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Sandia National Laboratories

Operated for the U.S. Department of Energy's
National Nuclear Security Administration
by **Sandia Corporation**

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Michael W. Hazen
Vice President
Infrastructure Operations
Chief Security Officer

Mr. Geoffrey Beausoleil
Manager
U. S. Department of Energy
National Nuclear Security Administration
Sandia Field Office, MS-0184
P. O. Box 5400
Albuquerque, NM 87185-0184

Dear Mr. Beausoleil:

Subject: ***Certification and Request for Modifications to Hazardous Waste Permit for the Corrective Action Management Unit (CAMU) at Sandia National Laboratories/New Mexico (SNL/NM), EPA ID Number NM5890110518***

Sandia Corporation (Sandia) is requesting that your office submit the enclosed materials to the New Mexico Environment Department (NMED). The enclosures include proposed modifications to the post-closure care requirements for the CAMU at SNL/NM.

The proposed permit modifications are presented in enclosures to this letter in accordance with the requirements of New Mexico Administrative Code, Title 20, Chapter 4, Part 1, Subpart IX (20.4.1.900 NMAC) incorporating Title 40 of the Code of Federal Regulations, Part 270.42(a) and (d) (40 CFR 270.42(a) and (d)).

The proposed modifications affect Module IV of Permit NM5890110518-1 and Appendices D, E, and G of the Class III Permit Modification Request for the Management of Hazardous Remediation Waste in the Corrective Action Management Unit, (CAMU Class III Permit Modification), issued in 1997 and most recently modified in 2003. The proposed changes include:

- Updates to reflect previous revisions
- Updates to contact personnel, procedure titles, procedure names, and dates
- Provisions to allow alternative methods for equipment calibration and recording monitoring data

- Provisions to allow use of alternative analytical methods for soil-gas samples. These changes are needed because numerous analytical laboratories, including the laboratories under contract to Sandia, are phasing out the TO-14 analytical method that is specified in the CAMU Class III Permit Modification and switching to the more rigorous TO-15 method.

The NMED has recently approved a modification of the post-closure care permit for the Chemical Waste Landfill to allow use of the alternative TO-15 method for analysis of soil-gas samples. Sandia is now requesting this modification for the CAMU.

The proposed permit modification to allow use of the alternative analytical method is not explicitly listed in 40 CFR 270.42 Appendix I, but it can be equated to a Class 1 modification associated with groundwater monitoring. Sandia requests a determination from NMED that the modification is a Class 1 modification. All the remaining proposed modifications are listed as Class 1 modifications in Appendix I.

The submittal consists of three enclosures:

- *Enclosure A:* Summary of changes with proposed permit modification class and rationale for each change.

- *Enclosure B:* Revised pages in redline/strikeout format.

- *Enclosure C:* Revised pages in final format with all changes incorporated.

I have signed the certification to be sent to the NMED as the Operator of the CAMU at SNL/NM. If you agree, please sign it as the Owner.

If you have any questions regarding the proposed modifications, please contact Fran Nimick, Senior Manager, at (505) 284-2577/fbnimic@sandia.gov or Pamela Puissant, Manager, at (505) 844-3185/ pmpuiss@sandia.gov.

Sincerely,

Michael W. Hazen
Vice President

Enclosures:
1. Request for Class 1 Permit Modifications, Module IV of Permit NM5890110518 Corrective Action Management Unit, Certification Statement
2. Request for Modification to Hazardous Waste Permit for the Corrective Action Management Unit at Sandia National Laboratories/New Mexico, EPA ID Number NM5890110518 (consists of Enclosures A, B, and C)

Copy to (w/enclosures):
MS-0184 John Weckerle, NNSA/SFO
MS-0184 Cynthia Wimberly, NNSA/SFO
MS-0184 SFO Waste Management File, NNSA/SFO

Blind copy to (w/enclosures):
MS-0651 Customer Funded Records Center, 09532

Blind copy to (w/o enclosures):
MS-0141 Amy J. Blumberg, 11100
MS-0725 Sidney M. Gutierrez, 04100
MS-0729 Francis B. Nimick, 04140
MS-0729 Pamela M. Puissant, 04142
MS-0729 Anita S. Reiser, 04144

AR/ja

Request for Class 1 Permit Modifications
Module IV of Permit NM5890110518
Corrective Action Management Unit
Sandia National Laboratories

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

Date signed

_____ _____

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

Date signed

Enclosure A

Sandia National Laboratories

Permit NM5890110518-1
Corrective Action Management Unit

Summary of Changes
Permit Module IV
CAMU Class II Permit Modification, Appendices D, E, and G

ATTACHMENT A
SUMMARY OF CHANGES FOR CORRECTIVE ACTION MANAGEMENT UNIT
PERMIT NM5890110518

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
1	Module IV. *Special Conditions Pursuant to the 1984 Hazardous and Solid Waste Amendments,* (Module IV) Section U Page 53	The Permittee shall construct and operate the CAMU in accordance to the procedures contained in the following documents: Sandia's Class III Permit Modification Application for the CAMU dated June 1996; Revision 1.0 of the Class III Permit Modification Application for the CAMU dated February 1997; and, Revision 2.0 of the Permit Modification Application for the CAMU dated July 1997. Sandia must also comply with the below stated conditions.	The Permittee shall construct and operate the CAMU in accordance to the procedures contained in the following documents: Sandia's Class III Permit Modification Application for the CAMU dated June 1996; Revision 1.0 of the Class III Permit Modification Application for the CAMU dated February 1997;Revision 2.0 of the Permit Modification Application for the CAMU dated July 1997, and all subsequently approved revisions. Sandia must also comply with the below stated conditions.	Revise text to reflect revisions to Permit after 1997.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1.
2	Module IV Section U Pages 53 and 54	4. Page 49 of the Closure Plan; Revision 2 of the Application: When taking soil samples, Sandia shall comply with all applicable FOPs and Administrative Operating Procedures (AOPs). Sandia shall also comply with the Quality Assurance Plan for the SNL/NM Sample Management Office (QAP 95-01) and Verification and Validation of Chemical and Radiochemical Data (TOP-94- 03) 5. When sampling the various vadose zone sampling systems, Sandia must comply with all applicable FOPs, AOPs, QAP-95-01, and TOP-94-03.	4. Page 49 of the Closure Plan; Revision 2 of the Application: When taking soil samples, Sandia shall comply with all applicable FOPs and Administrative Operating Procedures (AOPs). Sandia shall also comply with the Quality Assurance Project Plan for the SNL/NM Sample Management Office (SMO-QAPP) and Data Validation Procedure for Chemical and Radiochemical Data (AOP 00-03) 5. When sampling the various vadose zone sampling systems, Sandia must comply with all applicable FOPs, AOPs, and SMO-QAPP.	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

ATTACHMENT A
SUMMARY OF CHANGES FOR CORRECTIVE ACTION MANAGEMENT UNIT
PERMIT NM5890110518

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
3	Module IV Section U Page 54	10. For soil gas sampling in the vertical sensor array monitoring system, Sandia must sample the gas according to FOP 94-21. Chemical analysis will be performed using EPA method TO-14 and any applicable SW-846 method. Soil-gas samples will be taken quarterly.	10. For soil gas sampling in the vertical sensor array monitoring system, Sandia must sample the gas according to FOP 08-22. Chemical analysis will be performed using EPA method TO-14 or an equivalent method and any applicable SW-846 method. Soil-gas samples will be taken quarterly.	Update procedure numbers. Respond to analytical laboratory recommendation to change from the TO-14 analytical method for soil-gas samples to the more rigorous TO-15 method. Inclusion of the TO-15 or equivalent method which meets the requirements does not substantially alter the permit conditions or reduce the capacity of DOE/Sandia to protect human health and the environment during post-closure care of the CAMU.	*Other modification.* 20.4.1.900 NMAC, 40 CFR 270.42(d)(1) This modification is not explicitly listed in 40 CFR 270.42 Appendix I. However, it can be equated to Modification C.2 “Changes in ground-water sampling or analysis procedures or monitoring schedule, with prior approval of the Director” which is recognized as a Class 1 modification. The soil-gas monitoring is part of the vadose zone monitoring conducted to monitor the performance of the containment cell during post-closure care.

ATTACHMENT A
SUMMARY OF CHANGES FOR CORRECTIVE ACTION MANAGEMENT UNIT
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Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
4	Class III Permit Modification Request for the Management of Hazardous Remediation Waste in the Corrective Action Management Unit , (CAMU Class III Permit Modification) Appendix D *Closure Plan* Cover	**CLOSURE PLAN FOR THE CORRECTIVE ACTION MANAGEMENT UNIT TECHNICAL AREA III SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT FINAL SEPTEMBER 2003**	**CLOSURE PLAN FOR THE CORRECTIVE ACTION MANAGEMENT UNIT TECHNICAL AREA III SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT FINAL**	Update cover to delete outdated information .	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1
5	CAMU Class III Permit Modification Appendix D Section 6.1 Page 38	Joe Estrada U.S. Department of Energy Albuquerque Operations Office Sandia Field Office of Kirtland Site Operations P.O. Box 5400 Albuquerque, NM 87185 The contact person for SNL/NM is: Mr. Fran Nimick Sandia National Laboratories P.O. Box 5800 M/S 1087 Albuquerque, NM 87185-5800 (505) 284-2577	John Weckerle U.S. Department of Energy, National Nuclear Security Administration Albuquerque Operations Office Sandia Field Office P.O. Box 5400 Albuquerque, NM 87185 The contact person for SNL/NM is: Mr. Fran Nimick Sandia National Laboratories P.O. Box 5800, MS-0729 Albuquerque, NM 87185-5800 (505) 284-2577	Update contact information to reflect current personnel responsibilities and contact information.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
6	CAMU Class III Permit Modification Appendix D Section 6.4.4 Page 41 Table 6-1	<table><tr><td>Monitoring Method</td></tr><tr><td>Neutron Probe</td></tr><tr><td>TDR probe Method TO-14</td></tr><tr><td>Neutron Probe Method TO-14</td></tr><tr><td>Method TO-14</td></tr><tr><td>Neutron Probe</td></tr><tr><td>TDR probe Method TO-14</td></tr><tr><td>Neutron Probe Method TO-14</td></tr></table> [a] Monthly monitoring will continue beyond the first year, if necessary, until stable readings are obtained. [b] Active soil-gas sampling will be conducted annually unless increased soil moisture is detected, in which case active soil-gas sampling will be conducted on a quarterly basis until stable conditions are reached. [c] Quarterly monitoring will be conducted for a period of three years, and then is subject to renegotiation.	<table><tr><td>Monitoring Method</td></tr><tr><td>Neutron Probe</td></tr><tr><td>TDR probe Method TO-14[d]</td></tr><tr><td>Neutron Probe Method TO-14 [d]</td></tr><tr><td>Method TO-14 [d]</td></tr><tr><td>Neutron Probe</td></tr><tr><td>TDR probe Method TO-14 [d]</td></tr><tr><td>Neutron Probe Method TO-14 [d]</td></tr></table> [a] Monthly monitoring will continue beyond the first year, if necessary, until stable readings are obtained. [b] Active soil-gas sampling will be conducted annually unless increased soil moisture is detected, in which case active soil-gas sampling will be conducted on a quarterly basis until stable conditions are reached. [c] Quarterly monitoring will be conducted for a period of three years, and then is subject to renegotiation. [d] Monitoring will be conducted using EPA Compendium Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality.	Please see Item 3.	*Class 1 modification.* Analogous to Modification C.2 (please see Item 3).

ATTACHMENT A
SUMMARY OF CHANGES FOR CORRECTIVE ACTION MANAGEMENT UNIT
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Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
7	CAMU Class III Permit Modification Appendix E *Proposed Alternative to Groundater Monitoring for the CAMU* Cover	**PROPOSED ALTERNATIVE TO GROUNDWATER MONITORING FOR THE CORRECTIVE ACTION MANAGEMENT UNIT TECHNICAL AREA III SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT FINAL <u>SEPTEMBER 2003</u>**	**PROPOSED ALTERNATIVE TO GROUNDWATER MONITORING FOR THE CORRECTIVE ACTION MANAGEMENT UNIT TECHNICAL AREA III SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT FINAL**	Update cover to delete outdated information .	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1
8	CAMU Class III Permit Modification Appendix E List of Attachments Page 5	E-5 Monitoring System Analytes <u>Using EPA Method TO-14</u>	E-5 Monitoring System Analytes	Revise table of contents to reflect updated title of Attachment E-5 to Appendix E	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
9	CAMU Class III Permit Modification Appendix E Section 4.2.4 Page 27 Table 4-1	<table><tr><th>Monitoring Method</th></tr><tr><td>Neutron probe TDR probe Method TO-14 or TO-17[a] Neutron probe Method TO-14 or TO-17[a]</td></tr><tr><td>Method TO-14 or TO-17[a]</td></tr><tr><td>Neutron probe TDR probe Method TO-14 or TO-17[a] Neutron probe Method TO-14 or TO-17[a]</td></tr><tr><td>Method TO-14 or TO-17[a]</td></tr></table> [a]Due to the uncertainty of actual contaminant constituents to be managed in the containment cell, active soil gas sampling will be conducted using EPA Method TO-14 or TO-17. The analyte list for soil gas monitoring is contained in Attachment E-5. [b]Active soil gas sampling will be conducted annually unless increased soil moisture is detected, in which case active soil gas sampling will be conducted on a quarterly basis until steady-state conditions are reached.	<table><tr><th>Monitoring Method</th></tr><tr><td>Neutron probe TDR probe Method TO-14[a] Neutron probe Method TO-14[a]</td></tr><tr><td>Method TO-14[a]</td></tr><tr><td>Neutron probe TDR probe Method TO-14[a] Neutron probe Method TO-14[a]</td></tr><tr><td>Method TO-14[a]</td></tr></table> [a]The analyte list for soil gas monitoring is contained in Attachment E-5. Monitoring will be conducted using EPA Compendium Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality. [b]Active soil gas sampling will be conducted annually unless increased soil moisture is detected, in which case active soil gas sampling will be conducted on a quarterly basis until steady-state conditions are reached.	Please see Item 3.	*Class 1 modification.* Analogous to Modification C.2 (please see Item 3).
10	CAMU Class III Permit Modification Appendix E Attachment E-2 Cover	**ATTACHMENT E-2** **SAMPLING AND ANALYSIS PLAN FOR THE** **CWL AND SANITARY SEWER LINE MONITORING SYSTEM** **SEPTEMBER 2003**	**ATTACHMENT E-2** **SAMPLING AND ANALYSIS PLAN FOR THE** **CWL AND SANITARY SEWER LINE MONITORING SYSTEM**	Update cover to delete outdated information .	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

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Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
11	CAMU Class III Permit Modification Appendix E Attachment E-2 Section 2.2 Page 4	The CSS monitoring points will be sampled for soil gas to detect releases from the CWL and sanitary sewer line that could potentially migrate toward the containment cell. This sampling will be performed in accordance with SNL/NM Activity Specific Standard Operating Procedure (ASSOP) 01-04 "Activity Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU)" or ASSOP 01-05, "Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU)."	The CSS monitoring points will be sampled for soil gas to detect releases from the CWL and sanitary sewer line that could potentially migrate toward the containment cell. This sampling will be performed in accordance with SNL/NM Field Operating Procedure (FOP) 08-22 "Soil Vapor Sampling""	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
12	CAMU Class III Permit Modification Appendix E Attachment E-2 Section 2.3 Page 5	An on-site laboratory or an approved analytical laboratory under contract to the Sample Management Office will be used to provide the analytical services. Laboratory sample custody, sample analysis, data management, reporting, and sample disposal will be performed in accordance with established laboratory procedures. Analytical procedures will follow established laboratory standard operating procedures based on the referenced EPA method (i.e., TO-14 or TO-17). Active soil gas sampling will be conducted for selected volatile organic compounds (VOC) included in EPA Methods TO-14 or TO-17. TO-17 and any applicable SW-846 methods. All sample analyses will be performed either by an on-site laboratory or by an SNL/NM approved off-site laboratory.	An on-site laboratory or an approved analytical laboratory under contract to the Sample Management Office will be used to provide the analytical services. Laboratory sample custody, sample analysis, data management, reporting, and sample disposal will be performed in accordance with established laboratory procedures. Analytical procedures will follow established laboratory standard operating procedures based on the referenced EPA method . Active soil gas sampling will be conducted for the volatile organic compounds (VOC) listed in Attachment E-5, which includes analytes in EPA Method TO-14. Chemical analyses will be performed using either EPA Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality and any applicable SW-846 methods. All sample analyses will be performed either by an on-site laboratory or by an SNL/NM approved off-site laboratory.	Please see Item 3.	*Class 1 modification.* Analogous to Modification C.2 (please see Item 3).
13	CAMU Class III Permit Modification Appendix E Attachment E-2 Section 2.4 Page 5	Table 2-1 lists procedures which may be used in support of this SAP. These procedures comply with current sampling and analysis guidance documents, relevant SNL/NM FOP and Administrative Operating Procedures (AOP), the SNL/NM Environmental Restoration Project Program Implementation Plan, and SW-846 procedures.	Table 2-1 lists procedures which may be used in support of this SAP. These procedures comply with current sampling and analysis guidance documents, relevant SNL/NM FOP and Administrative Operating Procedures (AOP), and SW-846 procedures.	Update to delete outdated information.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

<table>
<tr><th>Item No.</th><th>Location</th><th>Current Language</th><th>Revised Language</th><th>Explanation for Change</th><th>Modification Class Rationale</th></tr>
<tr>
<td>14</td>
<td>CAMU Class III Permit Modification
Appendix E
Attachment E-2
Section 2.4
Page 6
Table 2-1</td>
<td>
<table>
<tr><th>Number</th><th>Administrative and Field Operating Procedure Title</th></tr>
<tr><td>AOP 94-22</td><td>Sample Management Office User's Guide</td></tr>
<tr><td>ASSOP 01-02</td><td>Activity-Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe Moisture Depth Gauge in Neutron Logging Activities at the Corrective Action Management Unit (CAMU)</td></tr>
<tr><td>ASSOP 01-04</td><td>Activity-Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU)</td></tr>
<tr><td>ASSOP 01-05</td><td>Activity-Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU)</td></tr>
<tr><td>AOP 94-24</td><td>System and Performance Audits</td></tr>
<tr><td>AOP 94-25</td><td>Deficiency Reporting</td></tr>
<tr><td>FOP 94-25</td><td>Documentation of Field Activities</td></tr>
<tr><td>FOP 94-26</td><td>General Equipment Decontamination</td></tr>
<tr><td>FOP 94-34</td><td>Field Sample Management and Custody</td></tr>
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<table>
<tr><th>Number</th><th>Administrative and Field Operating Procedure Title</th></tr>
<tr><td>AOP 00-03</td><td>Data Validation Procedure for Chemical and Radiochemical Data</td></tr>
<tr><td>FOP 08-20</td><td>Soil Moisture Determination Utilizing Neutron Logging</td></tr>
<tr><td>FOP 08-22</td><td>Soil Vapor Sampling</td></tr>
<tr><td>AOP 95-16</td><td>Sample Management and Custody</td></tr>
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<td>Update procedure titles and document numbers, and delete outdated information.</td>
<td>Class 1 modification.
Administrative change.

20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1</td>
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ATTACHMENT A
SUMMARY OF CHANGES FOR CORRECTIVE ACTION MANAGEMENT UNIT
PERMIT NM5890110518

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
15	CAMU Class III Permit Modification Appendix E Attachment E-2 Section 2.4.1 Subsection 1 Page 6	The CPN 503DR soil moisture probe is operated in accordance with ASSOP 01-02. The standard count measures the proper function of the gauge electronics and also compensates for the source decay. This measurement should be performed daily when used as described in the ASSOP.	The CPN 503DR soil moisture probe is operated in accordance with FOP 08-20. The standard count measures the proper function of the gauge electronics and also compensates for the source decay. This measurement should be performed daily when used as described in the FOP	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1
16	CAMU Class III Permit Modification Appendix E Attachment E-2 Section 2.4.1 Subsection 2 Page 7	Actual soil moisture contents can be determined as described in Klute, 1986, by mass weighing of the entire test apparatus, or with the aid of a previously calibrated TDR system.	Actual soil moisture contents can be determined as described in Klute, 1986, by mass weighing of the entire test apparatus, or with the aid of a previously calibrated TDR system. As an alternative to the procedure described above, the CPN 503DR neutron probe may be calibrated by the manufacturer.	Update description of calibration process to allow option of calibration by equipment manufacturer.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

ATTACHMENT A
SUMMARY OF CHANGES FOR CORRECTIVE ACTION MANAGEMENT UNIT
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Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
17	CAMU Class III Permit Modification Appendix E Attachment E-2 Section 2.5 Pages 7 and 8	Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 0l-02 *Activity Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe Moisture Depth Gauge in Neutron Logging Activities at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 01-04 *Activity Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 01-05 *Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico.	Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-20 *Soil Moisture Determination Utilizing Neutron Logging .* Sandia National Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-22 *Soil Vapor Sampling.* Sandia National Laboratories, Albuquerque, New Mexico.	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1
18	CAMU Class III Permit Modification Appendix E Attachment E-3 Cover	**ATTACHMENT E-3** **SAMPLING AND ANALYSIS PLAN FOR THE** **PRIMARY SUBLINER MONITORING SYSTEM** **SEPTEMBER 2003**	**ATTACHMENT E-3** **SAMPLING AND ANALYSIS PLAN FOR THE** **PRIMARY SUBLINER MONITORING SYSTEM**	Update cover to delete outdated information .	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
19	CAMU Class III Permit Modification Appendix E Attachment E-3 Section 2.1 Page 4	Following moisture logging in the access tubes using the neutron probe, the moisture content data will be entered onto a computer spreadsheet for evaluation. For details, see CAMU ASSOP 01-02, "Activity Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe Moisture Depth Gauge in Neutron Logging Activities at the CAMU."	Following moisture logging in the access tubes using the neutron probe, the moisture content data will be entered onto a computer spreadsheet for evaluation. For details, see FOP 08-20, "Soil Moisture Determination Utilizing Neutron Logging."	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1
20	CAMU Class III Permit Modification Appendix E Attachment E-3 Section 2.3 Pages 6 and 7	Chemical analyses will be performed using EPA SW-846 methods for liquid samples, and EPA Method TO-14 or TO-17 for the soil gas samples. Analyses will be conducted for selected volatile organic compounds (VOC) included in EPA Methods TO-14 or TO-17 plus any additional VOCs known to have been placed in the containment cell. All liquid sample analyses will be performed either by the SNL/NM ER Chemical Laboratory or by an SNL/NM approved off-site laboratory. Gas sampling will be performed in accordance with ASSOP 01-04, "Activity Specific Standard Operating Procedure for Active Soil Gas Sampling Using method TO-14 at the Corrective Action Management Unit (CAMU)" or ASSOP 01-05, "Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU)."	Chemical analyses will be performed using EPA SW-846 methods for liquid samples, and EPA Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality for the soil gas samples. Analyses will be conducted for the volatile organic compounds (VOCs) listed in Attachment E-5, which includes analytes in EPA Methods TO-14 plus any additional VOCs known to have been placed in the containment cell. All liquid sample analyses will be performed either by the SNL/NM ER Chemical Laboratory or by an SNL/NM approved off-site laboratory. Gas sampling will be performed in accordance with FOP 08-22, "Soil Vapor Sampling."	Please see Item 3.	*Class 1 modification.* Analogous to Modification C.2 (please see Item 3).

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<tr>
<td>21</td>
<td>CAMU Class III Permit Modification
Appendix E
Attachment E-3
Section 2.4
Page 7
Table 2-1</td>
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<tr><td>ASSOP 01-04</td><td>Activity-Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU)</td></tr>
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<tr><td>AOP 00-03</td><td>Data Validation Procedure for Chemical and Radiochemical Data</td></tr>
<tr><td>FOP 08-20</td><td>Soil Moisture Determination Utilizing Neutron Logging</td></tr>
<tr><td>FOP 08-22</td><td>Soil Vapor Sampling</td></tr>
<tr><td>AOP 95-16</td><td>Sample Management and Custody</td></tr>
</table>
</td>
<td>Update procedure titles and document numbers, and delete outdated information.</td>
<td>Class 1 modification.
Administrative change.

20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1</td>
</tr>
</table>

ATTACHMENT A
SUMMARY OF CHANGES FOR CORRECTIVE ACTION MANAGEMENT UNIT
PERMIT NM5890110518

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
22	CAMU Class III Permit Modification Appendix E Attachment E-3 Section 2.4.1 Subsection 1 Page 8	The CPN 503DR soil moisture probe is operated in accordance with ASSOP 01-02. The standard count measures the proper function of the gauge electronics and also compensates for the source decay. This measurement should be performed daily when used as described in the ASSOP.	The CPN 503DR soil moisture probe is operated in accordance with FOP 08-20. The standard count measures the proper function of the gauge electronics and also compensates for the source decay. This measurement should be performed daily when used as described in the FOP.	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1
23	CAMU Class III Permit Modification Appendix E Attachment E-3 Section 2.4.1 Subsection 2 Page 8	Actual soil moisture contents can be determined as described in Klute, 1986, by mass weighing of the entire test apparatus, or with the aid of a previously calibrated TDR system.	Actual soil moisture contents can be determined as described in Klute, 1986, by mass weighing of the entire test apparatus, or with the aid of a previously calibrated TDR system. As an alternative to the procedure described above, the CPN 503DR neutron probe may be calibrated by the manufacturer.	Update description of calibration process to allow option of calibration by equipment manufacturer.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
24	CAMU Class III Permit Modification Appendix E Attachment E-3 Section 2.5 Page 10	Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 0l-02 *Activity Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe Moisture Depth Gauge in Neutron Logging Activities at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 01-04 *Activity Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 01-05 *Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico.	Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-20 *Soil Moisture Determination Utilizing Neutron Logging .* Sandia National Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-22 *Soil Vapor Sampling.* Sandia National Laboratories, Albuquerque, New Mexico.	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1
25	CAMU Class III Permit Modification Appendix E Attachment E-4 Cover	**ATTACHMENT E-4** **SAMPLING AND ANALYSIS PLAN FOR THE** **VERTICAL SENSOR ARRAY MONITORING SYSTEM** **SEPTEMBER 2003**	**ATTACHMENT E-4** **SAMPLING AND ANALYSIS PLAN FOR THE** **VERTICAL SENSOR ARRAY MONITORING SYSTEM**	Update cover to delete outdated information .	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

ATTACHMENT A
SUMMARY OF CHANGES FOR CORRECTIVE ACTION MANAGEMENT UNIT
PERMIT NM5890110518

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
26	CAMU Class III Permit Modification Appendix E Attachment E-4 Section 2.2 Page 4	Soil gas sampling in the VSA will occur at the frequency specified in Appendix E, Table 4-1. Soil moisture measurements (both from PSL access tube neutron probe moisture results and VSA gradients), and moisture changes measured by the VSA subsystem will be interpreted by qualified personnel to distinguish the origin of moisture buildup beneath the liner system as originating from containment cell leakage or from sources outside the containment cell. Gas sampling will be performed in accordance with ASSOP 01-04, "Activity Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU) or ASSOP 01-05, "Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit."	Soil gas sampling in the VSA will occur at the frequency specified in Appendix E, Table 4-1. Soil moisture measurements (both from PSL access tube neutron probe moisture results and VSA gradients), and moisture changes measured by the VSA subsystem will be interpreted by qualified personnel to distinguish the origin of moisture buildup beneath the liner system as originating from containment cell leakage or from sources outside the containment cell. Gas sampling will be performed in accordance with FOP 08-22, "Soil Vapor Sampling."	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1
27	CAMU Class III Permit Modification Appendix E Attachment E-4 Section 2.2 Page 5	Moisture content values are displayed on the laptop PC and recorded in a field logbook.	Moisture content values are displayed on the laptop PC and recorded in a field logbook or on the PC.	Update description of process to allow electronic data collection.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

<table>
<tr><th>Item No.</th><th>Location</th><th>Current Language</th><th>Revised Language</th><th>Explanation for Change</th><th>Modification Class Rationale</th></tr>
<tr><td>28</td><td>CAMU Class III Permit Modification
Appendix E
Attachment E-4
Section 2.3
Page 5</td><td>Active soil gas sampling will be conducted for selected volatile organic compounds (VOC) included in EPA Methods TO-14 or TO-17 to provide a proper baseline for the system.

Chemical analyses will be performed using either EPA Method TO-14 or TO-17 and any applicable SW-846 methods.</td><td>Active soil gas sampling will be conducted for selected volatile organic compounds (VOC) listed in Attachment E-5, which includes analytes in EPA Method TO-14 to provide a proper baseline for the system.

Chemical analyses will be performed using either EPA Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality, and any applicable SW-846 methods.</td><td>Please see Item 3.</td><td>Class 1 modification.
Analogous to Modification C.2 (please see Item 3).</td></tr>
<tr><td>29</td><td>CAMU Class III Permit Modification
Appendix E
Attachment E-4
Section 2.4
Page 6
Table 2-1</td><td><table><tr><th>Number</th><th>Administrative and Field Operating Procedure Title</th></tr><tr><td>AOP 94-22</td><td>Sample Management Office User's Guide</td></tr><tr><td>ASSOP 01-02</td><td>Activity-Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe Moisture Depth Gauge in Neutron Logging Activities at the Corrective Action Management Unit (CAMU)</td></tr><tr><td>ASSOP 02-03</td><td>Activity-Specific Standard Operating Procedure for Time Domain Reflectometry and Temperature Data Collection from the CAMU Vertical Sensor Array Monitoring Locations Using a TDR100 System and CR23X Micrologger</td></tr></table></td><td><table><tr><th>Number</th><th>Administrative and Field Operating Procedure Title</th></tr><tr><td>AOP 00-03</td><td>Data Validation Procedure for Chemical and Radiochemical Data</td></tr><tr><td>FOP 08-20</td><td>Soil Moisture Determination Utilizing Neutron Logging</td></tr><tr><td>FOP 08-21</td><td>Soil Moisture Monitoring Using Time Domain Reflectometry</td></tr><tr><td>FOP 08-22</td><td>Soil Vapor Sampling</td></tr><tr><td>AOP 95-16</td><td>Sample Management and Custody</td></tr></table></td><td>Update procedure titles and document numbers, and delete outdated information.</td><td>Class 1 modification.
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</table>

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
		ASSOP 01-04 — Activity-Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU) ASSOP 01-05 — Activity-Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU) AOP 94-24 — System and Performance Audits AOP 94-25 — Deficiency Reporting FOP 94-25 — Documentation of Field Activities FOP 94-26 — General Equipment Decontamination FOP 94-34 — Field Sample Management and Custody			
30	CAMU Class III Permit Modification Appendix E Attachment E-4 Section 2.6 Pages 11 and 12	Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 0l-02 *Activity Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe Moisture Depth Gauge in Neutron Logging Activities at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 01-04 *Activity Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU).* Sandia National	Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-20 *Soil Moisture Determination Utilizing Neutron Logging .* Sandia National Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-22 *Soil Vapor Sampling.* Sandia National Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-21 *Soil Moisture Monitoring Using Time Domain Reflectometry*. Sandia National Laboratories, Albuquerque, New Mexico	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
		Laboratories, Albuquerque, New Mexico. Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 01-05 *Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico.			
31	CAMU Class III Permit Modification Appendix E Attachment E-5 Cover	**ATTACHMENT E-5 MONITORING SYSTEM ANALYTES USING EPA METHOD TO-14**	**ATTACHMENT E-5 MONITORING SYSTEM ANALYTES**	Please see Item 3.	*Class 1 modification.* Analogous to Modification C.2 (please see Item 3).
32	CAMU Class III Permit Modification Appendix E Attachment E-5 Page 1	**Monitoring System Analytes Using EPA Method TO-14**	**Monitoring System Analytes**	Please see Item 3.	*Class 1 modification.* Analogous to Modification C.2 (please see Item 3).
33	CAMU Class III Permit Modification Appendix E Attachment E-5 Page 1		Reference: "Compendium Method TO-15: Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)," Center for Environmental Research Information, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268, January 1999	Add reference for EPA Method TO-15. Please see discussion in Item 3.	*Class 1 modification.* Analogous to Modification C.2 (please see Item 3).

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
34	CAMU Class III Permit Modification Appendix G *Operating Procedures* Cover	**APPENDIX G OPERATING PROCEDURES FINAL SEPTEMBER 2003**	**APPENDIX G OPERATING PROCEDURES FINAL**	Update cover to delete outdated information .	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1
35	CAMU Class III Permit Modification Appendix G Page 1	ASSOP 01-02 Activity-Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe® Moisture Depth Gauge in Neutron Logging Activities at the Corrective Action Management Unit (CAMU) ASSOP 02-03 Activity Specific Standard Operating Procedure for Time Domain Reflectometry and Temperature Data Collection from the CAMU Vertical Sensor Array Monitoring Locations Using a TDR100 System and CR23X Micrologger FOP 08-22 ASSOP 01-04 Activity-Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU) ASSOP 01-05 Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU). AOP 00-03 Data Validation Procedure for Chemical and Radiochemical Data AOP 94-22 Sample Management Office User's Guide AOP 94-24 System and Performance Audits AOP 94-25 Deficiency Reporting	FOP 08-20 Soil Moisture Determination Utilizing Neutron Logging FOP 08-21 Soil Moisture Monitoring Using Time Domain Reflectometry FOP 08-22 Soil Vapor Sampling AOP 00-03 Data Validation Procedure for Chemical and Radiochemical Data AOP 95-16 Sample Management and Custody	Update procedure titles and document numbers.	*Class 1 modification.* Administrative change. 20.4.1.900 NMAC, 40 CFR 270.42, Appendix I, Modification A.1

Item No.	Location	Current Language	Revised Language	Explanation for Change	Modification Class Rationale
		FOP 94-25 Documentation of Field Activities FOP 94-26 General Equipment Decontamination FOP 94-34 Field Sample Management and Custody			

Enclosure B

Sandia National Laboratories

Permit NM5890110518-1
Corrective Action Management Unit

Revised Pages, Redline / Strikeout Format
Permit Module IV
CAMU Class II Permit Modification, Appendices D, E, and G

d. Within 90 days of the date the Permittee is notified to begin a CMS, the Permittee shall provide the Administrative Authority with signed, quarterly progress reports as specified in Module IV.F.l.·

T. TEMPORARY UNIT

1. The Permittee shall operate the Temporary Unit (TU) in accordance to the procedures contained in the revised application dated April 24, 1996.

2. The Permittee must submit a written certification to the Adminstrative Authority upon completion of the TU. The effective date for the one year timeframe will be when Sandia certifies to the Adminstrative Authority that the TU is complete and ready for operation.

U. CORRECTIVE ACTION MANAGEMENT UNIT (CAMU)

The Permittee shall construct and operate the CAMU in accordance to the procedures contained in the following documents: Sandia's Class III Permit Modification Application for the CAMU dated June 1996; Revision 1.0 of the Class III Permit Modification Application for the CAMU dated February 1997; ~~and,~~ Revision 2.0 of the Permit Modification Application for the CAMU dated July 1997, and all subsequently approved revisions. Sandia must also comply with the below stated conditions.

1. On Page 21 of Closure Plan; Revision 2 of the Application: If deeper vertical samples are needed, then Sandia will follow the applicable requirements under Table 6-1 to determine the vertical extent of soil contamination.

2. Page 46 of the Closure Plan; Revision 2 of the Application: Sandia must sample the waste staging soil areas for the constituents found in the treated waste. The Administrative Authority will determine if organic concentrations are present in sufficient quantities.

3. Page 49 of the Closure Plan; Revision 2 of the Application: The 2 foot soil samples will follow Field Operating procedure (FOP) 94-52. If soil samples are analyzed for volatile organics, an appropriate sampling procedure must be used which will not volatilize the contaminants; otherwise, sampling results will be considered invalid.

4. Page 49 of the Closure Plan; Revision 2 of the Application: When taking soil samples, Sandia shall comply with all applicable FOPs and Administrative Operating Procedures (AOPs). Sandia shall also comply

with the Quality Assurance Project Plan for the SNL/NM Sample Management Office (~~QAP-95-01~~SMO-QAPP) and Data ~~Verification and~~ Validation Procedure for ~~of~~ Chemical and Radiochemical Data (~~TOP-94-03~~AOP 00-03)

5. When sampling the various vadose zone sampling systems, Sandia must comply with all applicable FOPs, AOPs, ~~QAP-95-01,~~ and ~~TOP-94-03~~SMO-QAPP.

6. If fluids are found in the Primary Subliner System (PSL}, the fluids must be sampled for appropriate constituents found in waste being treated at the CAMU, using SW-846 methods.

7. Sandia must sample the soil-gas in the PSL annually and analyze for volatile organics using SW-846 methods.

8. Sandia must notify the Administrative Authority verbally within 24 hrs., and in writing within 7 days of detecting a leak from any of the vadose zone monitoring systems. The AA will review this information and will determine if any actions are necessary.

9. Sandia must send an annual vadose zone monitoring report to the Administrative Authority each year detailing the monitoring results of the previous year. The report will be due each January, with the first report due January 31, 1999.

V. If the vadose zone monitoring system becomes inoperable or is found to be inadequate, the Administrative Authority may require the installation of ground water monitoring wells around the CAMU.

10. For soil gas sampling in the vertical sensor array monitoring system, Sandia must sample the gas according to FOP ~~94-21~~08-22. Chemical analysis will be performed using EPA method TO-14 or an equivalent method and any applicable SW-846 method. Soil-gas samples will be taken quarterly.

11. Sandia must notify the Administrative Authority by mail within 14 days of beginning construction on the CAMU .

CLOSURE PLAN FOR THE CORRECTIVE ACTION MANAGEMENT UNIT TECHNICAL AREA III SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT

FINAL

~~SEPTEMBER 2003~~

~~Joe Estrada~~John Weckerle
U.S. Department of Energy, National Nuclear Security Administration
~~Albuquerque Operations Office~~
Sandia Field Office ~~of Kirtland Site Operations~~
P.O. Box 5400
Albuquerque, NM 87185

The contact person for SNL/NM is:

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P.O. Box 5800, MS-0729
~~M/S 1087~~
Albuquerque, NM 87185-5800
(505) 284-2577

1.1 Amendment of the Postclosure Care Plan—40 CFR §264.118(d)

At any time during the active life of the CAMU or during the postclosure care period, SNL/NM may submit a written notification or request to the EPA Regional Administrator for a permit modification to amend the postclosure plan. SNL/NM will submit a written request for a permit modification to the EPA Regional Administrator to authorize a change in the approved postclosure plan whenever:

- Changes in operating plans or facility design affect the approved postclosure plan.
- There is a change in the expected year of final closure.
- Events that occur during the active life of the facility, including partial and final closures, affect the approved postclosure plan.

1.2 Post-Closure Notices—40 CFR §264.119

Within 60 days of certification of closure of the CAMU, SNL/NM will submit to the local zoning authority, DOE, and the Secretary of the NMED a record of the type, location, and quantity of hazardous wastes disposed of within the containment cell. The notices and information supplied to these authorities will ensure the following two conditions are met:

- Notices will be filed with state and federal authorities such that the title record will disclose to a potential purchaser conducting a title search of the property that:

Restoration Project," (SNL/NM, October 2001b). After final closure, the vertical sensor array (VSA), primary subliner (PSL), and CWL sanitary sewer sensors will be monitored on a monthly basis for at least one year. This monitoring sequence will establish a sufficient database for characterizing nonleak conditions in the vadose zone below the containment cell, allow for adequate training and experience for monitoring personnel, and verify the viability and proper operation of sensors. After this initial period, monitoring will continue on a quarterly basis, for three more years, at which time the frequency of monitoring will be reevaluated and renegotiated. During this four-year period, the PSL will be monitored annually for soil-gas vapors. A summary of the VZMS postclosure monitoring frequency, parameters, and methods are presented in Table 6-1.

Table 6-1
VZMS Postclosure Monitoring Frequency, Parameters, and Methods

Time Frame	Monitoring Frequency	Monitoring System	Monitoring Parameter	Monitoring Method
Year 1	Monthly[a]	PSL	Moisture Content	Neutron Probe
		VSA	Soil Moisture Content Active Soil Gas	TDR probe Method TO-14[d]
		CSS	Moisture Content Active Soil Gas	Neutron Probe Method TO-14[d]
	Annually[b]	PSL	Active Soil Gas	Method TO-14[d]
Years 2–4	Quarterly[c]	PSL	Moisture Content	Neutron Probe
		VSA	Soil Moisture Content Active Soil Gas	TDR probe Method TO-14[d]
		CSS	Moisture Content Active Soil Gas	Neutron Probe Method TO-14[d]

[a]Monthly monitoring will continue beyond the first year, if necessary, until stable readings are obtained.
[b]Active soil-gas sampling will be conducted annually unless increased soil moisture is detected, in which case active soil-gas sampling will be conducted on a quarterly basis until stable conditions are reached.
[c]Quarterly monitoring will be conducted for a period of three years, and then is subject to renegotiation.
[d]Monitoring will be conducted using EPA Compendium Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality.
CSS = Chemical Waste Landfill and sanitary sewer line.
EPA = U.S. Environmental Protection Agency.
PSL = Primary subliner.
TDR = Time domain reflectometer.
TO-14 = EPA Method TO-14
VSA = Vertical sensor array.
VZMS = Vadose zone monitoring system.

PROPOSED ALTERNATIVE TO GROUNDWATER MONITORING FOR THE CORRECTIVE ACTION MANAGEMENT UNIT TECHNICAL AREA III SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT

FINAL

~~SEPTEMBER 2003~~

List of Attachments

Attachment	*Title*
E-1	Hydraulic Conductivity Values
E-2	Sampling and Analysis Plan for the CWL and Sanitary Sewer Line Monitoring System
E-3	Sampling and Analysis Plan for the Primary Subliner Monitoring System
E-4	Sampling and Analysis Plan for the Vertical Sensor Array Monitoring System
E-5	Monitoring System Analytes ~~Using EPA Method TO-14~~
E-6	Estimation of Runoff at the Sandia National Laboratories/New Mexico Technical Area III for the 24-Hour 100-Year Precipitation Event

Table 4-1

Monitoring Frequency, Parameters, and Methods for the Vadose Zone Monitoring System

Time Frame	Monitoring Frequency	Monitoring System	Monitoring Parameter	Monitoring Method
1st year after closure (and continuing, if necessary, until stable readings are obtained, whichever is greater)	Monthly	PSL VSA CSS 	Moisture content Soil moisture content Active soil gas Moisture content Active soil gas	Neutron probe TDR probe Method TO-14 ~~or TO-17~~[a] Neutron probe Method TO-14 ~~or TO-17~~[a]
	Annual	PSL	Active soil gas	Method TO-14 ~~or TO-17~~[a]
Remaining post-closure period	Quarterly for first three years, then subject to re-negotiation[b]	PSL VSA CSS 	Moisture content Soil moisture content Active soil gas Moisture content Active soil gas	Neutron probe TDR probe Method TO-14 ~~or TO-17~~[a] Neutron probe Method TO-14 ~~or TO-17~~[a]
	Annual	PSL	Active soil gas	Method TO-14 ~~or TO-17~~[a]

[a] ~~Due to the uncertainty of actual contaminant constituents to be managed in the containment cell, active soil gas sampling will be conducted using EPA Method TO-14 or TO-17.~~ The analyte list for soil gas monitoring is contained in Attachment E-5. Monitoring will be conducted using EPA Compendium Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality.

[b] Active soil gas sampling will be conducted annually unless increased soil moisture is detected, in which case active soil gas sampling will be conducted on a quarterly basis until steady-state conditions are reached.

ATTACHMENT E-2

SAMPLING AND ANALYSIS PLAN FOR THE CWL AND SANITARY SEWER LINE MONITORING SYSTEM

~~**SEPTEMBER 2003**~~

2.0 Monitoring and Sampling Strategy

The baseline for the CSS measurements was established over an approximate 12-month period after completion of Phase II construction. To provide a proper baseline for future data interpretation and to confirm viability of sensors throughout the containment cell construction process, the CSS monitoring points were monitored monthly for moisture content for the first year after Phase II completion. Monitoring will continue as specified in Appendix E, Table 4-1. Monitoring will establish a sufficient database for characterizing non-leak conditions in the vadose zone beside the containment cell, allow for adequate training and experience for monitoring personnel, and verify the viability and proper operation of the system (see Table 4-1).

2.1 Monitoring Methods

The CSS monitoring points will be monitored for soil moisture changes with the neutron probe. The probes are not installed in the monitoring points, but are manually lowered into the monitoring points during monitoring events. The neutron probe data will then be transferred into a personal computer, combined with the results from the other two vadose zone monitoring subsystems (PSL and VSA), and evaluated.

The primary moisture sensor will be a CPN 503DR neutron moisture probe, or an equivalent soil moisture probe. The CPN 503DR probe uses a 50.0-millicurie (mCi) americium-241:beryllium neutron source for moisture content measurement. The probe is self-contained and includes the radioactive sources and detectors.

2.2 Sampling Methods

The CSS monitoring points will be sampled for soil gas to detect releases from the CWL and sanitary sewer line that could potentially migrate toward the containment cell. This sampling will be performed in accordance with SNL/NM Field Operating Procedure (FOP) 08-22 "Soil Vapor Sampling"~~Activity Specific Standard Operating Procedure (ASSOP) 01-04 "Activity Specific Standard Operating Procedure for Active Soil Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU)" or ASSOP 01-05, "Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU)."~~

The sampling process involves attaching a sample line (polyethylene tubing or equivalent) to the fitting at the top of each CSS monitoring point. The monitoring point will be evacuated prior to

sampling, such that the soil gas representative of the vadose zone soil gas has completely displaced the internal volume of the monitoring point and sampling line. This will be

accomplished by connecting an air compressor/vacuum pump to the sampling line and operating the pump for such a duration that at least three (3) dead volumes have been removed. Sampling will be conducted immediately after monitoring point evacuation.

2.3 Analytical Procedures

An on-site laboratory or an approved analytical laboratory under contract to the Sample Management Office will be used to provide the analytical services. Laboratory sample custody, sample analysis, data management, reporting, and sample disposal will be performed in accordance with established laboratory procedures. Analytical procedures will follow established laboratory standard operating procedures based on the referenced EPA method ~~(i.e., TO-14 or TO-17)~~. Active soil gas sampling will be conducted for the ~~selected~~ volatile organic compounds (VOC) listed in Attachment E-5, which includes~~d~~ analytes in EPA Method~~s~~ TO-14 ~~or TO-17~~.

Chemical analyses will be performed using either EPA Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality~~TO-17~~ and any applicable SW-846 methods. All sample analyses will be performed either by an on-site laboratory or by an SNL/NM approved off-site laboratory.

2.4 Field and Laboratory Quality Assurance/Quality Control

Table 2-1 lists procedures which may be used in support of this SAP. These procedures comply with current sampling and analysis guidance documents, relevant SNL/NM FOP and Administrative Operating Procedures (AOP), ~~the SNL/NM Environmental Restoration Project Program Implementation Plan,~~ and SW-846 procedures.

Field and laboratory quality assurance (QA) samples will be collected per AOP requirements and may include duplicate samples, trip blank samples, field blanks, equipment rinsate blanks and matrix spike samples.

Samples will be submitted to an on-site laboratory or an analytical laboratory under contract to the Sample Management Office which meets the QA/QC requirements of SW-846 and, to the extent applicable, the procedures defined in AOP 00-03 (Data Validation Procedure for Chemical and Radiochemical Data).

Table 2-1
Applicable SNL/NM Operating Procedures

Number	Administrative and Field Operating Procedure Title
AOP ~~94-22~~00-03	~~Sample Management Office User's Guide~~Data Validation Procedure for Chemical and Radiochemical Data
~~ASSOP 01-02~~FOP 08-20	~~Activity-Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe~~ Soil Moisture Determination Utilizing ~~Depth Gauge in~~ Neutron Logging ~~Activities at the Corrective Action Management Unit (CAMU)~~
~~ASSOP 01-04~~FOP 08-22	~~Activity-Specific Standard Operating Procedure for Active~~ Soil Vapor ~~Gas~~ Sampling ~~Using Method TO-14 at the Corrective Action Management Unit (CAMU)~~
~~ASSOP 01-05~~	~~Activity-Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU)~~
~~AOP 94-24~~	~~System and Performance Audits~~
~~AOP 94-25~~	~~Deficiency Reporting~~
~~FOP 94-25~~	~~Documentation of Field Activities~~
~~FOP 94-26~~	~~General Equipment Decontamination~~
~~FOP 94-34~~AOP 95-16	~~Field~~ Sample Management and Custody

AOP = Administrative Operating Procedure.
FOP = Field Operating Procedure.

2.4.1 Neutron Probe Calibration and QA/QC

This section describes the calibration and QA/QC procedures to be used for the neutron probe associated with this monitoring system. The CPN 503DR soil moisture-density probe is a geophysical means of measuring soil moisture content. Briefly, a neutron probe uses the absorption of emitted neutrons to calculate soil moisture content. The assumption is made that the hydrogen in soil moisture is the dominant absorber of the emitted neutrons. In the CAMU soils, this has not been confirmed; therefore, the following calibration and QA/QC checks are required:

1. CPN 503DR Hydroprobe Moisture Depth Gauge QA/QC

The CPN 503DR soil moisture probe is operated in accordance with FOP 08-20~~ASSOP 01-02~~. The standard count measures the proper function of the gauge electronics and also compensates for the source decay. This measurement should be performed daily when used as described in the FOP~~ASSOP.~~

2. CPN 503DR Hydroprobe Moisture Depth Gauge Calibration

Calibration of the CPN 503DR neutron probe is performed in a controlled environment that duplicates as close as possible the *in situ* characteristics at the field measuring location. The calibration setup is shown in Figure 1.

The probe is inserted into the access tube and count readings are taken for a known moisture content in the packed native soil. The resulting count/soil moisture content relationship is used to develop a correlation curve for the instrument, which associates a neutron count to a known soil moisture content. Technically, this process is a correlation, not a calibration, because the probe electronics are not actually being adjusted or tuned to a known moisture content. Rather, a mathematical formula is developed that correlates a neutron count to a known moisture content. Actual soil moisture contents can be determined as described in Klute, 1986, by mass weighing of the entire test apparatus, or with the aid of a previously calibrated TDR system.

As an alternative to the procedure described above, the CPN 503DR neutron probe may be calibrated by the manufacturer.

2.5 References

CPN Company, May 1984. CPN 503DR Hydroprobe Moisture Depth Gauge Operating Manual, CPN Company, Martinez, CA.

Klute, A. (Ed). *Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods.* 1986. 2nd Edition, Soil Science Society of America, Inc. Madison, WI.

Sandia National Laboratories/New Mexico (SNL/NM), September 2000. *Corrective Action Management Unit Vadose Zone Monitoring System Annual Monitoring Results Report.* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM)~~, November 2001~~. ~~ASSOP 0l-02~~FOP 08-20 ~~*Activity Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe*~~ *Soil Moisture Determination Utilizing ~~Depth Gauge in~~ Neutron Logging ~~Activities at the Corrective Action Management Unit (CAMU)~~*.
Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM)~~, November 2001~~. ~~ASSOP 01-04~~FOP 08-22 ~~*Activity Specific Standard Operating Procedure for Active*~~ *Soil Vapor~~Gas~~ Sampling ~~Using Method TO-14 at the Corrective Action Management Unit (CAMU)~~*. Sandia National Laboratories, Albuquerque,
New Mexico.

~~Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 01-05 *Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico.~~

ATTACHMENT E-3

SAMPLING AND ANALYSIS PLAN FOR THE PRIMARY SUBLINER MONITORING SYSTEM

~~**SEPTEMBER 2003**~~

Following moisture logging in the access tubes using the neutron probe, the moisture content data will be entered onto a computer spreadsheet for evaluation. For details, see FOP 08-20~~CAMU-ASSOP-01-02~~, "~~Activity Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe~~Soil Moisture Determination Utilizing~~Depth Gauge in~~ Neutron Logging ~~Activities at the CAMU~~."

2.2 Sampling Methods

Monitoring in the PSL subsystem will be performed as specified in Appendix E, Table 4-1. Additional sampling in the PSL subsystem will only be conducted if monitoring with the neutron probe suggests leakage from the containment cell. This sampling will be conducted to determine if the moisture contains constituents known to have been placed into the containment cell. This will be accomplished by comparing the analytical results from this sampling with the characterization data from the treated waste placed into the cell. The data will also be compared to background data initially collected during the construction of the wicking layer. During construction, the wicking materials will be saturated, drained, and the effluent sampled for background concentrations.

Sampling of the PSL will involve moisture/passive soil gas/liquid sampling and laboratory analyses. The sampling will be accomplished by the deployment of an everting flexible membrane (e.g., Flute™ membrane or equivalent) placed into the access tube. Detailed procedures for deployment of the membrane will be supplied by the manufacturer of the technology based on the site-specific application requirements.

The Flute™ membrane technology pertinent to the PSL will be manufactured with external tabs allowing incorporation of absorbent pads and passive gas samplers (e.g., Goresorber™) based on the location of a suspected leak, as determined using the data from the three vadose zone monitoring subsystems (PSL, VSA, and CSS). Absorbent pads and other devices can be attached to the liner at SNL/NM in a protected area, allowing 400 to 500 feet of roll-out space. The membrane liner will then be brought to the access tubes in a deflated, rolled up state with the absorbent pads and passive gas samplers already attached. The Flute™ membrane technology relies on air pressure to deploy and maintain placement of the liner in the hole. Initial deployment utilizes a pressurized deployment canister purchased with the liner. As the liner is pressurized, it will unroll into the access tube and place the absorbent pads and passive gas samplers against the inside of the access tube at the predetermined locations. Once deployed, the liner is kept inflated using pressurized air (e.g., 1 psi gauge) supplied by an air pump using a

The vadose zone monitoring system was designed to utilize the VSA for soil gas characterization. The placement of passive gas samplers (e.g., Goresorber™) in the access tubes utilizing the membrane liner will provide additional data regarding soil gas character. The Goresorber™ analyses will provide meaningful data regarding the type and relative abundance of a variety of constituents. The results present the mass of the specific constituents per mass of absorbent and therefore will indicate relative concentrations (low, medium, high). The Goresorber™ module consists of long (approximately 120 centimeters) hollow Gore-Tex™ membrane cord containing three separate granular Tenax-Ta™ sorbent packs positioned at one end. Tenax-Ta™ is a material that has a strong affinity for a broad range of organic compounds, independent of sample moisture. The Gore-Tex™ membrane, which also serves as a wrapping for each pack, is an expanded polytetrafluoroethylene transparent to gasses while preventing direct contact of the sorbent with solid or aqueous matrices. Thus, during deployment in the field, the sorbent is both wrapped and sheathed in an inert, hydrophobic, microporous membrane, allowing only for the penetration of vapors. The modules will be left in place for a period of two to three weeks at which time the module will be retrieved and sent to the laboratory for extraction and analysis.

2.3 Analytical Procedures

An on-site laboratory or an approved analytical laboratory under contract to the Sample Management Office will be used to provide the analytical services. Analysis of the Goresorber™ will be performed at the W.L. Gore and Associates' Screening Module Laboratory. Laboratory sample custody, sample analysis, data management, reporting, and sample disposal will be performed in accordance with established laboratory procedures. Analytical procedures will follow established laboratory standard operating procedures based on the referenced EPA method.

Chemical analyses will be performed using EPA SW-846 methods for liquid samples, and EPA Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality~~TO-17~~ for the soil gas samples. Analyses will be conducted for the ~~selected~~ volatile organic compounds (VOCs) listed in Attachment E-5, which includes~~d~~ analytes in EPA Methods TO-14 ~~or TO-17~~ plus any additional VOCs known to have been placed in the containment cell. All liquid sample analyses will be performed either by the SNL/NM ER Chemical Laboratory or by an SNL/NM approved off-site laboratory. Gas sampling will be performed in accordance with ~~ASSOP 01-04~~FOP 08-22, "~~Activity Specific Standard Operating~~

~~Procedure for Active~~ Soil Vapor~~Gas~~ Sampling ~~Using method TO-14 at the Corrective Action Management Unit (CAMU)" or ASSOP 01-05, "Activity Specific~~

~~Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU).~~"

2.4 Field and Laboratory Quality Assurance/Quality Control

Table 2-1 lists procedures which may be used in support of this SAP. These procedures comply with current sampling and analysis guidance documents, relevant SNL/NM Field Operating Procedures (FOP) and Administrative Operating Procedures (AOP), the SNL/NM Environmental Restoration Project Program Implementation Plan, and SW-846 procedures.

Table 2-1

Applicable SNL/NM Operating Procedures

Number	Administrative and Field Operating Procedure Title
AOP ~~94-22~~00-03	~~Sample Management Office User's Guide~~Data Validation Procedure for Chemical and Radiochemical Data
~~ASSOP 01-02~~FOP 08-20	~~Activity-Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe~~Soil Moisture Determination Utilizing ~~Depth Gauge in~~ Neutron Logging ~~Activities at the Corrective Action Management Unit (CAMU)~~
~~ASSOP 01-04~~FOP 08-22	~~Activity-Specific Standard Operating Procedure for Active~~ Soil Vapor~~Gas~~ Sampling ~~Using Method TO-14 at the Corrective Action Management Unit (CAMU)~~
~~ASSOP 01-05~~	~~Activity-Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU)~~
~~AOP 94-24~~	~~System and Performance Audits~~
~~AOP 94-25~~	~~Deficiency Reporting~~
~~FOP 94-25~~	~~Documentation of Field Activities~~
~~FOP 94-26~~	~~General Equipment Decontamination~~
~~FOP 94-34~~AOP 95-16	~~Field~~ Sample Management and Custody

AOP = Administrative Operating Procedure.
FOP = Field Operating Procedure.

Field and laboratory quality assurance (QA) samples will be collected per OP requirements and may include duplicate samples, trip blank samples, field blanks, equipment rinsate blanks and matrix spike samples.

Samples will be submitted to an on-site laboratory or an analytical laboratory under contract to the Sample Management Office which meets the QA/QC requirements of SW-846 and, to the extent applicable, the procedures defined in AOP 00-03 (Data Validation Procedure for Chemical and Radiochemical Data).

2.4.1 Neutron Probe Calibration and QA/QC

The CPN 503DR Hydroprobe Moisture Depth Gauge is a geophysical means of measuring soil moisture content. Briefly, a neutron probe uses the absorption of emitted neutrons to calculate soil moisture content. The assumption is made that the hydrogen in soil moisture is the dominant absorber of the emitted neutrons. In the CAMU soils, this has not been confirmed; therefore the following calibration and QA/QC checks are required.

1. CPN 503DR Hydroprobe Moisture Depth Gauge QA/QC

The CPN 503DR probe is operated in accordance with FOP 08-20~~the ASSOP 01-02~~. The standard count measures the proper function of the gauge electronics and also compensates for the source decay. This measurement should be performed daily when used as described in the FOP~~ASSOP~~.

2. CPN 503DR Hydroprobe Moisture Depth Gauge Calibration

Calibration of the CPN 503DR neutron probe is performed in a controlled environment that duplicates as close as possible the in situ characteristics at the field measuring location. The calibration setup is shown in Figure 1.

The probe is inserted into the access tube and count readings are taken as the soil moisture content in the repacked native soil is varied. The resulting count/soil moisture content relationship is used to develop a correlation curve for the instrument, which associates a neutron count to a known soil moisture content. Technically, this process is a correlation, not a calibration, because the probe electronics are not actually being adjusted or tuned to a known moisture content. Rather, a mathematical formula is developed that correlates a neutron count to a known moisture content. Actual soil moisture contents can be determined as described in Klute, 1986, by mass weighing of the entire test apparatus, or with the aid of a previously calibrated TDR system.

As an alternative to the procedure described above, the CPN 503DR neutron probe may be calibrated by the manufacturer.

2.5 References

CPN Company, May 1984. CPN 503DR Hydroprobe Moisture Depth Gauge Operating Manual, CPN Company, Martinez, CA.

Klute, A. (Ed). *Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods.* 1986. 2nd Edition, Soil Science Society of America, Inc. Madison, WI.

Sandia National Laboratories/New Mexico (SNL/NM), September 2000. *Corrective Action Management Unit Vadose Zone Monitoring System Annual Monitoring Results Report.* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM)~~, November 2001~~. ~~ASSOP 0l-02~~FOP 08-20 ~~*Activity Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe*~~ *Soil Moisture Determination Utilizing* ~~*Depth Gauge in*~~ *Neutron Logging* ~~*Activities at the Corrective Action Management Unit (CAMU)*~~.
Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM)~~, November 2001~~. ~~ASSOP 01-04~~FOP 08-22 ~~*Activity Specific Standard Operating Procedure for Active*~~ *Soil Vapor*~~*Gas*~~ *Sampling* ~~*Using Method TO-14 at the Corrective Action Management Unit (CAMU)*~~. Sandia National Laboratories, Albuquerque,
New Mexico.

~~Sandia National Laboratories/New Mexico (SNL/NM), November 2001. ASSOP 01-05 *Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU).* Sandia National Laboratories, Albuquerque, New Mexico.~~

ATTACHMENT E-4

SAMPLING AND ANALYSIS PLAN FOR THE VERTICAL SENSOR ARRAY MONITORING SYSTEM

~~**SEPTEMBER 2003**~~

2.0 Monitoring and Sampling Strategy

The baseline for the VSA measurements was established over an approximate 12-month period after completion of Phase II construction. As soon as possible after installation of the VSA (but before construction of the PSL, subliner wicking layer, or containment cell liner), all VSA instrumentation collectors and sensors will be tested for proper operation. After installation of the PSL and compaction of the PSL access tube trenches, but before construction of the subliner wicking layer or containment cell liner, the VSA components will again be tested for proper operation. To provide a proper baseline for future data interpretation and to confirm viability of sensors throughout the containment cell construction process, all VSA components will be monitored monthly for the first year after Phase II completion. The monitoring sequence will be as outlined in Appendix E, Table 4-1. Monitoring will establish a sufficient database for characterizing non-leak conditions in the vadose zone below the containment cell, allow for adequate training and experience for monitoring personnel, and verify the viability and proper operation of sensors (see Table 4-1).

2.1 Monitoring Methods

The soil moisture and temperature components of the VSA will be monitored at the frequency specified in Appendix E, Table 4-1 using the data acquisition system to upload the data. Baseline establishment is discussed above in Section 2.0.

2.2 Sampling Methods

Soil gas sampling in the VSA will occur at the frequency specified in Appendix E, Table 4-1. Soil moisture measurements (both from PSL access tube neutron probe moisture results and VSA gradients), and moisture changes measured by the VSA subsystem will be interpreted by qualified personnel to distinguish the origin of moisture buildup beneath the liner system as originating from containment cell leakage or from sources outside the containment cell. Gas sampling will be performed in accordance with ~~ASSOP 01-04~~FOP 08-22, "~~Activity Specific Standard Operating Procedure for Active~~ Soil Vapor~~Gas~~ Sampling ~~Using Method TO-14 at the Corrective Action Management Unit (CAMU) or ASSOP 01-05, "Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit~~."

The TDR moisture sampling package will include TDR moisture probes with coaxial cabling, a reflectometer (Campbell Scientific Inc., Model TDR100 or similar), and a data acquisition system consisting of a PC with appropriate software. Because of the sampling interval, and the

synchronous manual collection of gas samples, a system composed of a single reflectometer and laptop PC for data acquisition may be used. When a soil moisture measurement is needed, the reflectometer is connected to the coaxial cable of an individual TDR probe. Moisture content values are displayed on the laptop PC and recorded in a field logbook or on the PC.

The temperature sampling package will include the thermistors, wire, and a datalogger. Campbell Scientific Graphterm™ software or similar will be used to facilitate datalogger operation and data retrieval.

2.3 Analytical Procedures

An on-site laboratory or an approved analytical laboratory under contract to the Sample Management Office will be used to provide the analytical services. Laboratory sample custody, sample analysis, data management, reporting, and sample disposal will be performed in accordance with established laboratory procedures. Analytical procedures will follow established laboratory standard operating procedures based on the referenced EPA method. Active soil gas sampling will be conducted for selected volatile organic compounds (VOC) listed in Attachment E-5, which includes~~d~~ analytes in EPA Method~~s~~ TO-14 ~~or TO-17~~ to provide a proper baseline for the system.

Chemical analyses will be performed using either EPA Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality,~~TO-17~~ and any applicable SW-846 methods. All sample analyses will be performed either by an on-site laboratory or by an SNL/NM approved off-site laboratory.

2.4 Field and Laboratory Quality Assurance/Quality Control

Table 2-1 lists procedures which may be used in support of this SAP. These procedures comply with current sampling and analysis guidance documents, relevant SNL/NM Field Operating Procedures (FOP) and Administrative Operating Procedures (AOP), the SNL/NM Environmental Restoration Project Program Implementation Plan, and SW-846 procedures.

Field and laboratory quality assurance (QA) samples will be collected per OP requirements and may include duplicate samples, trip blank samples, field blanks, equipment rinsate blanks and matrix spike samples.

Table 2-1

Applicable SNL/NM Operating Procedures

Number	Administrative and Field Operating Procedure Title
AOP ~~94-22~~00-03	~~Sample Management Office User's Guide~~Data Validation Procedure for Chemical and Radiochemical Data
~~ASSOP 01-02~~FOP 08-20	~~Activity-Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe~~Soil Moisture Determination Utilizing~~Depth Gauge in~~ Neutron Logging ~~Activities at the Corrective Action Management Unit (CAMU)~~
~~ASSOP 02-03~~FOP 08-21	~~Activity-Specific Standard Operating Procedure for~~Soil Moisture Monitoring Using Time Domain Reflectometry ~~and Temperature Data Collection from the CAMU Vertical Sensor Array Monitoring Locations Using a TDR100 System and CR23X Micrologger~~
~~ASSOP 01-04~~FOP 08-22	~~Activity-Specific Standard Operating Procedure for Active~~ Soil Vapor~~Gas~~ Sampling ~~Using Method TO-14 at the Corrective Action Management Unit (CAMU)~~
~~ASSOP 01-05~~	~~Activity-Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU)~~
~~AOP 94-24~~	~~System and Performance Audits~~
~~AOP 94-25~~	~~Deficiency Reporting~~
~~FOP 94-25~~	~~Documentation of Field Activities~~
~~FOP 94-26~~	~~General Equipment Decontamination~~
~~FOP 94-34~~AOP 95-16	~~Field~~ Sample Management and Custody

AOP = Administrative Operating Procedure.
FOP = Field Operating Procedure.

Samples will be submitted to an on-site laboratory or an analytical laboratory under contract to the Sample Management Office which meets the QA/QC requirements of SW -846 and, to the extent applicable, the procedures defined in AOP 00-03 (Data Validation Procedure for Chemical and Radiochemical Data).

2.4.1 Time Domain Reflectometry Calibration and QA/QC

This section describes the calibration and QA/QC procedures associated with the TDR monitoring technique. TDR is a geophysical means of measuring *in situ* soil moisture content. The TDR system includes a probe assembly with coaxial cabling and a reflectometer that is used

for generating and receiving an electromagnetic signal. The following calibrations and/or QA/QC checks are recommended for the TDR soil moisture content monitoring technique.

2.6 References

Campbell Scientific, Inc., CR10X Measurement and Control System Operators Manual, Revision September 2001. Campbell Scientific, Inc., Logan, Utah.

Campbell Scientific, Inc., TDR Soil Moisture Measurement System Manual, Revision February, 1992. Campbell Scientific, Inc., Logan, Utah.

Campbell Scientific, Inc., TDR100 Instruction Manual, Revision April, 2002. Campbell Scientific, Inc., Logan, Utah.

Klute, A. (Ed). *Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods.* 1986. 2nd Edition, Soil Science Society of America, Inc. Madison, WI.

Knight, J. H. (1992), Sensitivity of Time Domain Reflectometry Measurements to Lateral Variations in Soil Water Content, Water Resources Research. Vol. 28, No.9.

Kachanoski, R. G., Pringle, E., and Ward, A. (1992), Field Measurement of Solute Travel Times Using Time Domain Reflectometry; Soil Sci. Soc. Am. J. 56:46-52

Ledieu, J., DeRidder, P., DeClerck, P., and Dautrebande, S., (1986), A Method of Measuring Soil Moisture by Time-Domain Reflectometry; Journal of Hydrology, 88:319-328.

Topp, G. C., Davis, J. L., and Annan, A. P. (1980), Electromagnetic Determination of Soil Water Content: Measurements in Coaxial Transmission Lines; Water Resources Research, Vol. 16, No. 3, 574-582

Dasberg, S. and Hopmans, J. W. (1992), Time Domain Reflectometry Calibration for Uniformly and Nonuniformly Wetted Sandy and Clayey Loam Soil; Soil Sci. Soc. Am. J. 56:1341-1345

Sandia National Laboratories/New Mexico (SNL/NM), September 2000. *Corrective Action Management Unit Vadose Zone Monitoring System Annual Monitoring Results Report.* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM)~~, November 2001~~. ~~ASSOP 0l-02~~FOP 08-20 ~~*Activity Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe*~~*Soil Moisture Determination Utilizing~~*Depth Gauge in* *Neutron Logging*~~ Activities at the Corrective Action Management Unit (CAMU)~~.
Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM)~~, November 2001~~. ~~ASSOP 01-04~~FOP 08-22 ~~*Activity Specific Standard Operating Procedure for Active*~~ *Soil Vapor~~Gas~~ Sampling*~~ Using Method TO-14 at the Corrective Action Management Unit (CAMU)~~. Sandia National Laboratories, Albuquerque,
New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), ~~November 2001. ASSOP 01-05 *Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU).*~~ FOP 08-21 *Soil Moisture Monitoring Using Time Domain Reflectometry.* Sandia National Laboratories, Albuquerque, New Mexico.

ATTACHMENT E-5

MONITORING SYSTEM ANALYTES ~~USING EPA METHOD TO-14~~

Monitoring System Analytes ~~Using EPA Method TO-14~~

Acetone
Benzene
Bromodichloromethane
Bromomethane
Bromoform
2-butanone
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
Chlorotoluene
Dibromochloromethane
1,2-Dichloro-1,1,2,2-tetrafluoroethane
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
Dichlorodifluoroethane
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
cis-1,2-dichloroethene
1,2-dichloropropane
cis-1,3-dichloropropene
trans-1,3-dichloropropene
Ethyl benzene
Ethylene dibromide
4-ethyltoluene
Hexachlorobutadiene
2-hexanone
4-methyl-2-pentanone
Methylene chloride
Styrene
1,1,2,2-tetrachloroethane
Tetrachloroethene
1,2,4-trichlorobenzene
1,1,1-trichloroethane
1,1,2-trichloroethane
Trichlorotrifluoromethane
1,1,2-trichlorotrifluoroethane
(freon 113)
1,2,4-trimethylbenzene
1,3,5-trimethylbenzene
Toluene
Trichloroethene
Vinyl chloride
Vinyl acetate
m,p-xylene
o-xylene

Reference: "Compendium Method TO-14: The Determination of Volatile Organic Compounds (VOC) in Ambient Air Using SUMMA® Passivated Canister Sampling and Gas Chromatographic Analysis," Quality Assurance Division, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, May 1988.

Reference: "Compendium Method TO-15: Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)," Center for Environmental Research Information, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268, January 1999

APPENDIX G

OPERATING PROCEDURES

FINAL

~~SEPTEMBER 2003~~

APPENDIX G

List of Primary Operating Procedures Used in Support of Vadose Zone Monitoring System

FOP 08-20 ~~ASSOP 01-02 Activity-Specific Standard Operating Procedure for Use of the CPN 503DR Hydroprobe® Soil~~ Moisture Determination Utilizing ~~Depth Gauge in~~ Neutron Logging ~~Activities at the Corrective Action Management Unit (CAMU)~~

FOP 08-21 ~~ASSOP 02-03 Activity Specific Standard Operating Procedure for~~ Soil Moisture Monitoring Using Time Domain Reflectometry ~~and Temperature Data Collection from the CAMU Vertical Sensor Array Monitoring Locations Using a TDR100 System and CR23X Micrologger~~

FOP 08-22 ~~ASSOP 01-04 Activity-Specific Standard Operating Procedure for Active~~ Soil ~~Gas~~ Vapor Sampling ~~Using Method TO-14 at the Corrective Action Management Unit (CAMU)~~

~~ASSOP 01-05 Activity Specific Standard Operating Procedure for Active Soil Gas Sampling onto Sorbent Tubes at the Corrective Action Management Unit (CAMU).~~

AOP 00-03 Data Validation Procedure for Chemical and Radiochemical Data

~~AOP 94-22 Sample Management Office User's Guide~~

~~AOP 94-24 System and Performance Audits~~

~~AOP 94-25 Deficiency Reporting~~

~~FOP 94-25 Documentation of Field Activities~~

~~FOP 94-26 General Equipment Decontamination~~

AOP 95-16 ~~FOP 94-34 Field~~ Sample Management and Custody

Enclosure C

Sandia National Laboratories

Permit NM5890110518-1
Corrective Action Management Unit

Revised Pages, Final
Permit Module IV
CAMU Class II Permit Modification, Appendices D, E, and G

d. Within 90 days of the date the Permittee is notified to begin a CMS, the Permittee shall provide the Administrative Authority with signed, quarterly progress reports as specified in Module IV.F.l.·

T. TEMPORARY UNIT

1. The Permittee shall operate the Temporary Unit (TU) in accordance to the procedures contained in the revised application dated April 24, 1996.

2. The Permittee must submit a written certification to the Adminstrative Authority upon completion of the TU. The effective date for the one year timeframe will be when Sandia certifies to the Adminstrative Authority that the TU is complete and ready for operation.

U. CORRECTIVE ACTION MANAGEMENT UNIT (CAMU)

The Permittee shall construct and operate the CAMU in accordance to the procedures contained in the following documents: Sandia's Class III Permit Modification Application for the CAMU dated June 1996; Revision 1.0 of the Class III Permit Modification Application for the CAMU dated February 1997;Revision 2.0 of the Permit Modification Application for the CAMU dated July 1997, and all subsequently approved revisions. Sandia must also comply with the below stated conditions.

1. On Page 21 of Closure Plan; Revision 2 of the Application: If deeper vertical samples are needed, then Sandia will follow the applicable requirements under Table 6-1 to determine the vertical extent of soil contamination.

2. Page 46 of the Closure Plan; Revision 2 of the Application: Sandia must sample the waste staging soil areas for the constituents found in the treated waste. The Administrative Authority will determine if organic concentrations are present in sufficient quantities.

3. Page 49 of the Closure Plan; Revision 2 of the Application: The 2 foot soil samples will follow Field Operating procedure (FOP) 94-52. If soil samples are analyzed for volatile organics, an appropriate sampling procedure must be used which will not volatilize the contaminants; otherwise, sampling results will be considered invalid.

4. Page 49 of the Closure Plan; Revision 2 of the Application: When taking soil samples, Sandia shall comply with all applicable FOPs and Administrative Operating Procedures (AOPs). Sandia shall also comply

with the Quality Assurance Project Plan for the SNL/NM Sample Management Office (SMO-QAPP) and Data Validation Procedure for Chemical and Radiochemical Data (AOP 00-03)

5. When sampling the various vadose zone sampling systems, Sandia must comply with all applicable FOPs, AOPs, and SMO-QAPP.

6. If fluids are found in the Primary Subliner System (PSL}, the fluids must be sampled for appropriate constituents found in waste being treated at the CAMU, using SW-846 methods.

7. Sandia must sample the soil-gas in the PSL annually and analyze for volatile organics using SW-846 methods.

8. Sandia must notify the Administrative Authority verbally within 24 hrs., and in writing within 7 days of detecting a leak from any of the vadose zone monitoring systems. The AA will review this information and will determine if any actions are necessary.

9. Sandia must send an annual vadose zone monitoring report to the Administrative Authority each year detailing the monitoring results of the previous year. The report will be due each January, with the first report due January 31, 1999.

V. If the vadose zone monitoring system becomes inoperable or is found to be inadequate, the Administrative Authority may require the installation of ground water monitoring wells around the CAMU.

10. For soil gas sampling in the vertical sensor array monitoring system, Sandia must sample the gas according to FOP 08-22. Chemical analysis will be performed using EPA method TO-14 or an equivalent method and any applicable SW-846 method. Soil-gas samples will be taken quarterly.

11. Sandia must notify the Administrative Authority by mail within 14 days of beginning construction on the CAMU .

CLOSURE PLAN FOR THE CORRECTIVE ACTION MANAGEMENT UNIT TECHNICAL AREA III SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT

FINAL

John Weckerle
U.S. Department of Energy, National Nuclear Security Administration

Sandia Field Office
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1.1 Amendment of the Postclosure Care Plan—40 CFR §264.118(d)

At any time during the active life of the CAMU or during the postclosure care period, SNL/NM may submit a written notification or request to the EPA Regional Administrator for a permit modification to amend the postclosure plan. SNL/NM will submit a written request for a permit modification to the EPA Regional Administrator to authorize a change in the approved postclosure plan whenever:

- Changes in operating plans or facility design affect the approved postclosure plan.
- There is a change in the expected year of final closure.
- Events that occur during the active life of the facility, including partial and final closures, affect the approved postclosure plan.

1.2 Post-Closure Notices—40 CFR §264.119

Within 60 days of certification of closure of the CAMU, SNL/NM will submit to the local zoning authority, DOE, and the Secretary of the NMED a record of the type, location, and quantity of hazardous wastes disposed of within the containment cell. The notices and information supplied to these authorities will ensure the following two conditions are met:

- Notices will be filed with state and federal authorities such that the title record will disclose to a potential purchaser conducting a title search of the property that:

Restoration Project," (SNL/NM, October 2001b). After final closure, the vertical sensor array (VSA), primary subliner (PSL), and CWL sanitary sewer sensors will be monitored on a monthly basis for at least one year. This monitoring sequence will establish a sufficient database for characterizing nonleak conditions in the vadose zone below the containment cell, allow for adequate training and experience for monitoring personnel, and verify the viability and proper operation of sensors. After this initial period, monitoring will continue on a quarterly basis, for three more years, at which time the frequency of monitoring will be reevaluated and renegotiated. During this four-year period, the PSL will be monitored annually for soil-gas vapors. A summary of the VZMS postclosure monitoring frequency, parameters, and methods are presented in Table 6-1.

Table 6-1
VZMS Postclosure Monitoring Frequency, Parameters, and Methods

Time Frame	Monitoring Frequency	Monitoring System	Monitoring Parameter	Monitoring Method
Year 1	Monthly[a]	PSL	Moisture Content	Neutron Probe
		VSA	Soil Moisture Content Active Soil Gas	TDR probe Method TO-14[d]
		CSS	Moisture Content Active Soil Gas	Neutron Probe Method TO-14[d]
	Annually[b]	PSL	Active Soil Gas	Method TO-14[d]
Years 2–4	Quarterly[c]	PSL	Moisture Content	Neutron Probe
		VSA	Soil Moisture Content Active Soil Gas	TDR probe Method TO-14[d]
		CSS	Moisture Content Active Soil Gas	Neutron Probe Method TO-14[d]

[a]Monthly monitoring will continue beyond the first year, if necessary, until stable readings are obtained.
[b]Active soil-gas sampling will be conducted annually unless increased soil moisture is detected, in which case active soil-gas sampling will be conducted on a quarterly basis until stable conditions are reached.
[c]Quarterly monitoring will be conducted for a period of three years, and then is subject to renegotiation.
[d]Monitoring will be conducted using EPA Compendium Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality.
CSS = Chemical Waste Landfill and sanitary sewer line.
EPA = U.S. Environmental Protection Agency.
PSL = Primary subliner.
TDR = Time domain reflectometer.
TO-14 = EPA Method TO-14
VSA = Vertical sensor array.
VZMS = Vadose zone monitoring system.

PROPOSED ALTERNATIVE TO GROUNDWATER MONITORING FOR THE CORRECTIVE ACTION MANAGEMENT UNIT TECHNICAL AREA III SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT

FINAL

List of Attachments

Attachment	Title
E-1	Hydraulic Conductivity Values
E-2	Sampling and Analysis Plan for the CWL and Sanitary Sewer Line Monitoring System
E-3	Sampling and Analysis Plan for the Primary Subliner Monitoring System
E-4	Sampling and Analysis Plan for the Vertical Sensor Array Monitoring System
E-5	Monitoring System Analytes
E-6	Estimation of Runoff at the Sandia National Laboratories/New Mexico Technical Area III for the 24-Hour 100-Year Precipitation Event

Table 4-1

Monitoring Frequency, Parameters, and Methods for the Vadose Zone Monitoring System

Time Frame	Monitoring Frequency	Monitoring System	Monitoring Parameter	Monitoring Method
1st year after closure (and continuing, if necessary, until stable readings are obtained, whichever is greater)	Monthly	PSL	Moisture content	Neutron probe
		VSA	Soil moisture content	TDR probe
			Active soil gas	Method TO-14[a]
		CSS	Moisture content	Neutron probe
			Active soil gas	Method TO-14[a]
	Annual	PSL	Active soil gas	Method TO-14[a]
Remaining post-closure period	Quarterly for first three years, then subject to re-negotiation[b]	PSL	Moisture content	Neutron probe
		VSA	Soil moisture content	TDR probe
			Active soil gas	Method TO-14[a]
		CSS	Moisture content	Neutron probe
			Active soil gas	Method TO-14[a]
	Annual	PSL	Active soil gas	Method TO-14[a]

[a]The analyte list for soil gas monitoring is contained in Attachment E-5. Monitoring will be conducted using EPA Compendium Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality.

[b]Active soil gas sampling will be conducted annually unless increased soil moisture is detected, in which case active soil gas sampling will be conducted on a quarterly basis until steady-state conditions are reached.

ATTACHMENT E-2

SAMPLING AND ANALYSIS PLAN FOR THE CWL AND SANITARY SEWER LINE MONITORING SYSTEM

2.0 Monitoring and Sampling Strategy

The baseline for the CSS measurements was established over an approximate 12-month period after completion of Phase II construction. To provide a proper baseline for future data interpretation and to confirm viability of sensors throughout the containment cell construction process, the CSS monitoring points were monitored monthly for moisture content for the first year after Phase II completion. Monitoring will continue as specified in Appendix E, Table 4-1. Monitoring will establish a sufficient database for characterizing non-leak conditions in the vadose zone beside the containment cell, allow for adequate training and experience for monitoring personnel, and verify the viability and proper operation of the system (see Table 4-1).

2.1 Monitoring Methods

The CSS monitoring points will be monitored for soil moisture changes with the neutron probe. The probes are not installed in the monitoring points, but are manually lowered into the monitoring points during monitoring events. The neutron probe data will then be transferred into a personal computer, combined with the results from the other two vadose zone monitoring subsystems (PSL and VSA), and evaluated.

The primary moisture sensor will be a CPN 503DR neutron moisture probe, or an equivalent soil moisture probe. The CPN 503DR probe uses a 50.0-millicurie (mCi) americium-241:beryllium neutron source for moisture content measurement. The probe is self-contained and includes the radioactive sources and detectors.

2.2 Sampling Methods

The CSS monitoring points will be sampled for soil gas to detect releases from the CWL and sanitary sewer line that could potentially migrate toward the containment cell. This sampling will be performed in accordance with SNL/NM Field Operating Procedure (FOP) 08-22 “Soil Vapor Sampling””

The sampling process involves attaching a sample line (polyethylene tubing or equivalent) to the fitting at the top of each CSS monitoring point. The monitoring point will be evacuated prior to sampling, such that the soil gas representative of the vadose zone soil gas has completely displaced the internal volume of the monitoring point and sampling line. This will be

accomplished by connecting an air compressor/vacuum pump to the sampling line and operating the pump for such a duration that at least three (3) dead volumes have been removed. Sampling will be conducted immediately after monitoring point evacuation.

2.3 Analytical Procedures

An on-site laboratory or an approved analytical laboratory under contract to the Sample Management Office will be used to provide the analytical services. Laboratory sample custody, sample analysis, data management, reporting, and sample disposal will be performed in accordance with established laboratory procedures. Analytical procedures will follow established laboratory standard operating procedures based on the referenced EPA method . Active soil gas sampling will be conducted for the volatile organic compounds (VOC) listed in Attachment E-5, which includes analytes in EPA Method TO-14.

Chemical analyses will be performed using either EPA Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality and any applicable SW-846 methods. All sample analyses will be performed either by an on-site laboratory or by an SNL/NM approved off-site laboratory.

2.4 Field and Laboratory Quality Assurance/Quality Control

Table 2-1 lists procedures which may be used in support of this SAP. These procedures comply with current sampling and analysis guidance documents, relevant SNL/NM FOP and Administrative Operating Procedures (AOP), and SW-846 procedures.

Field and laboratory quality assurance (QA) samples will be collected per AOP requirements and may include duplicate samples, trip blank samples, field blanks, equipment rinsate blanks and matrix spike samples.

Samples will be submitted to an on-site laboratory or an analytical laboratory under contract to the Sample Management Office which meets the QA/QC requirements of SW-846 and, to the extent applicable, the procedures defined in AOP 00-03 (Data Validation Procedure for Chemical and Radiochemical Data).

Table 2-1
Applicable SNL/NM Operating Procedures

Number	Administrative and Field Operating Procedure Title
AOP 00-03	Data Validation Procedure for Chemical and Radiochemical Data
FOP 08-20	Soil Moisture Determination Utilizing Neutron Logging
FOP 08-22	Soil Vapor Sampling
AOP 95-16	Sample Management and Custody

AOP = Administrative Operating Procedure.
FOP = Field Operating Procedure.

2.4.1 Neutron Probe Calibration and QA/QC

This section describes the calibration and QA/QC procedures to be used for the neutron probe associated with this monitoring system. The CPN 503DR soil moisture-density probe is a geophysical means of measuring soil moisture content. Briefly, a neutron probe uses the absorption of emitted neutrons to calculate soil moisture content. The assumption is made that the hydrogen in soil moisture is the dominant absorber of the emitted neutrons. In the CAMU soils, this has not been confirmed; therefore, the following calibration and QA/QC checks are required:

1. <u>CPN 503DR Hydroprobe Moisture Depth Gauge QA/QC</u>

The CPN 503DR soil moisture probe is operated in accordance with FOP 08-20. The standard count measures the proper function of the gauge electronics and also compensates for the source decay. This measurement should be performed daily when used as described in the FOP

2. CPN 503DR Hydroprobe Moisture Depth Gauge Calibration

Calibration of the CPN 503DR neutron probe is performed in a controlled environment that duplicates as close as possible the *in situ* characteristics at the field measuring location. The calibration setup is shown in Figure 1.

The probe is inserted into the access tube and count readings are taken for a known moisture content in the packed native soil. The resulting count/soil moisture content relationship is used to develop a correlation curve for the instrument, which associates a neutron count to a known soil moisture content. Technically, this process is a correlation, not a calibration, because the probe electronics are not actually being adjusted or tuned to a known moisture content. Rather, a mathematical formula is developed that correlates a neutron count to a known moisture content. Actual soil moisture contents can be determined as described in Klute, 1986, by mass weighing of the entire test apparatus, or with the aid of a previously calibrated TDR system.

As an alternative to the procedure described above, the CPN 503DR neutron probe may be calibrated by the manufacturer.

2.5 References

CPN Company, May 1984. CPN 503DR Hydroprobe Moisture Depth Gauge Operating Manual, CPN Company, Martinez, CA.

Klute, A. (Ed). *Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods.* 1986. 2nd Edition, Soil Science Society of America, Inc. Madison, WI.

Sandia National Laboratories/New Mexico (SNL/NM), September 2000. *Corrective Action Management Unit Vadose Zone Monitoring System Annual Monitoring Results Report.* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-20 *Soil Moisture Determination Utilizing Neutron Logging* .
Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-22 *Soil Vapor Sampling.*
Sandia National Laboratories, Albuquerque,
New Mexico.

ATTACHMENT E-3

SAMPLING AND ANALYSIS PLAN FOR THE PRIMARY SUBLINER MONITORING SYSTEM

Following moisture logging in the access tubes using the neutron probe, the moisture content data will be entered onto a computer spreadsheet for evaluation. For details, see FOP 08-20, "Soil Moisture Determination Utilizing Neutron Logging."

2.2 Sampling Methods

Monitoring in the PSL subsystem will be performed as specified in Appendix E, Table 4-1. Additional sampling in the PSL subsystem will only be conducted if monitoring with the neutron probe suggests leakage from the containment cell. This sampling will be conducted to determine if the moisture contains constituents known to have been placed into the containment cell. This will be accomplished by comparing the analytical results from this sampling with the characterization data from the treated waste placed into the cell. The data will also be compared to background data initially collected during the construction of the wicking layer. During construction, the wicking materials will be saturated, drained, and the effluent sampled for background concentrations.

Sampling of the PSL will involve moisture/passive soil gas/liquid sampling and laboratory analyses. The sampling will be accomplished by the deployment of an everting flexible membrane (e.g., Flute™ membrane or equivalent) placed into the access tube. Detailed procedures for deployment of the membrane will be supplied by the manufacturer of the technology based on the site-specific application requirements.

The Flute™ membrane technology pertinent to the PSL will be manufactured with external tabs allowing incorporation of absorbent pads and passive gas samplers (e.g., Goresorber™) based on the location of a suspected leak, as determined using the data from the three vadose zone monitoring subsystems (PSL, VSA, and CSS). Absorbent pads and other devices can be attached to the liner at SNL/NM in a protected area, allowing 400 to 500 feet of roll-out space. The membrane liner will then be brought to the access tubes in a deflated, rolled up state with the absorbent pads and passive gas samplers already attached. The Flute™ membrane technology relies on air pressure to deploy and maintain placement of the liner in the hole. Initial deployment utilizes a pressurized deployment canister purchased with the liner. As the liner is pressurized, it will unroll into the access tube and place the absorbent pads and passive gas samplers against the inside of the access tube at the predetermined locations. Once deployed, the liner is kept inflated using pressurized air (e.g., 1 psi gauge) supplied by an air pump using a

The vadose zone monitoring system was designed to utilize the VSA for soil gas characterization. The placement of passive gas samplers (e.g., Goresorber™) in the access tubes utilizing the membrane liner will provide additional data regarding soil gas character. The Goresorber™ analyses will provide meaningful data regarding the type and relative abundance of a variety of constituents. The results present the mass of the specific constituents per mass of absorbent and therefore will indicate relative concentrations (low, medium, high). The Goresorber™ module consists of long (approximately 120 centimeters) hollow Gore-Tex™ membrane cord containing three separate granular Tenax-Ta™ sorbent packs positioned at one end. Tenax-Ta™ is a material that has a strong affinity for a broad range of organic compounds, independent of sample moisture. The Gore-Tex™ membrane, which also serves as a wrapping for each pack, is an expanded polytetrafluoroethylene transparent to gasses while preventing direct contact of the sorbent with solid or aqueous matrices. Thus, during deployment in the field, the sorbent is both wrapped and sheathed in an inert, hydrophobic, microporous membrane, allowing only for the penetration of vapors. The modules will be left in place for a period of two to three weeks at which time the module will be retrieved and sent to the laboratory for extraction and analysis.

2.3 Analytical Procedures

An on-site laboratory or an approved analytical laboratory under contract to the Sample Management Office will be used to provide the analytical services. Analysis of the Goresorber™ will be performed at the W.L. Gore and Associates' Screening Module Laboratory. Laboratory sample custody, sample analysis, data management, reporting, and sample disposal will be performed in accordance with established laboratory procedures. Analytical procedures will follow established laboratory standard operating procedures based on the referenced EPA method.

Chemical analyses will be performed using EPA SW-846 methods for liquid samples, and EPA Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality for the soil gas samples. Analyses will be conducted for the volatile organic compounds (VOCs) listed in Attachment E-5, which includes analytes in EPA Methods TO-14 plus any additional VOCs known to have been placed in the containment cell. All liquid sample analyses will be performed either by the SNL/NM ER Chemical Laboratory or by an SNL/NM approved off-site laboratory. Gas sampling will be performed in accordance with FOP 08-22, "Soil Vapor Sampling."

2.4 Field and Laboratory Quality Assurance/Quality Control

Table 2-1 lists procedures which may be used in support of this SAP. These procedures comply with current sampling and analysis guidance documents, relevant SNL/NM Field Operating Procedures (FOP) and Administrative Operating Procedures (AOP), the SNL/NM Environmental Restoration Project Program Implementation Plan, and SW-846 procedures.

Table 2-1

Applicable SNL/NM Operating Procedures

Number	Administrative and Field Operating Procedure Title
AOP 00-03	Data Validation Procedure for Chemical and Radiochemical Data
FOP 08-20	Soil Moisture Determination Utilizing Neutron Logging
FOP 08-22	Soil Vapor Sampling
AOP 95-16	Sample Management and Custody

AOP = Administrative Operating Procedure.
FOP = Field Operating Procedure.

Field and laboratory quality assurance (QA) samples will be collected per OP requirements and may include duplicate samples, trip blank samples, field blanks, equipment rinsate blanks and matrix spike samples.

Samples will be submitted to an on-site laboratory or an analytical laboratory under contract to the Sample Management Office which meets the QA/QC requirements of SW-846 and, to the extent applicable, the procedures defined in AOP 00-03 (Data Validation Procedure for Chemical and Radiochemical Data).

2.4.1 Neutron Probe Calibration and QA/QC

The CPN 503DR Hydroprobe Moisture Depth Gauge is a geophysical means of measuring soil moisture content. Briefly, a neutron probe uses the absorption of emitted neutrons to calculate soil moisture content. The assumption is made that the hydrogen in soil moisture is the dominant absorber of the emitted neutrons. In the CAMU soils, this has not been confirmed; therefore the following calibration and QA/QC checks are required.

1. CPN 503DR Hydroprobe Moisture Depth Gauge QA/QC

The CPN 503DR probe is operated in accordance with FOP 08-20. The standard count measures the proper function of the gauge electronics and also compensates for the source decay. This measurement should be performed daily when used as described in the FOP.

2. CPN 503DR Hydroprobe Moisture Depth Gauge Calibration

Calibration of the CPN 503DR neutron probe is performed in a controlled environment that duplicates as close as possible the in situ characteristics at the field measuring location. The calibration setup is shown in Figure 1.

The probe is inserted into the access tube and count readings are taken as the soil moisture content in the repacked native soil is varied. The resulting count/soil moisture content relationship is used to develop a correlation curve for the instrument, which associates a neutron count to a known soil moisture content. Technically, this process is a correlation, not a calibration, because the probe electronics are not actually being adjusted or tuned to a known moisture content. Rather, a mathematical formula is developed that correlates a neutron count to a known moisture content. Actual soil moisture contents can be determined as described in Klute, 1986, by mass weighing of the entire test apparatus, or with the aid of a previously calibrated TDR system.

As an alternative to the procedure described above, the CPN 503DR neutron probe may be calibrated by the manufacturer.

2.5 References

CPN Company, May 1984. CPN 503DR Hydroprobe Moisture Depth Gauge Operating Manual, CPN Company, Martinez, CA.

Klute, A. (Ed). *Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods.* 1986. 2nd Edition, Soil Science Society of America, Inc. Madison, WI.

Sandia National Laboratories/New Mexico (SNL/NM), September 2000. *Corrective Action Management Unit Vadose Zone Monitoring System Annual Monitoring Results Report.* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-20 *Soil Moisture Determination Utilizing Neutron Logging.*
Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-22 *Soil Vapor Sampling.*
Sandia National Laboratories, Albuquerque,
New Mexico.

ATTACHMENT E-4

SAMPLING AND ANALYSIS PLAN FOR THE VERTICAL SENSOR ARRAY MONITORING SYSTEM

2.0 Monitoring and Sampling Strategy

The baseline for the VSA measurements was established over an approximate 12-month period after completion of Phase II construction. As soon as possible after installation of the VSA (but before construction of the PSL, subliner wicking layer, or containment cell liner), all VSA instrumentation collectors and sensors will be tested for proper operation. After installation of the PSL and compaction of the PSL access tube trenches, but before construction of the subliner wicking layer or containment cell liner, the VSA components will again be tested for proper operation. To provide a proper baseline for future data interpretation and to confirm viability of sensors throughout the containment cell construction process, all VSA components will be monitored monthly for the first year after Phase II completion. The monitoring sequence will be as outlined in Appendix E, Table 4-1. Monitoring will establish a sufficient database for characterizing non-leak conditions in the vadose zone below the containment cell, allow for adequate training and experience for monitoring personnel, and verify the viability and proper operation of sensors (see Table 4-1).

2.1 Monitoring Methods

The soil moisture and temperature components of the VSA will be monitored at the frequency specified in Appendix E, Table 4-1 using the data acquisition system to upload the data. Baseline establishment is discussed above in Section 2.0.

2.2 Sampling Methods

Soil gas sampling in the VSA will occur at the frequency specified in Appendix E, Table 4-1. Soil moisture measurements (both from PSL access tube neutron probe moisture results and VSA gradients), and moisture changes measured by the VSA subsystem will be interpreted by qualified personnel to distinguish the origin of moisture buildup beneath the liner system as originating from containment cell leakage or from sources outside the containment cell. Gas sampling will be performed in accordance with FOP 08-22, “Soil Vapor Sampling.”

The TDR moisture sampling package will include TDR moisture probes with coaxial cabling, a reflectometer (Campbell Scientific Inc., Model TDR100 or similar), and a data acquisition system consisting of a PC with appropriate software. Because of the sampling interval, and the

synchronous manual collection of gas samples, a system composed of a single reflectometer and laptop PC for data acquisition may be used. When a soil moisture measurement is needed, the reflectometer is connected to the coaxial cable of an individual TDR probe. Moisture content values are displayed on the laptop PC and recorded in a field logbook or on the PC.

The temperature sampling package will include the thermistors, wire, and a datalogger. Campbell Scientific Graphterm^{TM} software or similar will be used to facilitate datalogger operation and data retrieval.

2.3 Analytical Procedures

An on-site laboratory or an approved analytical laboratory under contract to the Sample Management Office will be used to provide the analytical services. Laboratory sample custody, sample analysis, data management, reporting, and sample disposal will be performed in accordance with established laboratory procedures. Analytical procedures will follow established laboratory standard operating procedures based on the referenced EPA method. Active soil gas sampling will be conducted for selected volatile organic compounds (VOC) listed in Attachment E-5, which includes analytes in EPA Method TO-14 to provide a proper baseline for the system.

Chemical analyses will be performed using either EPA Method TO-14 or an equivalent method such as TO-15 that includes the same analyte list, method detection limits equal to or lower than the TO-14 limits, and provides the same or higher level of data quality, and any applicable SW-846 methods. All sample analyses will be performed either by an on-site laboratory or by an SNL/NM approved off-site laboratory.

2.4 Field and Laboratory Quality Assurance/Quality Control

Table 2-1 lists procedures which may be used in support of this SAP. These procedures comply with current sampling and analysis guidance documents, relevant SNL/NM Field Operating Procedures (FOP) and Administrative Operating Procedures (AOP), the SNL/NM Environmental Restoration Project Program Implementation Plan, and SW-846 procedures.

Field and laboratory quality assurance (QA) samples will be collected per OP requirements and may include duplicate samples, trip blank samples, field blanks, equipment rinsate blanks and matrix spike samples.

Table 2-1

Applicable SNL/NM Operating Procedures

Number	Administrative and Field Operating Procedure Title
AOP 00-03	Data Validation Procedure for Chemical and Radiochemical Data
FOP 08-20	Soil Moisture Determination Utilizing Neutron Logging
FOP 08-21	Soil Moisture Monitoring Using Time Domain Reflectometry
FOP 08-22	Soil Vapor Sampling
AOP 95-16	Sample Management and Custody

AOP = Administrative Operating Procedure.
FOP = Field Operating Procedure.

Samples will be submitted to an on-site laboratory or an analytical laboratory under contract to the Sample Management Office which meets the QA/QC requirements of SW -846 and, to the extent applicable, the procedures defined in AOP 00-03 (Data Validation Procedure for Chemical and Radiochemical Data).

2.4.1 Time Domain Reflectometry Calibration and QA/QC

This section describes the calibration and QA/QC procedures associated with the TDR monitoring technique. TDR is a geophysical means of measuring *in situ* soil moisture content. The TDR system includes a probe assembly with coaxial cabling and a reflectometer that is used for generating and receiving an electromagnetic signal. The following calibrations and/or QA/QC checks are recommended for the TDR soil moisture content monitoring technique.

2.6 References

Campbell Scientific, Inc., CR10X Measurement and Control System Operators Manual, Revision September 2001. Campbell Scientific, Inc., Logan, Utah.

Campbell Scientific, Inc., TDR Soil Moisture Measurement System Manual, Revision February, 1992. Campbell Scientific, Inc., Logan, Utah.

Campbell Scientific, Inc., TDR100 Instruction Manual, Revision April, 2002. Campbell Scientific, Inc., Logan, Utah.

Klute, A. (Ed). *Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods.* 1986. 2nd Edition, Soil Science Society of America, Inc. Madison, WI.

Knight, J. H. (1992), Sensitivity of Time Domain Reflectometry Measurements to Lateral Variations in Soil Water Content, Water Resources Research. Vol. 28, No.9.

Kachanoski, R. G., Pringle, E., and Ward, A. (1992), Field Measurement of Solute Travel Times Using Time Domain Reflectometry; Soil Sci. Soc. Am. J. 56:46-52

Ledieu, J., DeRidder, P., DeClerck, P., and Dautrebande, S., (1986), A Method of Measuring Soil Moisture by Time-Domain Reflectometry; Journal of Hydrology, 88:319-328.

Topp, G. C., Davis, J. L., and Annan, A. P. (1980), Electromagnetic Determination of Soil Water Content: Measurements in Coaxial Transmission Lines; Water Resources Research, Vol. 16, No. 3, 574-582

Dasberg, S. and Hopmans, J. W. (1992), Time Domain Reflectometry Calibration for Uniformly and Nonuniformly Wetted Sandy and Clayey Loam Soil; Soil Sci. Soc. Am. J. 56:1341-1345

Sandia National Laboratories/New Mexico (SNL/NM), September 2000. *Corrective Action Management Unit Vadose Zone Monitoring System Annual Monitoring Results Report.* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-20 *Soil Moisture Determination Utilizing Neutron Logging.* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM). FOP 08-22 *Soil Vapor Sampling.* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), FOP 08-21 *Soil Moisture Monitoring Using Time Domain Reflectometry*. Sandia National Laboratories, Albuquerque, New Mexico.

ATTACHMENT E-5
MONITORING SYSTEM ANALYTES

Monitoring System Analytes

Acetone
Benzene
Bromodichloromethane
Bromomethane
Bromoform
2-butanone
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
Chlorotoluene
Dibromochloromethane
1,2-Dichloro-1,1,2,2-tetrafluoroethane
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
Dichlorodifluoroethane
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
cis-1,2-dichloroethene
1,2-dichloropropane
cis-1,3-dichloropropene
trans-1,3-dichloropropene
Ethyl benzene
Ethylene dibromide
4-ethyltoluene
Hexachlorobutadiene
2-hexanone
4-methyl-2-pentanone
Methylene chloride
Styrene
1,1,2,2-tetrachloroethane
Tetrachloroethene
1,2,4-trichlorobenzene
1,1,1-trichloroethane
1,1,2-trichloroethane
Trichlorotrifluoromethane
1,1,2-trichlorotrifluoroethane
(freon 113)
1,2,4-trimethylbenzene
1,3,5-trimethylbenzene
Toluene
Trichloroethene
Vinyl chloride
Vinyl acetate
m,p-xylene
o-xylene

Reference: "Compendium Method TO-14: The Determination of Volatile Organic Compounds (VOC) in Ambient Air Using SUMMA® Passivated Canister Sampling and Gas Chromatographic Analysis," Quality Assurance Division, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, May 1988.

Reference: "Compendium Method TO-15: Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)," Center for Environmental Research Information, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268, January 1999

APPENDIX G
OPERATING PROCEDURES

FINAL

APPENDIX G

List of Primary Operating Procedures Used in Support of Vadose Zone Monitoring System

FOP 08-20 Soil Moisture Determination Utilizing Neutron Logging

FOP 08-21 Soil Moisture Monitoring Using Time Domain Reflectometry

FOP 08-22 Soil Vapor Sampling

AOP 00-03 Data Validation Procedure for Chemical and Radiochemical Data

AOP 95-16 Sample Management and Custody