitor well installation. The P&A Report will be combined with the Well Installation Field Report and contain a brief narrative describing actual work performed at the site and any variances to the site-specific P&A Plan. Information to be contained in the P&A Report include: (1) daily field activity notes, (2) all materials used, (3) final "as-built" plugging and abandonment diagrams, and (4) documentation of notification of SNL/NM GIS group and the appropriate regulatory agencies. The Well Plugging and Abandonment Forms (Attachment 6) will be completed and included as part of the P&A Report.

Further P&A reporting elements are required by the OSE (OSE August 2005). SNL/NM personnel and the licensed well driller (contractor) will submit a plugging record with the OSE no later than twenty (20) days after completion of the plugging. The record will include the following elements:

- Name and address of the well owner
- Well driller's name and license number
- Name of each drill rig supervisor that supervised the well plugging
- State engineer file number for the well (if available)
- Location of the well (reported in New Mexico state plane coordinates to ± 0.01 ft)
- Dates when plugging began/concluded
- Plugging material(s) used
- Depth of the well
- Size and type of casing
- Location of perforations
- Location of the sanitary seal
- Completed well log with depth and thickness of all strata plugged, including whether each stratum was water bearing

10.2. Well Installation Records

All well installation field activities will be documented in a field log book per guidance in FOP 94-45. A Well Installation Field Report will be prepared and submitted to the NMED within 90 days upon completion of all well installation and development activities, or after completion of related well decommissioning work. The Field Report will document all site activities and provide the final as-built well completion diagrams developed from the Well Registry Data Sheets (Attachment 7). The Field Report will contain a brief narrative describing actual work

performed at the site and any variances to the site-specific Well Construction Plan. Information to be contained in the Field Report includes: (1) daily field activity notes, (2) all materials used, (3) final "as-built" well completion diagrams, and (4) geophysical logs, and (5) documentation of notification of SNL/NM GIS group and the appropriate regulatory agencies. The documentation will also include the 37 information elements required in Section VIII.D of the Consent Order (NMED April 2004). The following list of documents and records that are generated as part of the well installation process for each well will be provided to the SNL/NM Well File Coordinator who, in turn, will submit them to the SNL/NM Customer-Funded Records Center:

- Well permit agreement
- Well file contents checklist
- Well Registry Data Sheet
- Statement of work for drilling the well
- Drilling permit
- Lithologic (boring) log
- Geophysical logs
- Well construction diagram and completion parameters
- Well development data and groundwater parameters
- Copies of field logbook (geologist, driller)
- Surveyed elevations and location in New Mexico state plane coordinates (with a degree of accuracy of ± 0.01 ft)
- Location map
- Water level measurements
- Aquifer test data
- Analytical data
- Waste management documentation
- Photographs

11. References

New Mexico Environment Department (NMED) April 2004, "Compliance Order on Consent Pursuant to the New Mexico Hazardous Waste Act 74-4-10: Sandia National Laboratories Consent Order," New Mexico Environment Department, April 24, 2004.

New Mexico Office of the State Engineer (OSE) August 2005, "Rules and Regulations Governing Well Driller Licensing; Construction, Repair and Plugging of Wells," New Mexico Office of the State Engineer, August 2005.

New Mexico Environment Department (NMED) June 2007, "Notice of Disapproval: Monitoring Well Plug and Abandonment Plan and Replacement Well Construction Plan, Decommissioning of Groundwater Monitoring Well MWL-BW1, Installation of Replacement Groundwater Monitoring Well MWL-BW2, April 9, 2007, Sandia National Laboratories NM5890110518, HWB-SNL-07-014," Letter to Patty Wagner (SSO/NNSA) and Francis Nimick (Sandia) from James Bearzi, June 19, 2007

Attachment 1--Monitoring Well Completion Diagram for CWL-MW4

WELL DATABASE SUMMARY SHEET

Project Name:	CHEM WASTE LANDFILL	Geo Location:	TA-III
ER ADS #:	1267	Well Completion Date:	04-MAY-1990
Well Name:	CWL-MW4	Completion Zone:	COARSE SAND
Driller Name:	SNL	Formation of Completion:	SANTA FE GROUP
Date Drilling Started:		Well Comment:	AUGER TO 261' - MUD ROTARY TO TD - WATER LEVEL MEASURED 12-AUG-91
Drilling Contractor:			
Drilling Method:	AUGER/MUD ROTARY		
Borehole Depth:	505		
Casing Depth:	480		

Survey Data

Survey Date:

Surveyed By:

State Plane Coordinates

(X) Easting: 414195.17

(Y) Northing: 1445111.6


Surveyed Elevations (FAMSL)

Protective Casing: 5421.35

Top of Inner Well Casing: 5420.33

Concrete Pad: 5418.39

Ground Surface: 5418.38

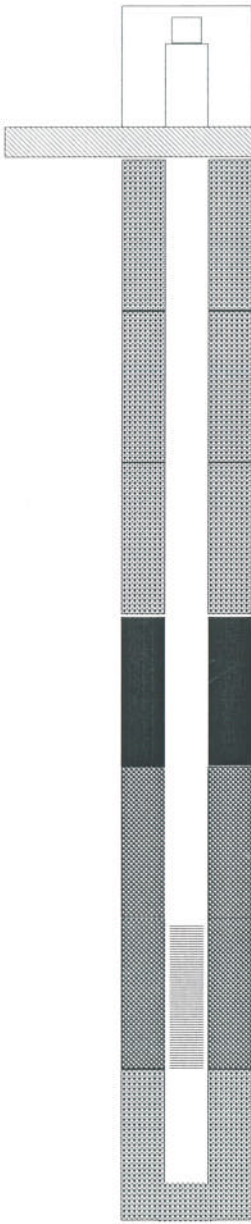


Calculated Depths and Elevations

Initial Water Elevation: 4935.88 (FAMSL)

Initial Depth To Water: 484.45 (FBGS)

Last measured water level was 4932.18 FASL
measured on 02-AUG-1996



Completion Data Measured Depths (FBGS)

Casing Stickup: 1.94

Interval	Start	Stop
GROUT/BACKFILL	0'	458'
BENTONITE/CEMENT		
Interval	Start	Stop
CASING	0'	480'
SCH 80 PVC/SS	I.D. 3.8"	O.D. 4.5"
Interval	Start	Stop
BOREHOLE	0'	505'
		O.D. 8.75"
Interval	Start	Stop
SEAL	458'	468'
BENTONITE		
Interval	Start	Stop
PRIMARY PACK	468'	505'
20/40 MESH SILICA		
Interval	Start	Stop
SCREEN	478'	498'
304 SS		
	Slot Size	.01"
Interval	Start	Stop
SUMP	498'	503'

Date Updated: 14-MAR-00 Date Printed: 12-JAN-2004

Attachment 2-- Monitoring Well Completion Diagram for CWL-MW5U/L

WELL DATABASE SUMMARY SHEET

Project Name: CHEM WASTE LANDFILL
ER ADS #: 1267
Well Name: CWL-MW5U
Well Name: SNL
Date Drilling Started: 29-MAR-1994
Drilling Contractor: WATER DEVELOPMENT
Drilling Method: AIR ROTARY/STRATEX
Borehole Depth: 558
Casing Depth: 502

Geo Location: TA-III
Well Completion Date: 19-APR-1994
Completion Zone: SILTY CLAYEY SAND
Formation of Completion: SANTA FE GROUP
Well Comment:

Survey Data

Survey Date: 20-JUL-1994
Surveyed By: GREINER

State Plane Coordinates

(X) Easting: 413999.191
(Y) Northing: 1444759.335

Surveyed Elevations (FAMSL)

Protective Casing: 5416.53
Top of Inner Well Casing: 5416.01
Concrete Pad: 5414.02
Ground Surface: 5414.02



Calculated Depths and Elevations

Initial Water Elevation:
 (FAMSL)
Initial Depth To Water:
 (FBGS)

Last measured water level was 4934.08 **FASL**
measured on 06-AUG-1996

Date Updated: 14-MAR-00
Date Printed: 12-JAN-2004

Completion Data Measured Depths (FBGS)

Casing Stickup:	1.93
Interval	Start Stop
GROUT/BACKFILL	0' 440'
VOLCLAY	
Interval	Start Stop
CASING	0' 502'
PVC	I.D. 4.77" O.D. 5.56"
Interval	Start Stop
BOREHOLE	0' 558'
	O.D. 12.5"
Interval	Start Stop
SEAL	440' 470'
VOLCLAY/BENTONITE	
Interval	Start Stop
SECONDARY PACK	470' 473'
60 SILICA	
Interval	Start Stop
PRIMARY PACK	473' 504'
40/60 SAND	
Interval	Start Stop
SCREEN	477' 497'
PVC	
Interval	Start Stop
SUMP	497' 502'

Slot Size .01"



WELL DATABASE SUMMARY SHEET

Project Name:	CHEM WASTE LANDFILL	Geo Location:	TA-III
ER ADS #:	1267	Well Completion Date:	19-APR-1994
Well Name:	CWL-MW5L	Completion Zone:	SANDY GRAVEL/SAND
Well Name:	SNL	Formation of Completion:	SANTA FE GROUP
Date Drilling Started:	29-MAR-1994	Well Comment:	
Drilling Contractor:	WATER DEVELOPMENT		
Drilling Method:	AIR ROTARY/STRATEX		
Borehole Depth:	558		
Casing Depth:	558		

Survey Data

Survey Date: 20-JUL-1994
 Surveyed By: GREINER

State Plane Coordinates

(X) Easting: 413999.067
 (Y) Northing: 1444759.62

Surveyed Elevations (FAMSL)

Protective Casing: 5416.53
 Top of Inner Well Casing: 5415.8
 Concrete Pad: 5414.02
 Ground Surface: 5414.02



Calculated Depths and Elevations

Initial Water Elevation:
 (FAMSL)

Initial Depth To Water:
 (FBGS)

Last measured water level was 4930.18 FASL
 asured on 06-AUG-1996

Date Updated: 14-MAR-00
 Date Printed: 12-JAN-2004

Completion Data Measured Depths (FBGS)

Casing Stickup:	1.73		
Interval	Start	Stop	
GROUT/BACKFILL	0'	440'	
VOLCLAY			
Interval	Start	Stop	
CASING	0'	558'	
PVC	I.D. 1.9"	O.D. 2.37"	
Interval	Start	Stop	
BOREHOLE	0'	558'	
		O.D. 12.5"	
Interval	Start	Stop	
SEAL	505'	527'	
BENT/VOLCLAY/SAND			
Interval	Start	Stop	
SECONDARY PACK	527'	529'	
60 SILICA			
Interval	Start	Stop	
PRIMARY PACK	529'	555'	
40/60 SAND			
Interval	Start	Stop	
SCREEN	533'	553'	
PVC			
Interval	Start	Stop	
SUMP	553'	558'	
Interval	Start	Stop	
PLUG BACK	555'	558'	
BENTONITE PELLETS			



Attachment 3--Monitoring Well Completion Diagram for CWL-MW6U/L

WELL DATABASE SUMMARY SHEET

Project Name:	CHEM WASTE LANDFILL	Geo Location:	TA-III
ER ADS #:	1267	Well Completion Date:	04-MAY-1994
Well Name:	CWL-MW6U	Completion Zone:	SANDY SILT
Well Name:	SNL	Formation of Completion:	SANTA FE GROUP
Date Drilling Started:	19-APR-1994	Well Comment:	SAMPLED QUARTERLY. WATER LEVEL MEASURED ON 8/2/96
Drilling Contractor:	WATER DEVELOPMENT		
Drilling Method:	AIR ROTARY/STRATEX		
Borehole Depth:	564		
Casing Depth:	502		

Survey Data

Survey Date: 20-JUL-1994
 Surveyed By: GREINER

State Plane Coordinates

(X) Easting: 414039.868
 (Y) Northing: 1445061.065

Surveyed Elevations (FAMSL)

Protective Casing: 5417.86
 Top of Inner Well Casing: 5416.78
 Concrete Pad: 5414.65
 Ground Surface: 5414.648



Calculated Depths and Elevations

Initial Water Elevation: 4934
 (FAMSL)
 Initial Depth To Water: 482.78
 (FBGS)
 Last measured water level was 4933.99 FASL
 measured on 02-AUG-1996

Date Updated: 14-MAR-00
 Date Printed: 12-JAN-2004

Completion Data Measured Depths (FBGS)

Casing Stickup:	2.1		
Interval	Start	Stop	
GROUT/BACKFILL	0'	440'	
VOLCLAY			
Interval	Start	Stop	
CASING	0'	502'	
PVC	I.D. 4.77"	O.D. 5.56"	
Interval	Start	Stop	
BOREHOLE	0'	564'	
		O.D. 12.5"	
Interval	Start	Stop	
SEAL	440'	470'	
VOLCLAY			
Interval	Start	Stop	
SECONDARY PACK	470'	472'	
60 SILICA			
Interval	Start	Stop	
PRIMARY PACK	472'	507'	
40/60 SAND			
Interval	Start	Stop	
SCREEN	477'	497'	
PVC			
Interval	Start	Stop	
SUMP	497'	502'	
	Slot Size	.01"	



WELL DATABASE SUMMARY SHEET

Project Name:	CHEM WASTE LANDFILL	Geo Location:	TA-III
ER ADS #:	1267	Well Completion Date:	04-MAY-1994
Well Name:	CWL-MW6L	Completion Zone:	SILTY CLAYEY SAND/GRAV SAND
Well Name:	SNL	Formation of Completion:	SANTA FE GROUP
Date Drilling Started:	19-APR-1994	Well Comment:	IRREGULARLY SAMPLED - 2" CASING
Drilling Contractor:	WATER DEVELOPMENT		
Drilling Method:	AIR ROTARY/STRATEX		
Borehole Depth:	564		
Casing Depth:	564		

Survey Data

Survey Date: 20-JUL-1994
 Surveyed By: GREINER

State Plane Coordinates

(X) Easting: 414039.516
 (Y) Northing: 1445061.152

Surveyed Elevations (FAMSL)

Protective Casing: 5417.86
 Top of Inner Well Casing: 5417.13
 Concrete Pad: 5414.648
 Ground Surface: 5414.648



Calculated Depths and Elevations

Initial Water Elevation: 4930.02
 (FAMSL)
 Initial Depth To Water: 482.79
 (FBGS)
 Last measured water level was 4930.02 FASL
 measured on 02-AUG-1996

Date Updated: 14-MAR-00
 Date Printed: 12-JAN-2004

Completion Data Measured Depths (FBGS)

Casing Stickup:	2.58		
Interval	Start	Stop	
GROUT/BACKFILL	0'	440'	
VOLCLAY			
Interval	Start	Stop	
CASING	0'	564'	
PVC	I.D. 1.9"	O.D. 2.37"	
Interval	Start	Stop	
BOREHOLE	0'	564'	
		O.D. 12.5"	
Interval	Start	Stop	
SEAL	507'	532'	
VOLCLAY/BENT CHIPS			
Interval	Start	Stop	
SECONDARY PACK	532'	534'	
60 SILICA			
Interval	Start	Stop	
PRIMARY PACK	534'	561'	
460 SAND			
Interval	Start	Stop	
SCREEN	539'	559'	
PVC			
	Slot Size	.01"	
Interval	Start	Stop	
SUMP	559'	564'	
Interval	Start	Stop	
PLUG BACK	561'	564'	
60 SILICA			



Attachment 4-- Monitoring Well Completion Diagram for CWL-BW4A

WELL DATABASE SUMMARY SHEET

Project Name:	CHEM WASTE LANDFILL	Geo Location:	TA-III
ER ADS #:	1267	Well Completion Date:	16-MAY-1994
Well Name:	CWL-BW4A	Completion Zone:	CLAYEY SAND/FINE SAND
Driller Name:	SNL	Formation of Completion:	SANTA FE GROUP
Date Drilling Started:	10-MAY-1994	Well Comment:	SAMPLED QUARTERLY. WATER LEVEL MEASURED 8/2/96
Drilling Contractor:	WATER DEVELOPMENT		
Drilling Method:	AIR ROTARY/STRATEX		
Borehole Depth:	511		
Casing Depth:	510		

Survey Data

Survey Date: 20-JUL-1994
 Surveyed By: GREINER

State Plane Coordinates

(X) Easting: 414699.161
 (Y) Northing: 1444697.69

Surveyed Elevations (FAMSL)

Protective Casing: 5432.16
 Top of Inner Well Casing: 5431.36
 Concrete Pad: 5429.24
 Ground Surface: 5429.235



Calculated Depths and Elevations

Initial Water Elevation: 4936.96
 (FAMSL)
 Initial Depth To Water: 492.4
 (FBGS)

Last measured water level was measured on FASL

Date Updated: 14-MAR-00
 Date Printed: 12-JAN-2004

Completion Data Measured Depths (FBGS)

Casing Stickup: 2

Interval	Start	Stop
GROUT/BACKFILL	0'	449'
VOLCLAY		
Interval	Start	Stop
CASING	0'	510'
PVC	I.D. 4.77"	O.D. 5.56"
Interval	Start	Stop
BOREHOLE	0'	511'
	O.D. 12.5"	
Interval	Start	Stop
SEAL	449'	479'
VOLCLAY		
Interval	Start	Stop
SECONDARY PACK	479'	481'
60 SILICA		
Interval	Start	Stop
PRIMARY PACK	481'	507'
40/60 SAND		
Interval	Start	Stop
SCREEN	485'	505'
CARBON STEEL		
	Slot Size .01"	
Interval	Start	Stop
SUMP	505'	510'
Interval	Start	Stop
PLUG BACK	507'	511'
60 SILICA		



Attachment 5--Groundwater Well Abandonment Diagram Form

Attachment 6--Well Plugging and Abandonment Form

Attachment 7—Well Registry Data Sheet