Permit

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OCT 23
NMED Hazardous Waste Bureau

ENTERED

National Nuclear Security Administration
Los Alamos Site Office, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
(505) 667-4255/FAX (505) 606-2132

Date: OCT 2 2 2012
Refer To: EP2012-0250

John Kieling, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building I
Santa Fe, NM 87505-6303

Subject: Modification to the March 1, 2005, Compliance Order on Consent

Dear Mr. Kieling:

The U.S. Department of Energy (DOE) and Los Alamos National Security, LLC (LANS) are requesting the New Mexico Environment Department's (NMED's) review and approval of a proposed modification of the March 2005 Compliance Order on Consent (Consent Order). This modification request, which is submitted in accordance with Section III.J.1 of the Consent Order, proposes to add Section III.Z that specifies the requirement to maintain a publicly accessible environmental database (e.g., Intellus NM) to the Consent Order.

Section III.J states that all modifications to the Consent Order must be in writing and signed by all Parties, and all modifications are subject to the same procedural rights that would apply to those modifications if made under Los Alamos National Laboratory's (the Laboratory's) Hazardous Waste Permit. These procedural rights are described in Title 40 of the Code of Federal Regulations Section 270.42 (40 CFR 270.42) (implemented by 20.4.1.900 New Mexico Administrative Code). After discussions with your staff, DOE/LANS are submitting this request as a Class 1*. In addition to this modification request, a Class 1* modification requires the following two steps before the modification is implemented:

- Approval by the Secretary, and
- DOE/LANS will send a written notice of this modification to all persons on the NMED Hazardous Waste Bureau–maintained Laboratory facility mailing list and to appropriate state, local, and tribal governments. This notice will be sent within 90 calendar days after the Secretary approves the modification.

While NMED is reviewing this Class 1* modification request, DOE/LANS will complete the uploading of analytical quality assurance/quality control and data validation packages associated with Consent Order data from March 2005 to December 2010. DOE/LANS anticipate this activity will be completed in the next few weeks.

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This Consent Order modification request package includes this transmittal letter, the Consent Order modification request, and pages of the revised portions of the Consent Order. Hard copy of revised pages is provided in redline-strikeout form, along with the MS Word file used to create the hard copy.

If you have any questions, please contact Jeff Mousseau at (505) 606-2337 (jmousseau@lanl.gov) or Peter Maggiore at (505) 665-5653 (peter.maggiore@nnsa.doe.gov).

Sincerely,

Jeff Mousseau, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

Peter Maggiore, Assistant Manager
Environmental Projects Office
Los Alamos Site Office

JM/PM/TG:sm

Attachments: (1) Class I Consent Order Modification
(2) Revised Pages of the Compliance Order on Consent
(3) Electronic copy of the redline-strikeout and the MS Word file used to create the hard copy

Cy: (w/att.)
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Class 1* Consent Order Modification

Introduction

This submittal has been prepared by the U.S. Department of Energy (DOE) and Los Alamos National Security, LLC (LANS) to request a modification to the March 2005 Compliance Order on Consent (Consent Order). Section III.J states that all modifications of the Consent Order must be in writing and signed by all parties and all modifications are subject to the same procedural rights that would apply to those modifications if made under the Los Alamos National Laboratory's (the Laboratory's) Hazardous Waste Permit. These procedural rights are described in Title 40 of the Code of Federal Regulations Section 270.42 (40 CFR 270.42) (implemented by 20.4.1 .900 New Mexico Administrative Code). This modification is consistent with the Class I permit modification examples in Appendix I to 40 CFR 270.42. After consultation with the New Mexico Environment Department (NMED), this modification has been prepared as a "Class 1*", which requires prior NMED approval.

Background

This modification request proposes to add Section III.Z that adds a requirement to maintain a publicly accessible environmental database (e.g., Intellus NM) to the Consent Order. Intellus NM is a web-based database that contains the results of environmental investigation and monitoring activities, including the following:

- Air-quality sampling
- Soil and sediment testing
- Groundwater and surface water monitoring
- Biota monitoring

The scope of the data contained in Intellus NM is broader than just the data collected pursuant to the Consent Order. For example, it includes historical data that were collected prior to the March 2005 effective date of the Consent Order.

Permit Modification Summary

Including a provision in the Consent Order to maintain this publically accessible environmental database is intended to document DOE/LANS commitment to providing a transparent and accessible means for the public to see the latest available environmental data at the Laboratory. The modification language was drafted to meet this commitment and clarify how this database relates to the Consent Order.

This Class 1* modification would add Section III.Z *Public Environmental Database* in Section III *General Provisions*.

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If the Department determines that the transferee agency plans to use, or is using, the subject property in a manner contrary to the use(s) discussed at the meeting described in Section III.Y.2.a, the Department shall notify DOE and the transferee agency in writing. In such writing, the Department shall explain its concerns with regard to the proposed or current use of the property. Within 30 days thereafter DOE, the Department, and the transferee agency shall meet to discuss the Department's stated concerns. The State reserves its right to take any action, including administrative or judicial action, to address the contrary land use.

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Table III-1

Explosive Compounds (Including Propellants, Pyrotechnics, and Degradation Products)

Constituent	**Abbreviation or Synonym**
2-Amino-4,6-Dinitrotoluene	2-Am-DNT
4-Amino-2,6-Dinitrotoluene	4-Am-DNT
2,4-Diamino-6-Nitrotoluene	2,4-DANT
2,6-Diamino-4-Nitrotoluene	2,6-DANT
3,5-Dinitroaniline	3,5-DNA
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX
2-Nitrotoluene	2-NT
3-Nitrotoluene	3-NT
4-Nitrotoluene	4-NT
Pentaerythritol tetranitrate	PETN
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX or Cyclonite
Triaminotrinitrobenzene	TATB
Tris (o-cresyl) phosphate	TCP
Methyl-2,4,6-trinitrophenylnitramine	Tetryl
2,4,6-Trinitrotoluene	TNT

III.Z PUBLIC ENVIRONMENTAL DATABASE

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The Respondents shall maintain a publically accessible database containing all data from environmental media (i.e., soil, sediment, surface water, groundwater, air, and biota) collected by the Respondents as part of environmental investigation and monitoring. The database shall include the capacity for the spatial display of data, the comparison of data to standards and reference values, and the plotting of trends in the data. Additionally, to the extent data are collected pursuant to the requirements of the Consent Order, the database shall include the analytical quality assurance/quality control and data validation information. As new data becomes available, the Respondents shall enter all such data into the public database through updates on no less than a monthly basis. The Respondents shall correct any inaccuracy in the data within 60 days of discovery of such inaccuracy.

This database and the data in it shall not be considered a submittal under Section III.G.

STATE OF NEW MEXICO

ENVIRONMENT DEPARTMENT

IN THE MATTER OF:

THE UNITED STATES DEPARTMENT OF ENERGY AND THE REGENTS OF THE UNIVERSITY OF CALIFORNIA	)	**COMPLIANCE ORDER ON CONSENT**
	)	
	)	**PROCEEDING UNDER THE NEW MEXICO HAZARDOUS WASTE ACT § 74-4-10 AND THE NEW MEXICO SOLID WASTE ACT § 74-9-36(D)**
LOS ALAMOS NATIONAL LABORATORY LOS ALAMOS COUNTY, NEW MEXICO,	)	
	)	
RESPONDENTS.	)	

MARCH 1, 2005
(Revised April 20, 2012)

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LIST OF ACRONYMS

AGI	American Geological Institute
AOC	Area of Concern
ASTM	American Society for Testing and Materials
BGS	Below Ground Surface
BS/BSD	Blank Spike/Blank Spike Duplicate
cfs	Cubic Feet Per Second
C.F.R.	Code of Federal Regulations
CLP	Contract Laboratory Program
COPC	Chemical of Potential Concern
DOE	Department of Energy
ECO-SSL	Ecological Soil Screening Level
EPA	Environmental Protection Agency
ER	Environmental Restoration
ESH	Environment, Safety, and Health
ESL	Ecological Screening Level
ft	Feet
HI	Hazard Index
HE	High Explosive
HHMSSL	Human Health Medium-Specific Screening Level
HMX	High Melting Explosive (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)
HQ	Hazard Quotient
HSWA	Hazardous and Solid Waste Amendments
HWA	New Mexico Hazardous Waste Act, NMSA 1978, §§74-4-1 et seq.
HWP	Hydrogelogic Workplan

IDW	Investigation-Derived Waste
IM	Interim Measures
K	Hydraulic Conductivity
K_d	Sorption Coefficient
kg	Kilogram
LANL	Los Alamos National Laboratory
m	Meter
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDA	Material Disposal Area
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSL	Mean Sea Level
NMAC	New Mexico Administrative Code
NPDES	National Pollutant Discharge Elimination System
ppb	Parts per billion
ppm	Parts per million
ppmv	Parts per million by volume
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation Recovery Act, 42 U.S.C. Section 6901 et seq.
RDX	Royal Demolition Explosive (cyclonitrite)
RFI	RCRA Facility Investigation
SAP	Sampling and Analysis Plan
SAR	SWMU Assessment Report

SDWS	Secondary Drinking Water Standards
SOP	Standard Operating Procedure
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TA	Technical Area
TAL	Target Analyte List
TKN	Total Kjeldahl Nitrogen
TNT	Trinitrotoluene
TT	Treatment Technique
TW	Test Well
UCL	Upper Confidence Level
USGS	United States Geological Survey
UTL	Upper Tolerance Level
VCA	Voluntary Corrective Action
VCM	Voluntary Corrective Measure
XRF	X-Ray Fluorescence
VOC	Volatile Organic Compound
WQCC	Water Quality Control Commission
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter

I. INTRODUCTION

This Compliance Order on Consent (Consent Order) is issued pursuant to the New Mexico Hazardous Waste Act (HWA), NMSA 1978, § 74-4-10, and entered into by the Secretary of the New Mexico Environment Department (NMED or the Department), Respondent the United States Department of Energy (DOE), and Respondent The Regents of the University of California (University of California). This Consent Order is also issued pursuant to the New Mexico Solid Waste Act (SWA), NMSA 1978, § 74-9-36(D), for the purpose of addressing the requirements concerning groundwater contaminants listed at 20.6.2.3103 NMAC, toxic pollutants listed at 20.6.2.7.VV NMAC, Explosive Compounds as defined herein, nitrate, and perchlorate that are set forth in this Consent Order.

This Consent Order contains investigation, cleanup, including corrective action, and other requirements for the Los Alamos National Laboratory (the Facility), which is owned and operated by DOE and co-operated by the University of California. The Consent Order is divided into 13 Sections. Section I provides an introduction. Section II sets forth the Department's findings of fact and conclusions of law in support of this Consent Order. Section III contains general provisions, such as purposes, definitions, jurisdiction, stipulated penalties, force majeure, dispute resolution, covenant not to sue, reservation of rights and defenses, enforcement, integration with permit, and land transfer. Section IV sets forth the requirements, other than those in Sections V and VI, for a comprehensive investigation of environmental contamination at the Facility. It is divided into three subsections, addressing general Facility-wide investigations, investigations of separate watersheds within the Facility, and investigations of individual technical areas (TAs) at the Facility. Section V provides for the investigation of newly identified SWMUs, AOCs, and releases, which are not otherwise addressed pursuant to Sections IV and VI. Section VI provides for the completion of investigations that are currently underway for several waste management units at the Facility. Section VII provides for the identification of cleanup alternatives and the implementation of cleanup measures for the Facility. Section VIII establishes screening and cleanup levels for Contaminants at the Facility. Section IX sets forth methods and procedures for investigation, sampling, and analysis. Section X establishes requirements for groundwater monitoring well construction. Section XI sets forth the requirements for various reports to be submitted to the Department. Section XII establishes the schedule for implementation of the Consent Order. Finally, Section XIII contains the effective date of the Consent Order.

The requirements of this Order do not apply to radionuclides, including, but not limited to, source, special nuclear, or byproduct material as defined in the Atomic Energy Act of 1954, as amended, or the radioactive portion of mixed waste. The requirements of this Order do apply, however, to the hazardous waste component of mixed waste.

This Consent Order has been negotiated in good faith and is entered into by the signatories hereto without the admission or adjudication of any issue of fact or law, and with the intent that the Parties will act in good faith to implement the terms and requirements of the Consent Order. The actions undertaken by Respondents in accordance with this Consent Order do not constitute

an admission of any liability, or any agreement with any Findings of Fact or Conclusions of Law contained in this Consent Order. Respondents do not admit, and retain the right to controvert in any subsequent proceedings, other than proceedings to implement or enforce this Consent Order, the validity of the Findings of Facts and Conclusions of Law in this Consent Order. Respondents agree to comply with and be bound by the terms of this Consent Order and agree that they will not contest the basis or validity of this Consent Order.

II. FINDINGS OF FACT AND CONCLUSIONS OF LAW

II.A FINDINGS OF FACT

The Department makes the following findings of fact.

II.A.1 The Parties

1. The New Mexico Environment Department is the department within the executive branch of the New Mexico State government charged with administration and enforcement of the HWA, NMSA 1978, § 74-4-10; the Hazardous Waste Regulations, 20.4.1 NMAC, and the SWA, NMSA 1978, § 74-9-36(D).

2. The Respondent DOE is a department of the United States government, and is the owner and a co-operator of the Facility. The Respondent University of California (the University) is the operating contractor for the Facility pursuant to a contract with DOE, and is a co-operator of the Facility.

II.A.2 The Facility

3. The Facility, as defined in Section III.B of this Consent Order, is the Los Alamos National Laboratory (the "Facility") site. That site currently comprises approximately 40 square miles (25,600 acres) and is located on the Pajarito Plateau in Los Alamos County in north central New Mexico, approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe**.** At one point during its history, the Facility comprised up to roughly 71 square miles (45,666 acres). The Facility is surrounded by the Pueblo of San Ildefonso, Los Alamos County, Bandelier National Monument, Santa Fe National Forest, and Santa Fe County.

4. The Pajarito Plateau is dissected by nineteen major surface drainages or canyons and their tributaries. The canyons run roughly west to east or southeast. From north to south, the most prominent canyons are Pueblo Canyon, Los Alamos Canyon, Sandia Canyon, Mortandad Canyon, Pajarito Canyon, Cañon de Valle and Water Canyon, Ancho Canyon, and Chaquehui Canyon. These canyons drain into the Rio Grande, which flows along part of the eastern border of the Facility.

5. Hydrogeologic investigations have identified four discrete hydrogeologic zones beneath the Pajarito Plateau on which the Facility is located: (1) canyon alluvial systems; (2) intermediate perched water in the volcanic rocks (Tschicoma Formation and the Tshirege Member of the Bandelier Tuff); (3) canyon-specific intermediate perched water within the Otowi Member of the Bandelier Tuff, Cerros del Rio basalt and sedimentary units of the Puye Formation; and (4) the regional aquifer.

II.A.3 Facility Operations

6. The Facility began operations in 1943 when the United States Army Manhattan Engineer District was established for the development and assembly of an atomic bomb. Current and historic operations have included nuclear weapons design and testing; high explosives research, development, fabrication, and testing; chemical and material science research; electrical research and development; laser design and development; and photographic processing.

7. The Facility is currently operated by DOE and the University.

8. The Facility has been divided into numerous Technical Areas, or "TAs." Currently, 49 TAs exist; however, many former TAs have ceased operations, have been combined with other TAs, or were cancelled before becoming operational. Those TAs include, for example, TA-2, located in Los Alamos Canyon near the western boundary of the Facility; TA-3, located at the western boundary of the Facility; former TA-10, located north of the Facility in Bayo Canyon; TA-16, located on the southwestern side of the Facility; TA-21, located on DP Mesa on the northern side of the Facility; former TA-45, located north of the Facility in the Los Alamos township; TA-49, located on the southwestern boundary of the Facility on Frijoles Mesa; TA-50, located in the center of the Facility between Mortandad Canyon and Two Mile Canyon; and TA-54, located at the eastern end of Mesita del Buey on the eastern side of the Facility.

9. For administration purposes, the Respondents have further categorized some of the areas within the TAs as "Material Disposal Areas" or "MDAs." These include, for example, MDAs A, B, T, U, and V in TA-21; MDA C in TA-50; MDAs G, H, and L in TA-54.

10. Water supply wells at the Facility, in Los Alamos County and on San Ildefonso Pueblo property withdraw water from the regional aquifer beneath the Pajarito Plateau.

II.A.4 Waste Management

11. As a result of the Facility operations, from approximately 1943 to the present, the Respondents have generated, treated, stored, disposed of, and otherwise handled solid wastes, including hazardous wastes, hazardous waste constituents, and mixed wastes at the Facility.

12. The Respondents have disposed of hazardous wastes, hazardous constituents and mixed waste at the Facility. In addition, certain groundwater contaminants listed at 20.6.2.3103 NMAC, certain toxic pollutants listed at 20.6.2.7.VV NMAC, certain Explosive Compounds as defined herein, nitrates, and perchlorate are present in the environment at the Facility. The Respondents have disposed of such wastes in septic systems, pits, surface impoundments, trenches, shafts, landfills, and waste piles at the Facility. The Respondents have also discharged industrial wastewater and other waste from outfalls into many of the canyon systems at the Facility.

II.A.5 Releases of Contaminants

13. Waste management activities at the Facility have resulted in the release of hazardous wastes, hazardous waste constituents, mixed waste, certain groundwater contaminants listed at 20.6.2.3103 NMAC, certain toxic pollutants listed at 20.6.2.7.VV NMAC, certain Explosive Compounds as defined herein, nitrate, and perchlorate.

14. Contaminants that have been released into, and detected in, soils and sediments at the Facility include, for example, explosives, such as RDX, HMX, TNT; volatile organic compounds and semi-volatile organic compounds; metals such as arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, molybdenum, silver, and zinc; and PCBs.

15. Contaminants that have been released into, and detected in, groundwater beneath the Facility include, for example, explosives, such as RDX; volatile organic compounds such as trichloroethylene, dichloroethylene, and dichloroethane; metals such as molybdenum, manganese, beryllium, lead, cadmium, and mercury; perchlorate; other inorganic contaminants such as ammonia, nitrate, and fluoride; and other contaminants. Contaminants have been detected beneath the Facility in all four groundwater zones.

II.A.6 Regulatory History of the Facility

16. On August 13, 1980, the Respondents submitted to the United States Environmental Protection Agency (EPA) a "Notification of Hazardous Waste Activity" for the Facility pursuant to Section 3010(a) of RCRA, 42 U.S.C. § 6930(a).

17. By letter dated November 19, 1980, the Respondents submitted to EPA a Part A RCRA permit application for the Facility. The Respondents also sent a copy of the Part A application to the Environmental Improvement Division of the New Mexico Department of Health and Environment, the predecessor to the Environment Department. The application covered hazardous waste treatment, storage, and disposal activities at TA-54, and included some 129 hazardous waste streams. The Respondents have revised the Part A permit application several times since it was first submitted, including, among other things, to notify the State that Respondents would not seek a permit for hazardous waste disposal activities at the Facility. Respondents' most recent Part A permit revision was submitted to the Department in August 2002.

18. On January 25, 1985, the State of New Mexico received from EPA authorization to implement its hazardous waste program under the HWA in lieu of the Federal program. 50 Fed. Reg. 1515 (Jan. 11, 1985). Subsequent program revision applications were approved effective on April 10, 1990, July 25, 1990, December 4, 1992, August 23, 1994, December 21, 1994, July 10, 1995, January 2, 1996, March 10, 1997, and June 13, 1998. 40 C.F.R. § 272.1601.

19. On November 8, 1989, the Department's predecessor agency issued a Hazardous Waste Facility Permit (Permit) to the Respondents to operate a hazardous waste treatment and storage facility at the Facility pursuant to Section 74-4-4.2 of the HWA. The Permit

covered hazardous waste container storage areas at TA-16, TA-50, and TA-54, hazardous waste storage and treatment tanks at TA-54, and hazardous waste incinerators at TA-16 and TA-50. Two of the four treatment tanks at TA-54 were removed in accordance with an approved closure plan in 1996. The Department approved the closure report in 1997. The remaining two tanks were removed from the site in 2002. The Department has not approved the closure. The Respondents closed the incinerator at TA-16 in accordance with an approved closure plan, and the Department approved the Closure Certification Report in October 2001. Respondents closed the incinerator at TA-50 in accordance with an approved closure plan, and the Department approved the Closure Certification Report in July 1998.

20. On July 25, 1990, the State of New Mexico received from EPA authorization to expand its hazardous waste program under the HWA in lieu of the federal program, including the authority to regulate the hazardous component of mixed waste. 55 Fed. Reg. 28397 (July 11, 1990).

21. In the late 1980's, the Respondents identified for EPA "Potential Release Sites," including solid waste management units (SWMUs) and "areas of concern" (AOCs), where hazardous wastes, hazardous constituents, solid wastes, or mixed wastes may have been disposed. Of those sites, EPA identified over 1200 as sites to be investigated and included on the Hazardous and Solid Waste Amendments (HSWA) portion (known as the "HSWA Module") of the Facility's RCRA permit.

22. On March 8, 1990, EPA issued to the Respondents the HSWA portion of the Permit, effective on May 23, 1990, covering those requirements of RCRA added by the HSWA of 1984. The EPA portion of the permit required corrective action for continuing releases of hazardous waste and hazardous waste constituents at and from the Facility pursuant to Section 3004(u) and (v) of RCRA, 42 U.S.C. § 6924(u) and (v).

23. Effective January 2, 1996, the State of New Mexico received from EPA final authorization to implement its corrective action program under the HWA. See 60 Fed. Reg. 53,708 (Oct. 17. 1995); 61 Fed. Reg. 2450 (Jan. 26, 1996).

24. Between 1995 and 1999, the Respondents submitted a Permit renewal application to the Department for permitted and interim status storage and treatment units at the Facility. The General Part B renewal application was initially submitted in August 1996; the TA-16 application for permitted and interim status units was initially submitted in June 1995; the TA-50 permit application for permitted and interim status units was initially submitted in January 1999; the TA-54 permit application for permitted and interim status units was initially submitted in January 1999; and the TA-55 permit application for interim status units was initially submitted in June 1996. Permit applications for interim status units at TA-3, TA-14, TA-36 and TA-39 were submitted to the Department in or before May 1999.

25. The Permit, which was originally set to expire in November 1999, was administratively extended pursuant to 20.4.1.900 NMAC (incorporating 40 C.F.R. § 270. 51), and it remains in effect.

II.A.7 Procedural History of Consent Order

26. On May 2, 2002, pursuant to Sections 74-4-10.1 and 74-4-13 of the HWA, the Department issued a Determination of an Imminent and Substantial Endangerment to Health or the Environment Concerning the Los Alamos National Laboratory (the Determination), to DOE and the University.

27. On May 2, 2002, the Department also issued a draft order pursuant to Sections 74-4-10.1 and 74-4-13 of the HWA, called "In Re: Proceeding Under the New Mexico Hazardous Waste Act §§ 74-4-10.1 and 74-4-13" (Draft Order). The Draft Order proposed a series of investigation and corrective action tasks for DOE and the University to complete at the Facility.

28. The Department provided notice and an opportunity to comment on the Draft Order. The comment period extended for 90 days and ended on July 31, 2002. During the public comment period, the Department held four public meetings to provide the public with information on the draft order. The Department received comments from 38 persons, including the Respondents, on the Draft Order.

29. On June 3, 2002, the University filed a Complaint for Declaratory and Injunctive Relief and for Review of Agency Action in the United States District Court for the District of New Mexico (No. CIV 02-637 MV/DJS) challenging the Determination. On June 3, 2003, the University and the United States each filed a Notice of Appeal with the New Mexico Court of Appeals (Ct. App. Nos. 23,172 and 23,173), challenging the Determination.

30. On October 9, 2002, the United States, on behalf of DOE, filed a Complaint in the United States District Court for the District of New Mexico (No. CIV 02-1273-LH/RHS), challenging the September 9, 2002 Installation Work Plan (IWP) Work Schedule issued by the Department. The IWP Work Schedule imposed requirements similar to those contained in the Draft Order.

31. On November 26, 2002, the Department issued to the Respondents a Final Order called "Re: Proceeding Under the New Mexico Hazardous Waste Act §§ 74-4-10.1 and 74-4-13" (Final Order). The Final Order contained a set of investigation, monitoring, and corrective action tasks and a schedule for implementation of those tasks. The Department also responded, in writing, to each of the public comments it had received on the Draft Order. The Determination issued on May 2, 2002 was also withdrawn on November 26, 2002, and the findings and conclusions contained therein were incorporated into the Final Order.

32. On December 18, 2002, the University dismissed its complaint in the United States District Court challenging the Determination because the Department had withdrawn that Determination, as noted above.

33. On December 24, 2002, the United States filed an Amended Complaint, challenging both the 2002 IWP Work Schedule and the Final Order. The United States also filed a Notice of Appeal in the New Mexico Court of Appeals (Ct. App. No. 23,693), challenging the Final Order

34. On December 26, 2002, the University filed a Complaint for Declaratory and Injunctive Relief and for Review of Agency Action in the United States District Court for the District of New Mexico (No. CIV 02-1631 LFG/WDS), challenging the Final Order. On December 26, 2002, the University also filed a Notice of Appeal with the New Mexico Court of Appeals (Ct. App. No. 23,698) challenging the Final Order.

35. From December 2002 through December 2003 and from February through March 2004, the Parties engaged in settlement negotiations to resolve the issues raised by the United States' and the University's lawsuits. To facilitate the settlement discussions, the Parties agreed to stay the pending litigation during the settlement process.

36. On April 25, 2003, the Department issued a Compliance Order HWB 03-02, alleging that the Department of Energy and the University failed to implement interim measures at the Airport Landfill, or SWMU 73-001(a), at the Facility. Respondents answered the Compliance Order, denying the Department's allegations. That action was also stayed during negotiations of this Consent Order.

37. This Consent Order is the result of the Parties' settlement negotiations. In addition, as the result of those settlement negotiations and the execution of this Consent Order, the Department has agreed to withdraw the Determination, the Final Order, the Airport Landfill Order, and the 2002 IWP Work Schedule, and the United States and the University have agreed to dismiss their lawsuits. *See* Section III.R (Pending Actions).

38. On September 1, 2004, the Department released this Consent Order for public review and comment. The Department placed a public notice of the availability of the proposed Consent Order in the local news outlets, and mailed copies of the notice to all interested parties. The Department provided the public with a 30-day period to comment on the proposed Consent Order. The comment period ended on October 1, 2004. The Department received comments from 18 persons on the proposed Consent Order. The Department is today responding, in writing, to each of those public comments.

II.B CONCLUSIONS OF LAW

The Department makes the following conclusions of law:

1. Each of the Respondents, DOE and the University, is a "person" within the meaning of section 74-4-3(K) of the HWA, and the Hazardous Waste Regulations at 4.1.100 NMAC (incorporating 40 C.F.R. § 260.10).

2. The Los Alamos National Laboratory is a "facility" within the meaning of the Hazardous Waste Regulations at 4.1.100 NMAC (incorporating 40 C.F.R. § 260.10).

3. The Respondent DOE is an "owner" and an "operator" of the Facility within the meaning of the Hazardous Waste Regulations at 4.1.100 NMAC (incorporating 40 C.F.R. § 260.10).

4. The Respondent University is an "operator" of the Facility within the meaning of the Hazardous Waste Regulations at 4.1.100 NMAC (incorporating 40 C.F.R. § 260.10).

5. The Respondents have engaged in the "storage," "treatment," and "disposal" of "hazardous waste" at the Facility, and are currently engaged in the "storage" and "treatment" of "hazardous waste" at the Facility, within the meaning of section 74-4-3(P), (T), (E), and (K) of the HWA, and the Hazardous Waste Regulations at 20.4.1.100 NMAC (incorporating 40 C.F.R. § 260.10).

6. The Department has determined that hazardous wastes and hazardous waste constituents have been "release[d]" from the Facility into the environment within the meaning of section 74-4-10(E) of the HWA.

7. Pursuant to Section 74-4-10(A) of the HWA, the Department has determined that the Respondents may have violated 20.4.1.900 NMAC, incorporating by reference 40 C.F.R. § 270.33, Schedule of Compliance.

8. Each of the Respondents is a "person" within the meaning of section 74-9-3(I) of the SWA.

9. Groundwater contaminants listed at 20.6.2.3103 NMAC, toxic pollutants listed at 20.6.2.7.VV NMAC, Explosive Compounds as defined herein, perchlorate, and nitrates are solid wastes within the meaning of Section 74-9-3(N) of the SWA.

10. The Department has determined that there is or has been a release of certain groundwater contaminants listed at 20.6.2.3103 NMAC, certain toxic pollutants listed at 20.6.2.7.VV NMAC, certain Explosive Compounds as defined herein, nitrate, and perchlorate into the environment requiring corrective action pursuant to section 74-9-36(D) of the SWA.

III. GENERAL PROVISIONS

III.A PURPOSES AND SCOPE OF CONSENT ORDER

The purposes of this Consent Order are: 1) to fully determine the nature and extent of releases of Contaminants at or from the Facility; 2) to identify and evaluate, where needed, alternatives for corrective measures, including interim measures, to clean up Contaminants in the environment, and to prevent or mitigate the migration of Contaminants at or from the Facility; and 3) to implement such corrective measures.

Except as provided in Section III.W.1, this Consent Order fulfills the requirements for: 1) corrective action for releases of hazardous waste or hazardous waste constituents under sections 3004(u) and (v) and 3008(h) of RCRA, 42 U.S.C. §§ 6924(u) and (v) and 6928(h), sections 74-4-4(A)(5)(h) and (i), 74-4-4.2(B), and 74-4-10(E) of the HWA, and their implementing regulations at 40 C.F.R. Part 264, subpart F (incorporated by 20.4.1.500 NMAC); 2) corrective action for releases of groundwater contaminants listed at 20.6.2.3103 NMAC, toxic pollutants listed at 20.6.2.7.VV NMAC, Explosive Compounds, nitrate, and perchlorate pursuant to section 74-9-36(D) of the SWA; 3) groundwater monitoring, groundwater characterization and groundwater corrective action requirements for regulated units under Subpart F and for miscellaneous units under Subpart X of 40 C.F.R. Part 264 and 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264); and 4) additional groundwater information required in Part B permit applications under 40 C.F.R. § 270.14(c) and (d)(3) and 40 C.F.R. § 270.23(b) (incorporated by 20.4.1.900 NMAC).

This Consent Order contains no requirements for radionuclides or the radioactive portion of mixed waste. Therefore, any radionuclides found in any media at the Facility shall not be subject to this Consent Order or any enforcement action relating to this Consent Order. Notwithstanding the foregoing, Respondents may voluntarily include in any plan, report or other document submitted pursuant to this Consent Order, including work plans, references to, or information concerning, radionuclides or the radioactive portion of mixed waste. The voluntary inclusion of such radionuclide information by the Respondents in any plan, report or other document shall not be enforceable by any entity, including the State, under this Consent Order, because such information falls wholly outside the requirements of this Consent Order.

This Consent Order also imposes no requirements on any areas of concern ("AOCs") previously investigated by the Respondents and reviewed and determined by EPA to require no further investigation or other action; those AOCs are specifically identified in a letter from EPA, dated January 21, 2005, to the Department.

Section 1004(27) of RCRA, 42 U.S.C. § 6903(27) (and its implementing regulations at 40 C.F.R. § 261.4(a)(2)) and the HWA, NMSA 1978 § 74-4-3(M) (and its implementing regulations at 20.4.1.200 NMAC, incorporating 40 C.F.R. § 261.4(a)(2)) exclude from the definition of "solid waste" and thus exclude from regulation under the HWA or RCRA industrial discharges that are point sources subject to permits under section 402 of the Clean Water Act. Solely for the purposes of this Consent Order, the Respondents shall not assert this exclusion in response to

enforcement of the specific requirements set forth in this Consent Order, or in a work plan approved under this Consent Order, for Contaminants existing at the Facility as of the effective date of this Consent Order. However, the Respondents reserve the right to assert the exclusion in response to any attempt to impose requirements, other than those set forth in this Consent Order, or to impose requirements for Contaminants resulting from industrial discharges that occur after the effective date of this Consent Order.

The application of this Consent Order to firing sites is as set forth in Section IV.A.5.

III.B DEFINITIONS

Unless otherwise expressly provided herein, the terms used in this Consent Order shall have the meanings set forth in the HWA, RCRA, and their implementing regulations.

"Administrative Record" means the administrative record supporting and otherwise relating to the requirements of this Consent Order, compiled as of the effective date of this Consent Order, which forms the basis for the terms of this Consent Order. The Administrative Record includes the full record relating to the Respondents' current Hazardous Waste Facility Permit (permit No. NM0890010515), and those documents submitted in writing by the Department, Respondents, or the public, as of the effective date of the Consent Order for inclusion in the Administrative Record. The Administrative Record is available for review at the Department's Hazardous Waste Bureau.

"Aggregate Area" means an area within a single watershed or canyon made up of one or more SWMUs or AOCs and the media affected or potentially affected by releases from those SWMUs or AOCs, and for which investigation or remediation, in part or in entirety, is conducted for the area as a whole in order to address area-wide contamination, ecological risk assessment, and other factors.

"Area of Concern" or "AOC" means any area that may have had a release of a hazardous waste or hazardous constituent, which is not a Solid Waste Management Unit.

"Consent Order" or "Order" means this Compliance Order on Consent.

"Contaminant" means any hazardous waste listed or identified as characteristic in 40 C.F.R. Part 261 (incorporated by 20.4.1.200 NMAC); any hazardous constituent listed in 40 C.F.R. Part 261, Appendix VIII (incorporated by 20.4.1.200 NMAC) and 40 C.F.R. Part 264, Appendix IX (incorporated by 20.4.1.500 NMAC); any groundwater contaminant listed in the WQCC Regulations at 20.6.2.3103 NMAC; any toxic pollutant listed in the WQCC Regulations at 20.6.2.7.VV NMAC; Explosive Compounds as defined herein; nitrate; and perchlorate. Contaminant does not include radionuclides or the radioactive portion of mixed waste.

"Day" means a calendar day, unless specified as a business day. "Business day" means Monday through Friday, excluding all federal and New Mexico State holidays.

"Department" means the New Mexico Environment Department, and any successor departments or agencies.

"DOE" means the United States Department of Energy, and any successor departments or agencies.

"EIB" means the New Mexico Environmental Improvement Board, and any successor departments or agencies.

"EPA" means the United States Environmental Protection Agency, and any successor departments or agencies.

"Explosive Compounds" means those compounds listed in Table III-1.

"Facility" means the Los Alamos National Laboratory site owned by the United States Department of Energy and located on the Pajarito Plateau in Los Alamos County in North Central New Mexico, comprised of approximately 40 square miles and located approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe.

"HWA" means the New Mexico Hazardous Waste Act, NMSA 1978, §§ 74-4-1 to 74-4-14.

"Groundwater" means interstitial water which occurs in saturated earth material and which is capable of entering a well in sufficient amounts to be utilized as a water supply.

"Hazard Index" or "HI" means the sum of more than one hazard quotient for multiple substances and/or multiple exposure pathways. The HI is calculated separately for chronic, subchronic, and shorter-duration exposures.

"Hazard Quotient" or "HQ" means the ratio of a single substance exposure level over a specified time period (e.g., subchronic) to a reference dose for that substance derived from a similar exposure period.

"Hazardous constituent" or "hazardous waste constituent" means any constituent identified in 40 C.F.R. Part 261, Appendix VIII (incorporated by 20.4.1.200 NMAC), and any constituent identified in 40 C.F.R. Part 264, Appendix IX (incorporated by 20.4.1.500 NMAC).

"Hazardous Waste" means any solid waste or combination of solid wastes which because of its quantity, concentration, or physical, chemical, or infectious characteristics meets the description set forth in NMSA 1978, § 74-4-3(K), and is listed as a hazardous waste or exhibits a hazardous waste characteristic under 40 C.F.R. Part 261 (incorporated by 20.4.1.200 NMAC).

"Hazardous Waste Regulations" means the New Mexico Hazardous Waste Management Regulations, 20.4.1 NMAC.

"Interim Measures" or "IM" means actions that can be implemented to minimize or prevent migration of Contaminants and to minimize or prevent actual or potential human or ecological exposure to Contaminants while long-term, final corrective action remedies are evaluated and, if necessary, implemented.

"Landfill" means a disposal facility or part of a facility where hazardous waste is placed in or on the land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit.

"Maximum Contaminant Level" or "MCL" means a maximum contaminant level adopted by EPA under the federal Safe Drinking Water Act, 42 U.S.C. §§ 300f to 300j-26, or by the Environmental Improvement Board under the Environmental Improvement Act, NMSA 1978, § 74-1-8(A)(2) (2000).

"Mixed Waste" means waste that contains both hazardous waste subject to the HWA and RCRA and source, special nuclear or byproduct material subject to the Atomic Energy Act of 1954, as amended.

"Operable Unit" or "OU" means any individual SWMU or AOC or a group of SWMUs or AOCs based on geographic location (i.e., technical area or test area) orgrouped by similar construction, transport pathways, exposure routes, receptors, potential risk, and potential locations for Contaminants to accumulate.

"Parties" means collectively the New Mexico Environment Department, the United States Department of Energy, and the Regents of the University of California, and the term "Party" shall refer to one of these three entities.

"Permit" means the RCRA Permit issued to the Respondents for the Facility to operate a hazardous waste treatment and storage facility, EPA ID No. NM0890010515, as it may be modified or amended.

"Pit" means an earthen surface impoundment or excavation constructed to retain waste.

"RCRA" means the Federal Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901 to 6992k, also known as the Solid Waste Disposal Act.

"Reach" means a subsection of a watercourse (e.g., canyon system, river system, storm drain network) treated as a single unit for the purpose of characterization, monitoring, or remediation. The reach location and extent is not arbitrary and must be based upon the following: 1) consistent geomorphic characteristics (e.g., slope, channel material size); 2) consistent contaminant characteristics without significant spatial trends (e.g., no major tributaries supplying sediment or water of different types or contaminant concentrations); and 3) consistent current or future land use (e.g., industrial, recreational, or residential).

"Respondents" means the United States Department of Energy and the Regents of the University of California.

"SWA" means the New Mexico Solid Waste Act, NMSA 1978, §§ 74-9-1 to 74-9-42.

"Secretary" means the Secretary of the New Mexico Environment Department or designated representative.

"Solid Waste" means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880), or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923).

"Solid Waste Management Unit" or "SWMU" means any discernible unit at which solid waste has been placed at any time, and from which the Department determines there may be a risk of a release of hazardous waste or hazardous waste constituents, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at the Facility at which solid wastes have been routinely and systematically released; they do not include one-time spills. *See* 61 Fed. Reg. 19431, 19442-43 (May 1, 1996).

"State of New Mexico" or "State" means the State of New Mexico, including all of its departments, agencies, and instrumentalities.

"Surface Impoundment" means a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen material (although it may be lined with man-made materials), which is designed to hold an accumulation of liquid wastes or wastes containing free liquids, and which is not an injection well. Examples of surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons.

"TAL metals" or "target analyte list metals" means the following metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

"Technical Area" or "TA" means an administrative unit of area established to encompass operations at the Facility.

"Trench" means a long, narrow depression or excavation, natural or artificial, in the earth's surface.

"UCL" means the 95 percent upper confidence limit of the mean value. The UCL shall be calculated following the methodology in EPA (1992) *Supplemental Guidance to RAGS: Calculating the Concentration Term.*

"UTL" means the upper tolerance limit, which is a statistical estimate of the maximum concentration. The UTL shall be calculated in accordance with the Hazardous Waste Bureau Position Paper (March 2000) *Use of Tolerance Intervals for Determining Inorganic Background Concentrations.*

"United States" means the United States of America, including all of its departments, agencies, and instrumentalities.

"University" means the Regents of the University of California.

"WQCC" means the New Mexico Water Quality Control Commission, and any successor agencies, boards, or commissions.

"Water Quality Control Commission (WQCC) Regulations" means the regulations at 20.6.2 NMAC promulgated by the New Mexico Water Quality Control Commission governing the quality of groundwater and surface water in New Mexico.

"Watershed" means a region or basin drained by, or contributing waters to, a river, stream, lake, or other body of water and separated from adjacent drainage areas by a divide such as a mesa, ridge or other geologic feature.

III.C HEADINGS

Any section or paragraph headings in this Consent Order are provided solely as a matter of convenience to the reader and shall not be construed to alter the meaning of any provision of this Consent Order.

III.D JURISDICTION

This Consent Order is issued to DOE and the University pursuant to section 74-4-10 of the HWA. It is also issued under section 74-9-36(D) of the SWA, for the limited purpose of addressing the corrective action requirements concerning groundwater contaminants listed at 20.6.2.3103 NMAC, toxic pollutants listed at 20.6.2.7.VV NMAC, Explosive Compounds, nitrate, and perchlorate. Although Respondents consent to SWA jurisdiction for enforcement of the corrective action requirements of this Consent Order relating to groundwater contaminants listed at 20.6.2.3103 NMAC, toxic pollutants listed at 20.6.2.7.VV NMAC, Explosive Compounds, nitrate, and perchlorate, they otherwise reserve any and all rights, claims, and defenses with respect to the applicability of the requirements of the SWA.

Section 6001 of RCRA provides, in part, that "[e]ach department, agency, and instrumentality of the executive …branch[] of the Federal Government (1) having jurisdiction over any solid waste management facility or disposal site, or (2) engaged in any activity resulting, or which may result, in the disposal or management of solid waste or hazardous waste shall be subject to, and comply with, all Federal, State, interstate, and local requirements, both substantive and procedural . . ., respecting control and abatement of solid waste or hazardous waste disposal and management in the same manner, and to the same extent, as any person is subject to such requirements." 42 U.S.C. § 6961.

III.E TERM OF CONSENT ORDER

III.E.1 Effective Date

The effective date of this Consent Order is the date on which all of the Parties have signed the Consent Order.

III.E.2 Termination Date

Respondents shall notify the Department, in writing, when all of the requirements of this Consent Order, except those requirements concerning record preservation in Section III.Q, have been completed. Respondents' notice to the Department shall include a copy of all of the certificates of completion, as described in Section VII.E.6.b, obtained by Respondents pursuant to this Consent Order.

If the Department identifies any requirements of this Consent Order that have not been satisfactorily completed and for which a certificate of completion has not been obtained, it will notify the Respondents in writing. The Department's notice shall identify which requirements of the Consent Order the Department believes have not been met and which activities must be undertaken by Respondents to satisfy those requirements.

This Consent Order shall terminate on the date that the Respondents receive written notice from the Department that the Respondents have demonstrated that the terms of this Consent Order, with the exception of record preservation, have been satisfactorily completed. The Department shall provide such written notice within 60 days of receipt of the Respondents' notice pursuant to this Section (III.E.2). If, however, a Class 3 permit modification pursuant to Section III.W.3.b is pending at the close of the 60-day period, the Department shall provide the written notice pursuant to this Paragraph within 15 days of the date on which the Department takes final agency action on the Class 3 permit modification. Sections III.Q (Record Severability), III.S (State's Covenant Not to Sue), and III.T (State's Reservation of Rights) shall survive the termination of this Consent Order as an agreement among the Parties.

III.F BINDING EFFECT

This Consent Order shall apply to and bind the State, its officers when acting in their official capacity but not in their individual capacity, its agents, successors and assigns, and the Respondents, their officers when acting in their official capacity but not in their individual capacity, their agents, successors, and assigns.

The Respondents' obligations under this Consent Order may be satisfied by the actions of either DOE or the University, or by both of them. However, the Respondents shall be jointly and severally responsible for, and liable for any failure to carry out, all their obligations under this Consent Order.

The obligations of the University under this Consent Order shall terminate upon the effective date of the termination or expiration of its prime contract with DOE. If the contract between DOE and the University is terminated or expires prior to such time as the obligations of this Consent Order are fully completed, DOE agrees to give the Department at least 30 days notice prior to a change in operating contractor and to impose the same obligations as are now imposed upon the University under this Consent Order upon any successor contractor or other applicable entity. Nothing in this Consent Order is intended to modify or abrogate, nor does it modify or abrogate, any provision in the prime contract between DOE and the University, nor does it create any third party rights in that contract.

The Respondents shall require all contractors, subcontractors, laboratories, and consultants retained to conduct or monitor any portion of the work performed pursuant to this Consent Order to comply with and abide by the terms of this Consent Order.

III.G STIPULATED PENALTIES

III.G.1 Submittals Subject to Stipulated Penalties

The Respondents shall confer with the Department by September 16, 2004 to determine which of the submittals required by this Consent Order are due to the Department during the federal fiscal year (i.e., beginning October 1 and ending September 30, 2005) shall be subject to stipulated penalties under this section (III.G). On or before June 30 of each calendar year, beginning in 2005, the Respondents shall confer with the Department to determine which of the submittals required by this Consent Order that are due to the Department during the subsequent federal fiscal year shall be subject to stipulated penalties under this section (III.G). The Chief of the Department's Hazardous Waste Bureau shall make the final decision on which submittals shall be subject to stipulated penalties under this section (III.G). In making such decision, the Bureau Chief will consider, among other things, the Respondents' history of compliance with this Consent Order. The Bureau Chief may decide to reduce the number of submittals that are subject to stipulated penalties or eliminate the requirement for stipulated penalties for any given federal fiscal year. Such decision shall be in writing and will be sent to the Respondents no later than July 15 of each year. Such decision shall be final and shall not be subject to dispute resolution or judicial review.

For each federal fiscal year from 2005 through the termination of this Consent Order, up to fifteen (15) submittals required by this Consent Order shall be subject to stipulated penalties.

III.G.2 Process and Notice

For each failure of the Respondents to submit the deliverables identified by the Bureau Chief as being subject to stipulated penalties pursuant to Section III.G.1. by the deadlines specified in this Consent Order, the Department may assess a stipulated penalty in the amounts and pursuant to the procedures set forth in this section (III.G). The Department may also assess a stipulated penalty in the amounts and pursuant to the procedures set forth in this section if a submittal identified by the Bureau Chief pursuant to Section III.G.1 does not substantially comply with the specifications set forth in this Consent Order; provided, however, that the Department shall bear the burden of proof of demonstrating that the submittal does not substantially comply with the specifications of this Consent Order. Stipulated penalties may not be assessed for any reason other than the two set forth in this Paragraph.

If the Department seeks to assess stipulated penalties pursuant to this section, it shall provide written notice of that fact to the Respondents. Such written notice shall state the violation for which penalties are being assessed. If the Department issues such written notice within 15 days of the submittal deadline identified in Table XII-2, stipulated penalties may be assessed beginning with the day after the submittal deadline date. If the Department provides written notice 16 days or more after the submittal deadline, the Department may only assess stipulated

penalties beginning on the date that written notice was given to the Respondents pursuant to this Section.

III.G.3 Stipulated Penalty Amounts

Consistent with the beginning dates for assessment of stipulated penalties set forth in Section III.G.2, the Respondents shall pay to the State the following stipulated penalties for each day of noncompliance:

Days 1 through 30:	$1,000.00 per day
Days 31 and beyond:	$3,000.00 per day

The Department may, in its discretion, agree to reduce or waive the stipulated penalties that would otherwise be due under this Section (III.G.). Such decision shall not be subject to judicial review.

III.G.4 Revisions to Specifications or Schedules

The Respondents shall not be liable for stipulated penalties for failure to take any action by a deadline specified in Table XII-2 of this Consent Order if (1) the Department has approved an alternate schedule in writing, through either an approved work plan or other document, or (2) a schedule has been modified pursuant to the provisions for modification in Section III.J. If any deadline for a submittal is modified, the Parties shall modify Tables XII-2 and XII-3 to reflect the revised deadline. The Respondents must comply with the revised deadline approved by the Department and that deadline, if not met, shall be the basis for stipulated penalties pursuant to this section (III.G). The Respondents shall not be liable for stipulated penalties based on the Department's belief that a submission does not substantially comply with the requirements of this Consent Order if the submittal substantially complies with alternate requirements approved by the Department, in writing, through a work plan or other document under this Consent Order.

III.G.5 Procedure for Payment

Stipulated penalties under this Section shall be due within 45 days from the date that the Department makes a written demand for payment of stipulated penalties in accordance with Section III.G.2 (Process and Notice) and III.L (Notice to Parties). Payment shall be by check, made payable to the State of New Mexico, and shall be delivered to:

Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-2567

The check shall be accompanied by a transmittal letter referencing this Consent Order. A copy of the transmittal letter shall be delivered to the attorney for the Department at the following address:

First class mail address:
Office of General Counsel
New Mexico Environment Department
Post Office Box 26110
Santa Fe, New Mexico 87502

Overnight delivery address:
Office of General Counsel
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe, New Mexico 87501

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III.G.6 Interest

Interest shall accrue on all stipulated penalties not paid when due at the rate specified in 28 U.S.C. § 1961. Interest shall accrue from the date the penalty is due until the date it is actually paid.

III.G.7 Reservation

The Department reserves the right to seek other appropriate relief, in lieu of stipulated penalties under this section (III.G), for any failure of the Respondents to comply with any requirement, including schedules, of this Consent Order. If, however, the Department elects to assess stipulated penalties pursuant to the provisions of this section (III.G), the State will not seek a separate civil penalty or other monetary relief for the alleged deficiency identified in the Department's notice pursuant to Section III.G.2.

III.H FORCE MAJEURE

III.H.1 General

For the purposes of this Consent Order, "force majeure" shall mean any event arising from causes beyond the reasonable control of the Respondents or their respective agents, contractors, or employees that delays or prevents the performance of any of the obligations of the Respondents under this Consent Order and that could not be overcome by due diligence. A force majeure shall not include unanticipated or increased costs or expenses associated with the implementation of this Consent Order.

III.H.2 Examples of Force Majeure

A force majeure could include, but is not limited to:

1. Acts of God, natural disasters such as fire or flood, war, terrorism, insurrection, civil disturbance, or explosion;
2. A federal government shut down, such as the ones that occurred in 1995 and 1996;

3. Unanticipated breakage or accident to machinery, equipment or lines of pipe;
4. Restraint by court order;
5. Inability to obtain, at reasonable cost, any necessary authorizations, approvals, permits or licenses due to action or inaction of any governmental agency or authority other than DOE; and
6. Delays caused by compliance with applicable statutes or regulations governing contracting, procurement or acquisition procedures.

The Parties recognize that the events set forth above are merely examples of potential force majeure. Any force majeure claimed by the Respondents, whether identified in the above list or not, must meet the definition of force majeure in Section III.H.1. The Department reserves its right to evaluate each force majeure claimed by Respondents and determine whether the facts associated with such claimed force majeure meet the definition of force majeure in Section III.H.1. The Parties further agree that the absence of a type of force majeure from the list of examples set forth herein does not create any presumption or evidence that such event does not constitute a force majeure.

III.H.3 Procedure for Claiming Force Majeure

If any event occurs which causes or may cause a delay in, or which prevents or may prevent, the performance of any obligations of the Respondents under this Consent Order, the Respondents shall notify the Department orally, or in writing in accordance with Section III.L (Notice to Parties), within 72 hours of when the Respondents first knew that the event might cause a delay. Within seven business days of the Respondents' verbal notification to the Department, the Respondents shall provide a written notice to the Department in accordance with Section III.L (Notice to Parties). The notice shall describe in detail: a) the cause or causes of the delay; b) the expected duration of the delay, including any obligations that would be affected; c) the actions taken or to be taken by the Respondents to prevent or minimize the delay; and d) the timetable by which those actions will be implemented. The Respondents shall take all reasonable actions to prevent or minimize any such delay. The Respondents' failure to provide notice pursuant to the terms of this Paragraph shall constitute a waiver of any claim of force majeure as to the event in question.

The Department will notify the Respondents, in writing in accordance with Section III.L (Notice to Parties) whether it agrees or disagrees that a force majeure has occurred, and will provide such notice within seven business days after receipt of the Respondents' notice of the event. If the Department agrees in writing that a delay or anticipated delay is attributable to a force majeure event, as defined in Section III.H.1, the time for performance of the affected obligation or obligations will be extended for a period not to exceed the actual delay resulting from the force majeure event, and stipulated penalties shall not be due for such delay. If the Department does not agree that a delay or anticipated delay is attributable to a force majeure event, it will notify the Respondents in writing and provide the basis for its conclusion.

III.I DISPUTE RESOLUTION

Any dispute that arises under this Consent Order shall be subject to the procedures of this section (III.I), unless the Consent Order expressly excludes such dispute from dispute resolution.

III.I.1 Informal Negotiations

Any dispute that arises under this Consent Order shall in the first instance be the subject of informal negotiations among or between the Parties to the dispute. The period for informal negotiations shall not exceed ten business days from the date the dispute arises, unless the period is extended by written agreement of the Parties to the dispute. The complaining Party (or Parties) shall send the other Party (or Parties) a written notice of dispute by overnight mail, facsimile, or hand delivery in accordance with Section III.L (Notice to Parties). Such notice shall describe in detail the disputed issue and propose a resolution. The dispute shall be considered to have arisen when the receiving Party(ies) receives the written notice of dispute from the complaining Party(ies).

III.I.2 Tier 1 Negotiations

If the Parties are unable to resolve a dispute by informal negotiation under Section III.I.1, the dispute shall be elevated to the Department Director of the Water and Waste Management Division, the Assistant Manager for Environmental Stewardship for the DOE/National Nuclear Security Administration (NNSA) Los Alamos Site Office, and the Division Leader, Environmental Stewardship Division for the University (the "Tier 1 Officials"). Within seven business days after the expiration of the informal dispute resolution period, each of the Parties to the dispute shall submit a written statement of position to the Tier 1 Officials. The Tier 1 Officials shall review the written statements of position and shall meet and confer in an attempt to resolve the dispute. The period for Tier 1 negotiations shall not exceed five business days from the date the Tier 1 Officials receive the Parties' statements of position, unless the period is extended by written agreement of the Parties to the dispute.

III.I.3 Tier 2 Negotiations

If the Parties are unable to resolve a dispute by Tier 1 negotiations under the preceding Paragraph, the matter shall be immediately elevated to the Department Deputy Secretary, Manager for the DOE/NNSA Los Alamos Site Office, and the Associate Director for Technical Services for the University (the "Tier 2 Officials"). The Tier 2 Officials shall review the Parties' written statements of position and shall meet and confer in an attempt to resolve the dispute. The period for Tier 2 negotiations shall not exceed five business days from the date the Tier 2 Officials receive the statements, unless the period is extended by written agreement of the Parties to the dispute.

III.I.4 Tier 3 Negotiations

If the Parties are unable to resolve a dispute by Tier 2 negotiations under the preceding Paragraph, the matter shall be immediately elevated to the Department Secretary and the

Associate Administrator for Infastructure and Environment of NNSA, and the Director of Los Alamos National Laboratory (the "Tier 3 Officials"). The Tier 3 Officials shall review the Parties' written statements of position and shall meet and confer in an attempt to resolve the dispute. The period for Tier 3 negotiations shall not exceed three business days from the date the Tier 3 Officials receive the statements, unless the period is extended by written agreement of the Parties to the dispute.

III.I.5 Other Remedies

If the Parties are unable to resolve a dispute by Tier 3 negotiations under the preceding Paragraph, the Parties may agree to seek to resolve the dispute through non-binding mediation or another non-binding dispute resolution method, or the Parties may pursue any available legal remedy to resolve the dispute, which may include, for the Department, bringing an enforcement action or, for the Respondents, petitioning a court to resolve the matter. The decision or other action forming the basis of the dispute shall be deemed final for purposes of judicial review once the Tier 3 negotiations are complete.

III.I.6 Extension of Deadlines

The deadline for any obligation of the Respondents under this Consent Order that is directly affected by a dispute raised pursuant to this section (III.I) shall be extended by a period of time not to exceed the actual time taken to resolve the dispute in accordance with the procedures of this section (III.I). The invocation of the dispute resolution process under this section (III.I) shall not, however, extend, postpone, or affect in any way any obligations of the Respondents under this Consent Order not directly in dispute, unless otherwise agreed by the Department in writing. Stipulated penalties attributable to the disputed matter shall continue to accrue, but payment shall be stayed pending resolution of the dispute. If the Department prevails in the dispute, the Respondents shall pay all accrued stipulated penalties, plus accrued interest, in accordance with Section III.G.

III.J MODIFICATION

III.J.1 Procedures for Modifying Provisions of the Consent Order

The Parties may modify any of the provisions of this Consent Order. Except as provided in Sections III.L (Notice to Parties) and III.M (Work Plans and Other Deliverable Documents), any such modifications must be in writing and signed by all Parties. As provided in Section III.W.5, modifications of this Consent Order are subject to the same procedural rights that would apply to those modifications if made under the Facility's Hazardous Waste Permit pursuant to the regulations at 20.4.1.900 NMAC (incorporating 40 C.F.R. § 270.42) and 20.4.1.901 NMAC.

III.J.2 Provisions Governing Extensions of Time

The Respondents may seek an extension of time in which to perform a requirement of this Consent Order, for good cause, by sending a written request for extension of time and proposed

revised schedule to the Department. The request shall state the length of the requested extension and describe the bases for the request. The Department will respond in writing to any request for extension within ten business days following receipt of the request. If the Department denies the request for extension, it will state the reasons for the denial. If the Department does not respond in writing within ten business days, the requested extension shall automatically be granted.

As set forth in Section III.M.2 (Review, Revision, and Approval of Work Plans and Other Deliverable Documents), a failure by the Department to meet the notice dates identified in Tables XII-2 and XII-3, shall result in an automatic extension of time for Respondents.

III.K COMPLIANCE WITH APPLICABLE LAWS

III.K.1 General

The Respondents shall undertake all actions required by this Consent Order in accordance with the requirements of all applicable federal, state, and local laws and regulations. Nothing in this Consent Order shall be construed as relieving the Respondents of their obligation to comply with applicable law.

III.K.2 Atomic Energy Act

The Atomic Energy Act (AEA), as amended, 42 U.S.C. §§ 2011 *et seq.*, and the Department of Energy Organization Act, 42 U.S.C. §§ 7101 *et seq.*, and their implementing regulations, orders and directives, require DOE to protect the public health and safety, and, to this end, exclusively authorize DOE to regulate nuclear safety at its facilities. DOE's authority to regulate nuclear safety is governed by the provisions of 10 C.F.R. Parts 830 through 835. Pursuant to those regulations, DOE is required to review and approve all activities and work, including activities and work under this Consent Order, to ensure that its statutory and regulatory responsibilities for nuclear safety are met. In making determinations concerning nuclear safety, DOE follows the requirements of 10 C.F.R. Parts 830 through 835. Nothing in this Consent Order shall require the performance of any work or activity that is inconsistent with any nuclear safety requirement implemented pursuant to 10 C.F.R. Parts 830 through 835. If such an inconsistency arises, the Respondents shall provide appropriate documentation demonstrating the inconsistency to the Department.

III.K.3 Anti-Deficiency Act

No provision of this Consent Order shall be interpreted as, or constitute, a commitment or requirement that the United States shall obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341. Payment or obligation of funds by the United States is subject to the availability of appropriated funds.

III.L NOTICE TO PARTIES

Whenever under the terms of this Consent Order, any Party is required to provide notice to any other Party, or to submit any plan, report, or other document called for under this Consent Order, such notice, plan, report or other document shall be sent or directed to the following persons.

As to the Department:

Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1 Santa Fe, New Mexico 87505-6303 Telephone: (505) 428-2512 Facsimile: (505) 428-2567

As to DOE:

First Class Mail and Overnight Delivery address:
Environmental Restoration Program Manager
U.S. Department of Energy / National Nuclear Security Administration
Los Alamos Site Office
528 35th Street Los Alamos, New Mexico 87544 Telephone: (505) 667-5808 Facsimile: (505) 667-9998

As to the University:

First Class mail address:
Remediation Services Deputy Project Director
Los Alamos National Laboratory
P.O. Box 1663, MS-M992
Los Alamos, New Mexico 87545 Telephone: (505) 667-0808 Facsimile: (505) 665-4747

Overnight delivery address:
Remediation Services Deputy Project Director
Los Alamos National Laboratory
1900 Diamond Drive
Building 1237, Room 601
Los Alamos, New Mexico 87544

Any Party may change the name, title, address, phone number or fax number of the contact person noted above by providing written notice to the other Parties. The provisions of Section III.J.1 (Modification) shall not apply to such changes.

III.M WORK PLANS AND OTHER DELIVERABLE DOCUMENTS

All work plans, schedules, reports, and other deliverable documents that the Respondents are required to prepare under this Consent Order shall be submitted to the Department for review and approval.

III.M.1 Submittal of Work Plans

Each work plan shall meet or address the requirements of this Consent Order in one or more of the following ways:

1. The work plan shall provide for performance of the work in full compliance with the requirements of this Consent Order.

2. The work plan shall state that work meeting the requirements of this Consent Order has been completed. The background section of the work plan shall summarize the data or other information used to satisfy the investigation requirements of this Consent Order. The summaries shall cite supporting documents with corresponding page numbers.

3. The work plan shall propose to the Department alternate requirements that differ from those in this Consent Order. Any such proposal shall be in writing, shall specifically identify each proposed alternate requirement and how it differs from the requirement in the Consent Order, and shall be accompanied by a detailed written justification. Alternate requirements may be satisfied by previous work that is documented in the work plan as described in Paragraph 2 above. If the Department approves in writing a work plan with alternate requirements, the alternate requirements of the work plan, rather than the requirements of the Consent Order, shall be applicable and enforceable.

III.M.2 Review, Revision, and Approval of Work Plans and Other Deliverable Documents

Upon receipt of each work plan, schedule, report, or other deliverable document, the Department will review the document. The Department may either approve the document as submitted, modify the document and approve it as modified, or disapprove the document. Upon completing its review, the Department will send Respondents a written notice of approval, approval with modification, or disapproval, and will state in writing the deficiencies and other reasons for any modification or disapproval. If the Department disapproves the document, the Department may include in the written notice directions to the Respondents to modify and resubmit the document. Upon receipt of a written notice of disapproval, the Respondents shall revise the document to incorporate all modifications and comments, and otherwise correct all deficiencies that gave rise to the disapproval, or provide responses to written deficiency comments. Within 30 days after Respondents' receipt of a written disapproval, or such other time as specified by the Department, Respondents shall re-submit the revised document to the Department for approval or submit responses to written deficiency comments. The Department will either approve the revised document as submitted, modify the revised document and approve it as modified, or disapprove the revised document. Upon completing its review, the Department will send Respondents a written notice of approval, approval with modification, or disapproval, and will state in writing the deficiencies and other reasons for any modification or disapproval. If the Department disapproves the document, the Department may include in the written notice directions to the Respondents to modify and resubmit the document.

The Department anticipates that it will review all work plans and schedules, and other deliverable documents, that the Respondents are required to prepare pursuant to this Consent Order by the Department notice dates set forth in Tables XII-2 and XII-3. Timely review constitutes sending the Respondents, by the notice dates specified in Tables XII-2 and XII-3, a written notice of approval, notice of approval as modified, or directions to modify pursuant to this section (III.M.2). If additional time, beyond the notice dates specified in Tables XII-2 and XII-3, is taken to complete review and approval, including any time specified by the Department for resubmittal of a disapproved document pursuant to this Section, then the schedule for any subsequent work or deliverable document that is dependent upon such review shall be automatically extended by a period equal to such additional time. No stipulated penalties or any other liability for noncompliance with the Consent Order attributable to the Department's failure to respond by the notice dates specified in Tables XII-2 and XII-3 shall accrue to the Respondents.

III.N OFFSITE ACCESS

To the extent any requirement of this Consent Order, including any work plan approved under this Consent Order, requires access to property not owned or controlled by DOE, Respondents shall use their best efforts to obtain access from the present owners of such property to conduct required activities, and to allow the Department access to such property to oversee such activities. In the event that access is not obtained when necessary, the Respondents shall notify the Department in writing regarding their best efforts and their failure to obtain such access.

III.O ENTRY AND INSPECTION

In accordance with section 74-4-4.3 of the HWA, for purposes of enforcing the requirements of this Consent Order, the Respondents shall allow any authorized representative of the Department to enter the Facility at reasonable times and in accordance with applicable security requirements: (1) to inspect the Facility; (2) to obtain samples of any hazardous waste, soil, surface water, or ground water; and (3) to inspect and copy documents relating to this Consent Order, subject to normal security restrictions related to classified information.

The Respondents shall notify the Department in writing or by e-mail or fax of any field sampling activities undertaken pursuant to any plan or requirement of this Consent Order a minimum of 15 days prior to the sampling being conducted as required to meet the terms of this Consent Order, and shall provide the Department the opportunity to collect split samples upon request of the Department. For such events, Respondents shall provide the Department as much advance notice as is practicable.

The Respondents shall notify the Department in writing or by e-mail or fax a minimum of 15 days prior to the implementation of any plan required under this Consent Order.

Nothing in this section (III.O) shall be construed to limit or impair in any way the inspection and entry authority of the Department under the HWA, the Hazardous Waste Regulations, RCRA, or any other applicable law or regulations.

III.P AVAILABILITY OF INFORMATION

In accordance with section 74-4-4.3 of the HWA, the Respondents shall, within a reasonable time after receipt of a request from any authorized representative of the Department, furnish information to the Department relating to hazardous wastes that are or have been managed at the Facility.

Nothing in this section (III.P) shall be construed to limit or impair in any way the information gathering authority of the Department under the HWA, the Hazardous Waste Regulations, RCRA, or any other applicable law or regulation.

III.Q RECORD PRESERVATION

Until ten years after the Respondents' receipt of the Department's written notice of termination of the Consent Order pursuant to Section III.E, the Respondents shall maintain all records, documents, data, and other information required to be prepared under this Consent Order. The only exception to this requirement relates to those SWMUs for which a Class 3 permit modification for corrective action complete with or without controls has been granted by the Department pursuant to the Permit (see Section III.W Integration with Permit). The record preservation requirements for such SWMUs shall be set forth in the Permit and those permit requirements shall control and supersede the requirements of this Section. Nothing herein shall be construed as a waiver of any attorney client, work product or other privilege that the Respondents might otherwise possess.

III.R PENDING ACTIONS

Upon entry of this Consent Order, and in consideration of the Respondents' agreement to perform the work under this Consent Order, the Department hereby withdraws and vacates the following: (i) the Final Order entitled "Order Proceeding Under the New Mexico Hazardous Waste Act §§ 74-4-10.1 and 74-4-13," issued to the Respondents on November 26, 2002; (ii) the September 9, 2002 revision of the Installation Work Plan ("IWP") Work Schedule; and (iii) the Compliance Order No. HWB 03-02 issued to the Respondents on April 25, 2003.

The United States and the University have filed lawsuits challenging the Section 13 Order and the 2002 IWP Work Schedule. Given that this Consent Order vacates those actions, and thereby renders the lawsuits moot, the United States and the University will dismiss their respective federal and state court lawsuits, which are captioned as follows: 1) *United States v. Ron Curry* (Civil No. 03-1273 LH/RHS) (D.N.M.); 2) *United States v. Ron Curry* (Ct. App. No. 23,693) (N.M. Ct. App.); 3) *United States v. Ron Curry* (Ct. App. No. 23,496) (N.M. Ct. App.); 4) *The Regents of the University of California v. Ron Curry* (Civil No. 02-1631 LFG/WDS) (D.N.M.); 5) *The Regents of the University of California v. Ron Curry* (Ct. App. No. 23,698) (N.M. Ct. App.); and 6) *The Regents of the University of California v. Ron Curry* (Ct. App. No. 23,471) (N.M. Ct. App.).

III.S STATE'S COVENANT NOT TO SUE

In consideration of the actions that will be performed by the Respondents under the terms of this Consent Order, and except as specifically provided in Section III.T (State's Reservation of Rights), the State covenants not to sue or take administrative action against the Respondents, their respective officers, agents, successors, or assigns, under the HWA, the SWA, or RCRA, for matters addressed in this Consent Order. This covenant not to sue shall take effect upon the Effective Date of this Consent Order. This covenant not to sue extends only to the Respondents and their respective officers, agents, successors, and assigns and does not extend to any other person. This covenant not to sue shall survive the termination of this Consent Order.

III.T STATE'S RESERVATION OF RIGHTS

As provided in Section III.U, nothing herein shall prevent the State from seeking legal or equitable relief, either administratively or judicially, to enforce the requirements of this Consent Order. Moreover, nothing herein shall prevent the State from taking administrative action to implement the requirements of this Consent Order (e.g., approving or disapproving work plans, issuing certificates of completion). Finally, nothing herein shall prevent the State from taking appropriate action to address conditions at the Facility that constitute an emergency situation or that present an immediate threat to public health or the environment.

The covenant not to sue set forth in Section III.S does not pertain to any matters not addressed in this Consent Order. The State reserves, and this Consent Order is without prejudice to, all rights against the Respondents with respect to all such other matters, including, but not limited to, the following:

1. Conditions unknown to the Department at the time of issuance of a completion certificate pursuant to Section VII.E.6.b of this Consent Order, which are discovered following issuance of the completion certificate, where the previously unknown conditions together with other relevant information indicate that a particular completion certificate is not protective of human health or the environment;

2. Information unknown to the Department at the time of issuance of a completion certificate pursuant to Section VII.E.6.b of this Consent Order, which is discovered following issuance of the completion certificate, where the new information together with other relevant information indicate that a particular completion certificate is not protective of human health or the environment;

3. Liability arising from the past, present, or future disposal or release of Contaminants outside the Facility to the extent the State obtains information concerning such disposal or release following termination of this Consent Order and such information was not available to the Department at the time of termination;

4. Liability arising from the future disposal or release of Contaminants at the Facility to the extent the State obtains information concerning such disposal or release following

termination of this Consent Order and such information was not available to the Department at the time of termination;

5. Liability for damages for injury to, destruction of, or loss of natural resources and the costs of any natural resource damage assessment or other related costs, and liability for damages under any federal or state statute (except for such liability, if any, under the HWA, SWA or RCRA) or federal or state common law, for past, present or future releases of contaminants to the environment;

6. Criminal liability; and

7. Liability for violation of federal or state law, which occurs during or after implementation of the corrective action.

Although this Consent Order does not address radionuclides or radionuclide contamination at the Facility, the State reserves the right to bring any action, including judicial or administrative action, under any appropriate authority, to compel the Respondents to monitor and report radionuclide contamination at or from the Facility, to consider such radionuclide contamination in conducting risk assessment, and to clean up such radionuclide contamination.

Respondents reserve all available defenses to any action reserved by the State under this section (III.T).

III.U ENFORCEMENT

This Consent Order is an enforceable document. If the Respondents violate any requirements of this Consent Order, the State's sole remedy for such noncompliance shall be to enforce those requirements pursuant to applicable law, subject, however, to the provisions of Section III.G.7, which apply where the State has sought stipulated penalties pursuant to this Consent Order.

The State maintains that it may take the following actions, or some combination of the following actions, to enforce the requirements of this Consent Order: issue a compliance order under section 74-4-10 of the HWA seeking injunctive relief or civil penalties for Respondents' noncompliance with the requirements of the Consent Order; file a civil action under sections 74-4-10 and 74-4-10.1(E) of the HWA or section 7002(a) of RCRA, 42 U.S.C. § 6972(a), seeking injunctive relief or civil penalties for alleged violations of the Consent Order; and file an action seeking criminal penalties under section 74-4-11 of the HWA. The State also maintains that each requirement of this Consent Order is an enforceable "requirement" of the HWA within the meaning of section 74-4-10 and an enforceable "requirement" of RCRA within the meaning of section 7002(a)(1)(A), 42 U.S.C. § 6972(a)(1)(A). The State further maintains that the list of authorities identified in this Paragraph is not exhaustive and reserves all rights to take any action authorized by law to enforce the requirements of this Consent Order. The State maintains that citizens may sue to enforce the requirements of this Consent Order pursuant to section 7002(a) of RCRA, 42 U.S.C. § 6972(a), if Respondents violate those requirements.

The Respondents reserve any and all rights and defenses to any enforcement action taken by the State or any citizen, and nothing in this Consent Order will constitute a waiver of such rights or defenses.

III.V RELATIONSHIP TO WORK COMPLETED

This Consent Order shall be construed to avoid duplication of work already satisfactorily completed as determined by the Department pursuant to its current HWA authority or by EPA pursuant to its RCRA authority prior to delegation of the RCRA program to the State. Investigations and other work that have been satisfactorily completed prior to the effective date of this Consent Order, that fulfill the substantive requirements of this Consent Order, and that have been approved by the Department or EPA, in writing, shall be deemed to comply with this Consent Order.

III.W INTEGRATION WITH PERMIT

III.W.1 General

The Department has determined that all corrective action for releases of hazardous waste or hazardous constituents at the Facility, required by sections 3004(u) and (v) of RCRA, 42 U.S.C. §§ 6924(u) and (v), and sections 74-4-4(A)(5)(h) and (i) and 74-4-4.2(B) of the HWA, shall be conducted solely under this Consent Order and not under the current or any future Hazardous Waste Facility Permit ("Permit"), with the exception of the following four items which will be addressed in the Permit and not in this Consent Order: (1) new releases of hazardous waste or hazardous constituents from operating units at the Facility; (2) the closure and post-closure care requirements of 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264, Subpart G), as they apply to operating units at the Facility; (3) implementation of the controls, including long-term monitoring, for any SWMU on the Permit's Corrective Action Complete With Controls list, which is described in Section III.W.3.b; and (4) any releases of hazardous waste or hazardous constituents that occur after the date on which this Consent Order terminates pursuant to Section III.E.2. The Department has determined that setting forth corrective action requirements in this Consent Order in lieu of the Permit fully complies with the requirements of section 3004 of RCRA, 42 U.S.C. § 6924, and section 74-4-4.2(B) of the HWA.

III.W.2 Effect of Consent Order on Permit

In addition to the four items listed in Section III.W.1 above, the Permit will include a list of SWMUs requiring corrective action under this Consent Order. That list is for tracking purposes only.

The Parties enter into this Consent Order based on their understanding that there shall be only one enforceable instrument for corrective action relating to the Facility, except as provided in Section III.W.1, and that such instrument is this Consent Order. For the purposes of any enforcement action taken by the State or any third party, other than the items listed in Section III.W.1, compliance with the terms of this Consent Order constitutes compliance with the requirements for corrective action under RCRA and the HWA and their implementing regulations, including section 3004(u) and (v) of RCRA, 42 U.S.C. § 6924(u) and (v), 40 C.F.R.

Part 264, Subpart F, sections 74-4-4.2(B) and 74-4-4(A)(5)(h) and (i) of the HWA and section 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264, Subpart F). Upon the effective date of this Consent Order, the sole mechanism for enforcing corrective action requirements, except as provided in Section III.W.1, shall be this Consent Order. The State will not take any action to enforce the corrective action requirements of the existing Permit, except as to those items listed in Section III.W.1.

This Consent Order sets forth corrective action requirements for certain Contaminants that are not hazardous wastes or hazardous constituents. The Department reserves any right it may have to impose long-term monitoring or other activities relating to such Contaminants following issuance of a certificate of completion under this Consent Order. Such requirements shall not be imposed through this Consent Order, however.

III.W.3 Modification of Permit

III.W.3.a Class 3 Permit Modification to Remove Corrective Action Requirements

The Facility Permit currently contains corrective action requirements. Given the Department's position that corrective action shall be conducted under this Consent Order and not under the Permit as provided in Section III.W.1, and the Parties' understanding that the sole enforceable mechanism for corrective action will be this Consent Order, except as provided in Section III.W.1, the Respondents intend to seek a Class 3 permit modification for the Permit pursuant to 20.4.1.900 NMAC (incorporating 40 C.F.R. § 270.42(c)) ("Permit Modification"). That Permit Modification request, consistent with Section III.W.1, will seek to remove all corrective action requirements of the Permit for releases of hazardous waste or hazardous constituents at the Facility, with the exception of the four items specifically identified in Section III.W.1. The Permit Modification request will also provide that the terms of this Consent Order are not enforceable as terms of the Permit, except as provided in Section III.W.1. Finally, as set forth in Section III.W.3.b, the Permit Modification request will authorize the Respondents to seek additional permit modifications to remove a SWMU from the list of SWMUs requiring corrective action to one of two lists identified in Section III.W.3.b concerning SWMUs for which corrective action is complete. The Department supports the Permit Modification.

III.W.3.b Class 3 Permit Modification For Corrective Action Complete

Whenever the Respondents obtain a certificate of completion pursuant to the terms of this Consent Order for a SWMU or group of SWMUs, the Respondents can initiate a "Class 3 Permit Modification for Corrective Action Complete" pursuant to the terms of the Permit. The Permit Modification described in Section III.W.3.a will provide that once a Class 3 Permit Modification for Corrective Action Complete is granted, the SWMU or SWMUs that are the subject of that modification shall be removed from the list of SWMUs requiring corrective action and placed onto one of the following two lists: "Corrective Action Complete With Controls"; or "Corrective Action Complete Without Controls." These two lists are for informational purposes only and are not enforceable; provided, however, that where controls are identified for a SWMU, only those controls (e.g., institutional controls, engineered barriers, long-term monitoring and operation and

maintenance) are enforceable under the Permit. The Department's determination that corrective action is complete for a SWMU placed on either the Corrective Action Complete With Controls list or the Corrective Action Complete Without Controls list will be subject to the State's reservation of rights for new information or unknown conditions. During the pendency of this Consent Order, if the Department seeks to require additional work at any SWMU contained on either of the two lists for Corrective Action Complete, it will initiate a Permit modification to remove the SWMU from such list.

III.W.4 Renewal of Permit

The requirements of this Consent Order shall not terminate upon renewal of the Permit issued to the Respondents. The renewed Permit, and any future modifications, renewals, or reissuance of the Permit, will not include any corrective action requirements, nor any other requirement that is duplicative of this Consent Order. The Permit or any renewed Permit can include the four excepted items and the list of SWMUs requiring corrective action described in Section III.W.1.

III.W.5 Preservation of Procedural Rights

This Consent Order hereby incorporates all rights, procedures and other protections afforded the Respondents and the public pursuant to the regulations at 20.4.1.900 NMAC (incorporating 40 C.F.R. § 270.42) and 20.4.1.901 NMAC, including, but not limited to, opportunities for public participation, including public notice and comment, administrative hearings, and judicial appeals concerning, for example, remedy selection decisions of the Department.

III.W.6 Contingencies

The Department hereby commits to process the Permit Modification described in Section III.W.3.a (Class III Permit Modification to Remove Corrective Action Requirements) expeditiously. In making this commitment, the State recognizes that the Respondents have entered into this Consent Order based on their understanding that there shall be only one enforceable instrument for corrective action and that such instrument is this Consent Order. (See Section III.W.2 Effect of Consent Order on Permit). If the Department fails to issue for public comment a draft Permit Modification as described in Section III.W.3.a within 6 months after the date a Permit Modification request is submitted, this Consent Order automatically shall be vacated. In such circumstance, the Parties agree to meet and confer within one week following the vacating of the Consent Order in an attempt to agree upon the most efficient approach to setting forth the corrective action requirements in an enforceable document.

If the Department denies the Permit Modification request and the basis for the denial can be cured, the Parties will promptly take all appropriate actions to cure the identified deficiency. This Consent Order automatically shall be vacated 30 days after the Department's denial of the Permit Modification request, unless the basis for the permit modification denial can be cured.

If the Department grants the Permit Modification request, and a court of competent jurisdiction determines that corrective action requirements for releases of hazardous waste or hazardous waste constituents in this Consent Order must be included in the Permit, the Respondents shall submit a Class 3 Permit Modification request that incorporates those terms of the Consent Order

which, as of the date of the modification, have not been met. Once that Permit Modification becomes effective, this Consent Order automatically shall be vacated.

III.X SEVERABILITY

If any provision or authority of this Consent Order is held by a court of competent jurisdiction to be invalid, if that provision or authority is severable from the remainder of the Consent Order, the remainder of the Consent Order shall remain in force and shall not be affected by the court's order and ruling. Additionally, if the application of this Consent Order to any party or circumstance is held by a court of competent jurisdiction to be invalid, the application of this Consent Order to other parties or circumstances shall remain in force and shall not be affected thereby.

III.Y LAND TRANSFER

III.Y.1 Transfer of Facility Property in Fee

The provisions of this section (III.Y.1) shall apply for the duration of the Consent Order to any transfer in fee of Facility property from the United States to another entity during DOE's operational control of the property, to the extent that such property is subject to any requirement under the Consent Order.

III.Y.1.a Notice and Meeting

Prior to the United States transferring in fee any portion of the Facility to another entity, DOE will provide written notice of such transfer to the Department at least 120 days prior to the date of transfer. Appropriate representatives of DOE, the Department, and the entity to which the United States intends to transfer title to the property ("the transferee") will meet within 30 days after issuance of DOE's written notice of transfer. At the meeting, the Parties will discuss the transferee's intended use of the property that is the subject of the transfer ("the property"). The Department and DOE will review the corrective measures, including remedy, taken with regard to the property, in light of the transferee's intended use of the property.

III.Y.1.b Department's Determination

Within 60 days after the meeting described in Section III.Y.1.a, the Department will determine if the corrective measures implemented by the Respondents with regard to the property are protective of human health and the environment in light of the transferee's intended use of the property.

(i) If the Department determines that the corrective measures implemented by the Respondents with regard to the property are not protective of human health and the environment in light of the transferee's intended use of the property, the Department must explain, in writing, why such measures are not protective, and must identify the specific additional corrective action requirements that Respondents must complete with regard to the property. If DOE thereafter still intends to go through with the transfer, Respondents will endeavor to conduct any additional corrective action requirements identified by the

Department prior to transfer. With the Department's prior approval, DOE may conduct such additional corrective action requirements following transfer, pursuant to a schedule approved by the Department. Such schedule shall be enforceable pursuant to the terms of this Consent Order.

(ii) If the Department determines that the corrective measures implemented by Respondents with regard to the property are protective of human health and the environment in light of the transferee's intended use of the property, no additional corrective action requirements will be imposed with regard to the property prior to transfer. If the Department determines, pursuant to this paragraph, that no additional corrective measures will be imposed, DOE shall not be precluded from transferring the property immediately following receipt of the Department's determination, even if that determination is received prior to the expiration of the review period.

The Department must notify Respondents no later than 60 days following the meeting required by Section III.Y.1.a as to whether additional corrective action measures are necessary with regard to the property given the transferee's intended use of the property. If the Department does not notify Respondents within this time-frame, the Department will be deemed to have concluded that no additional corrective measures are necessary given the transferee's intended use of the property.

III.Y.1.c Terms of Transfer

In transferring land to another entity, the United States shall comply with the terms of section 120(h) of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended ("CERCLA"), 42 U.S.C. § 9620(h). That section applies to any property owned by the United States on which any hazardous substance was stored for one year or more, known to have been released, or disposed of. Consistent with CERCLA section 120(h)(3)(A), the United States will include in the deed transferring the property the information required by CERCLA section 120(h)(3)(A)(i), the covenant required by CERCLA section 120(h)(3)(A)(ii), and the access clause required by CERCLA section 120(h)(3)(A)(iii). The United States may defer the requirement of section 120(h)(3)(A)(ii)(I), consistent with the terms of CERCLA section 120(h)(3)(C).

III.Y.1.d Restricted Use

When the United States transfers property that has been cleaned to a level less protective than a residential use scenario, the United States will include in the deed a restriction that limits future use of the property to the particular use scenario on which DOE has based its cleanup of the property (e.g., if the property was cleaned based on an industrial use scenario, future use of the property would be limited to industrial use). The language of the deed restriction governing future land use necessarily will differ for each deed, depending upon the facts and circumstances of the property being transferred. Such restriction shall, at a minimum, be consistent with the following language:

The property shall not be used for any purpose other than [define the use scenario

on which DOE has based its cleanup of the property]. That means that the property shall not be used for [define less restrictive uses].

At least 30 days prior to transfer, DOE shall provide the Department the opportunity to review and comment upon the language of the proposed deed restriction limiting future land use, as described generally in the preceding Paragraph. The Department shall provide comments on such proposed language no later than 15 days after receipt of DOE's proposed language.

III.Y.1.e Enforceability Against Transferee

The Parties agree that the covenant required by CERCLA section 120(h)(3)(A)(ii), and the deed restriction described in Section III.Y.1.d (to the extent the property is not remediated for unrestricted use), are requirements within the meaning of CERCLA section 310(a)(1), 42 U.S.C. § 9659(a)(1).

The Parties agree that the contract of sale between the United States and the transferee will state that the parties to the contract agree that the deed restriction to be set forth in the deed is a requirement within the meaning of CERCLA section 310(a)(1), 42 U.S.C. § 9659(a)(1). Further, the Parties agree that such statement within the Contract of Sale will survive the transfer of the deed.

The Parties also agree that the deed transferring title from the United States to the transferee will state that the restriction on land use set forth in the deed is intended to be an equitable servitude, that both the Department and the transferor are beneficiaries of the equitable servitude, that the parties intend for the restriction on land use to run with the land and to bind subsequent transferees, that such restriction is enforceable by the Department and the transferor against any subsequent transferee that fails to comply with its terms. The deed shall be recorded in the appropriate recording office in the chain of title of the property to give notice of the use restriction to subsequent transferees of the property.

III.Y.1.f EPA Institutional Controls Tracking System

For any deed transferring title from the United States to the transferee that contains a restriction on future land use, DOE will, within 90 days of transfer of the property, notify EPA, Region VI, of the transfer and identify for EPA the location of the property that is the subject of the transfer so that EPA can, as appropriate, include such property in its pilot institutional controls data base and tracking system. This database and tracking system, among other things, identifies former United States' property on which deed restrictions have been placed.

III.Y.2 Transfer of Control of Facility Property to Another Federal Entity

The provisions of this section (III.Y.2) shall apply for the duration of the Consent Order to any transfer of operational control of Facility property from DOE to another agency, department, or instrumentality of the United States, to the extent that such property is subject to any requirement under the Consent Order.

III.Y.2.a Notice and Meeting

If DOE decides or learns of a decision that operational control of any portion of the Facility will be transferred from DOE to another agency, department or instrumentality of the United States (the "transferee agency"), DOE will provide written notice of such operational transfer to the Department at least 120 days prior to the transfer, if practicable. If, however, DOE decides or learns of such decision fewer than 120 days prior to the transfer, DOE will provide written notice to the Department as soon thereafter as is reasonably practicable. Appropriate representatives of DOE will meet with representatives of the Department and the transferee agency. Such meeting shall take place within 30 days after DOE's written notice under this Paragraph. The meeting may occur following the change in operational control, if the United States determines that the change in operational control cannot be delayed. At the meeting, the Parties will discuss the transferee agency's intended use of the property. The Department and DOE will review the corrective measures, including remedy, taken with regard to the property, in light of the transferee agency's intended use of the property.

III.Y.2.b Department's Determination

Within 60 days after the meeting, the Department will determine if the corrective measures implemented by Respondents with regard to the property are protective of human health and the environment in light of the transferee agency's intended use of the property.

(i) If the Department determines that the corrective measures implemented by Respondents with regard to the property are not protective of human health and the environment in light of the transferee agency's intended use of the property, the Department must explain, in writing, why such measures are not protective, and must identify the specific additional corrective action requirements that Respondents must complete with regard to the property. To the extent practicable, Respondents will endeavor to conduct any additional corrective action requirements identified by the Department prior to the transfer of operational control. DOE may, however, conduct such additional corrective action requirements following transfer of operational control, pursuant to a schedule approved by the Department. Such schedule shall be enforceable pursuant to the terms of this Consent Order.

(ii) If the Department determines that the corrective measures implemented with regard to the property are protective of human health and the environment in light of the transferee agency's intended use of the property, no additional corrective action work will be taken with regard to the property.

The Department must notify Respondents no later than 60 days following the meeting required by Section III.Y.2.a as to whether additional corrective action measures are necessary with regard to the property. If the Department does not notify Respondents within this time-frame, the Department will be deemed to have concluded that no additional corrective measures are necessary given the transferee agency's intended use of the property.

III.Y.2.c Contrary Land Use

If the Department determines that the transferee agency plans to use, or is using, the subject property in a manner contrary to the use(s) discussed at the meeting described in Section III.Y.2.a, the Department shall notify DOE and the transferee agency in writing. In such writing, the Department shall explain its concerns with regard to the proposed or current use of the property. Within 30 days thereafter DOE, the Department, and the transferee agency shall meet to discuss the Department's stated concerns. The State reserves its right to take any action, including administrative or judicial action, to address the contrary land use.

Table III-1

Explosive Compounds (Including Propellants, Pyrotechnics, and Degradation Products)

Constituent	**Abbreviation or Synonym**
2-Amino-4,6-Dinitrotoluene	2-Am-DNT
4-Amino-2,6-Dinitrotoluene	4-Am-DNT
2,4-Diamino-6-Nitrotoluene	2,4-DANT
2,6-Diamino-4-Nitrotoluene	2,6-DANT
3,5-Dinitroaniline	3,5-DNA
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX
2-Nitrotoluene	2-NT
3-Nitrotoluene	3-NT
4-Nitrotoluene	4-NT
Pentaerythritol tetranitrate	PETN
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX or Cyclonite
Triaminotrinitrobenzene	TATB
Tris (o-cresyl) phosphate	TCP
Methyl-2,4,6-trinitrophenylnitramine	Tetryl
2,4,6-Trinitrotoluene	TNT

~~III.Y.3~~

III.Z PUBLIC ENVIRONMENTAL DATABASE

The Respondents shall maintain a publically accessible database containing all data from environmental media (i.e., soil, sediment, surface water, groundwater, air, and biota) collected by the Respondents as part of environmental investigation and monitoring. The database shall include the capacity for the spatial display of data, the comparison of data to standards and reference values, and the plotting of trends in the data. Additionally, to the extent data are collected pursuant to the requirements of the Consent Order, the database shall include the analytical quality assurance/quality control and data validation information. As new data

becomes available, the Respondents shall enter all such data into the public database through updates on no less than a monthly basis. The Respondents shall correct any inaccuracy in the data within 60 days of discovery of such inaccuracy.

This database and the data in it shall not be considered a submittal under Section III.G.

IV. FACILITY INVESTIGATION

IV.A GENERAL REQUIREMENTS

This Section (IV.A) provides general requirements for the investigation of contamination at the Facility. The requirements of this Section (IV.A) shall apply to the canyon watershed investigations under Section IV.B and the TA investigations under Section IV.C.

IV.A.1 Background

Prior to the issuance of this Consent Order, the Respondents began investigations to evaluate for the presence of contamination at the Facility and performed corrective measures pursuant to the Facility's Hazardous Waste Permit. The results of previous investigation work are to be incorporated into the investigations conducted under this Consent Order. However, additional investigation is necessary to fully characterize the nature, extent, fate, and transport of contaminants that have been released to the environment, including air, soil, sediment, surface water, and groundwater, to determine the need for and scope of corrective action.

The Respondents have established a groundwater-monitoring network for the purpose of hydrogeologic characterization and groundwater quality sampling. The current Facility monitoring network includes municipal supply wells, test wells, monitoring wells, and springs. Implementation of the groundwater monitoring requirements of this Consent Order will fulfill the groundwater monitoring requirements of the Hazardous Waste Regulations, 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264, Subpart F). Pursuant to the Facility's Hazardous Waste Permit, the Respondents have prepared and are implementing a Hydrogeologic Workplan, dated May 1998, to characterize the hydrogeologic system beneath the Facility. The requirements of this Consent Order replace the requirements of the Hydrogeologic Workplan. Based on the results of groundwater investigations conducted in accordance with this Consent Order or other information, the Department may require modification of the number and location of piezometers and wells to be installed as part of this Consent Order.

IV.A.2 General Facility Information

The Respondents shall submit to the Department the following information. These submittals are one-time submittals, unless new information becomes available. In that case, the affected submittals shall be updated and resubmitted triennially beginning in 2014:

1. Facility-wide topographic map;

2. Facility-wide geologic maps, surface geology, and structure contour maps;

3. Maps and tables indicating the surveyed coordinates and locations of all existing springs, wells, and surface water gaging stations;

4. Fault and high-fracture density zone maps;

5. Maps presenting the discharge points of seeps and springs, with tables indicating estimated flow, associated stratigraphic units, and discharge point elevations;

6. Alluvial groundwater maps depicting known saturated aquifer thickness and extent and suspected extent of contamination;

7. Perched-intermediate groundwater maps presenting aquifer thickness and flow direction data, and known and suspected vertical and lateral extents of contamination;

8. Regional groundwater maps depicting measured groundwater elevations and known flow direction(s);

9. The Facility's existing Hydrogeologic Atlas, including water-level contour map of regional aquifer and known radii-of-effects from pumping of municipal supply wells;

10. Diagrams using representative data showing groundwater flow regimes as indicated by water chemistry (e.g., Stiff, Piper diagrams) for all groundwater zones; and

11. Periodic water level data presented graphically and in tabular format.

The information shall be submitted to the Department, in hardcopy and CD-ROM, beginning 30 days after the effective date of this Consent Order, and no later than March 31 of each subsequent calendar year. The information shall be submitted triennially after 2011. The first update of the information after 2011 must be submitted no later than March 31, 2014.

IV.A.3 Groundwater Investigation

The Respondents shall conduct investigations of groundwater in accordance with Department-approved work plans to fully characterize the nature, vertical and lateral extent, fate, and transport of groundwater contamination originating from the Facility to determine the need for, and scope of, corrective action. The investigation shall include an evaluation of the physical, biological and chemical factors influencing the transport of contaminants in groundwater. The Respondents shall implement the groundwater investigation requirements in accordance with the schedule set forth in Section XII of this Consent Order. All data shall be collected according to EPA and industry accepted methods and procedures, and in accordance with Section IX of this Consent Order.

IV.A.3.a Objectives

The Respondents shall implement the groundwater investigations, including all sampling and analysis, to determine the following:

1. nature and extent of contamination; historical and current releases of contaminants to groundwater;

2. fate and transport, including boundary conditions, of releases of contaminants within groundwater;

3. the depth to groundwater, groundwater elevations, water table elevations, and potentiometric surface distributions;

4. groundwater flow directions and velocities;

5. migration of groundwater across hydrostratigraphic boundaries;

6. site-specific, where applicable, watershed and regional water balance information for evaluating contaminant fate and transport including:

    - recharge and discharge locations, rates, and volumes,
    - evapotranspiration data,
    - stream-flow data;

7. water supply well pumping influences, including data for wells not owned by the Respondents, if available;

8. saturated and unsaturated hydraulic-conductivity ($K_{x,y,z}$), porosity, effective porosity, permeability, transmissivity, particle-size, storage coefficients, and estimated fracture/secondary porosity for each hydrostratigraphic unit from core and geophysical logging of boreholes;

9. contaminant concentrations from soil, rock, sediment, and vapor sample analyses and absorption coefficients (K_ds) for each hydrostratigraphic unit; and

10. changes in groundwater chemistry and the causes.

In selecting sites for new wells, the Respondents shall consider paleotopography, fracture density and orientation, source areas, contaminant characteristics, geologic structures, groundwater flow direction, and the occurrences of groundwater. All existing and newly installed wells and piezometers shall be surveyed in accordance with the requirements described in Sections IX.B and X of this Consent Order.

IV.A.3.b Groundwater Monitoring Plan

Within ninety (90) days after the effective date of this Consent Order, the Respondents shall submit to the Department for review and written approval an Interim Facility-Wide Groundwater Monitoring Plan (Interim Plan). The Interim Plan, approved pursuant to the procedures in Section III.M of this Consent Order, shall provide for all groundwater and spring monitoring necessary to fulfill the requirements of this Consent Order. The Interim Plan shall state the proposed locations and frequency of groundwater sampling, the proposed parameters for analysis, and the proposed methods for sampling and analysis. The sampling schedule in Table XII-5 shall be used to develop the Interim Plan. Results of previous groundwater monitoring at the Facility may be used as guidance for development of the Interim Plan. All groundwater monitoring and sampling implemented pursuant to this Consent Order shall begin after, and in

accordance with, an Interim Plan that has been approved by the Department pursuant to Section III.M. The Interim Plan shall comply with the investigation methods and procedures set forth in Section IX of this Consent Order. The plan shall be prepared in accordance with Section XI.B of this Consent Order. Submittal of the initial eight watershed-specific periodic monitoring reports may be staggered over the first year of groundwater monitoring conducted under this Consent Order. This may be accomplished by submitting two watershed-specific periodic monitoring reports for different watersheds to the Department per quarter starting 180 days after the Department's approval of the initial Interim Plan.

The Respondents shall revise and update the Interim Plan annually to propose changes to the monitoring plan (e.g., to include newly installed monitoring wells; to remove wells not providing good quality data, if approved by the Department; and to make any other appropriate changes). The Respondents shall submit the revised and updated plan to the Department for approval ninety (90) days after each anniversary of the effective date of this Consent Order.

After completing the installation of all additional monitoring wells in a canyon watershed or at a specific site as described in Section IV.B of this Consent Order, the Respondents shall submit to the Department for review and written approval a watershed- or site-specific long-term groundwater monitoring plan for each watershed or identified site or sites. Upon Department approval of a long-term monitoring plan for a specific watershed, site or sites, the requirements of the long-term monitoring plan shall apply and shall supersede the requirements of the watershed- or site-specific section of the Interim Plan.

IV.A.3.c Geophysical Investigations

The Respondents shall conduct geophysical and geochemical investigations in accordance with work plans approved under or incorporated into this section (IV) and with Section IX of this Consent Order. Pursuant to those approved work plans, the Respondents shall collect core and open-hole geophysical measurements from each boring to meet the purposes of this Consent Order as stated in Section III.A. Cased hole geophysical logging may be approved by the Department on a site-specific basis, but is not preferred because of the limited logging tool suite and reduced resolution of currently available geophysical equipment.

IV.A.3.d Background Investigation

The Respondents shall determine the background concentrations for naturally occurring metals and general chemistry parameters in alluvial, intermediate , and regional groundwater. Within 180 days after the effective date of this Consent Order, the Respondents shall submit to the Department for review and written approval a Groundwater Background Investigation Report to determine Facility background concentrations for naturally occurring metals in groundwater at or near the Facility. The background investigation report shall state the background concentration for each metal and the general chemistry parameters, and state the bases for selecting each such concentration. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order.

IV.A.3.e Monitoring Wells and Piezometers

The Respondents shall comply with the requirements of this section (IV.A.3.e) for the installation of all alluvial monitoring wells, piezometers, intermediate zone monitoring wells, and regional monitoring wells.

All well construction and installation shall be conducted in accordance with Sections IX and X of this Consent Order, and according to the schedule set forth in Section XII of this Consent Order. All monitoring and sampling shall be conducted in accordance with Section IX of this Consent Order, and according to the schedule set forth in Section XII of this Consent Order.

The Department shall approve in writing all drilling locations, monitoring well and piezometer construction and installation details, sampling depths, and abandonment activities prior to the start of the activities.

IV.A.3.e.i Alluvial Wells and Piezometers

The Respondents shall submit work plans for construction of alluvial wells and piezometers that meet the following requirements, subject to the procedures in Section III.M of this Consent Order.

1. The alluvial well borings shall be advanced to minimum depths of five ft below the alluvium-bedrock interface.

2. Samples of alluvial sediments and underlying bedrock shall be collected for hydraulic and soil property testing and for analysis to determine the presence of contaminants at depths or intervals approved by the Department and in accordance with the methods described in Section IX.B of this Consent Order.

3. Alluvial wells and piezometers shall be constructed and developed in accordance with Section X of this Consent Order. Wells and piezometers that are abandoned shall be abandoned in accordance with the procedures for abandonment in Section X.D of this Consent Order.

4. Samples shall be obtained from each boring between the ground surface and one ft below the ground surface (0.0-1.0 ft interval), at five-ft intervals, at the alluvium-bedrock contact, and at the maximum depth of each boring in accordance with the methods described in Section IX.B of this Consent Order.

5. Field screening and chemical analyses of collected samples shall be conducted in accordance with Section IX of this Consent Order.

6. Selected soil, rock, and sediment samples collected during drilling activities shall be submitted to an analytical laboratory for the required analyses.

7. Site-specific or watershed-specific work plans shall be prepared in accordance with Sections IX and XI.B of this Consent Order. The Respondents may request site-specific

modifications to the work plans, including the required analytical suite, based on known site or watershed histories and previous investigation results in the site-specific investigation or monitoring work plans submitted to the Department prior to the start of field activities.

8. Groundwater samples shall be submitted for the analyses required in this section (IV) and Section IX of this Consent Order.

9. Groundwater monitoring data and groundwater samples shall be collected from each well at the frequencies specified in and in accordance with the requirements of this section (IV) and Section IX of this Consent Order. In accordance with Section IV.B of this Consent Order, the Respondents shall submit to the Department for review and written approval a watershed- or site-specific long-term groundwater monitoring plan for each watershed, site or area. Upon Department approval of the long-term monitoring plan for a specific watershed, site or area, the requirements of the long-term monitoring plan shall apply and shall supersede the requirements of the watershed- or site-specific section of the Interim Plan.

Piezometers should be used only for the purpose of determining the extent of saturation and hydraulic gradients. Piezometers should not be used to characterize or monitor the extent of contamination. The Department may approve the use of other methods to determine the extent of subsurface saturation.

IV.A.3.e.ii Intermediate Wells

The Respondents shall submit work plans for construction of intermediate wells that meet the following requirements, subject to the procedures in Section III.M of this Consent Order.

1. As appropriate, based on site-specific conditions, geophysical measurements and soil, rock, vapor, and groundwater samples shall be collected from each boring prior to well construction in accordance with Section IX of this Consent Order.

2. After completion of the borings, the Respondents shall submit a monitoring well design plan to the Department for approval prior to construction of the intermediate zone wells. The Respondents shall not leave any borehole open or cased with drill casing for longer than five (5) days.

3. The Department may impose specific conditions for well construction, require borings to be extended to the regional aquifer, or require the drilling of additional borings that intersect intermediate perched saturated zones or the regional aquifer based on investigation results.

4. Field screening and sample collection of soil, rock, vapor, and groundwater samples shall be conducted in accordance with Section IX of this Consent Order.

5. Selected soil, rock, and sediment samples shall be submitted to an analytical laboratory for the required analyses.

6. Site-specific or watershed-specific work plans shall be prepared in accordance with Section XI of this Consent Order. Site-specific modifications to the required analytical suite and sampling frequency based on known site or watershed histories and previous investigation results may be requested by the Respondents in site-specific investigation or monitoring work plans submitted to the Department prior to the start of field activities.

7. Groundwater samples shall be submitted for the analyses required in Section IV.B below and Section IX of this Consent Order.

8. Groundwater monitoring data and groundwater samples shall be collected from each well at the frequencies specified in and in accordance with the requirements of this section (IV) and Section IX of this Consent Order. In accordance with Section IV.B of this Consent Order, the Respondents shall submit to the Department for review and written approval a watershed-specific long-term groundwater monitoring plan for each watershed. Upon Department approval of the long-term monitoring plan for a specific watershed, the requirements of the long-term monitoring plan shall apply and shall supersede the requirements of the watershed-specific section of the Interim Plan.

IV.A.3.e.iii Regional Wells

The Respondents shall submit work plans for construction of regional aquifer wells that meet the following requirements, subject to the procedures in Section III.M of this Consent Order.

1. The proposed locations, depths and details of drilling, sampling, and well construction shall be described in work plans prepared in accordance with Sections IX and XI.B of this Consent Order or other document approved by the Department prior to well installation.

2. After completion of the borings, a monitoring well design plan shall be submitted to the Department for written approval prior to construction of the regional aquifer wells. No borehole shall be left open or cased with drill casing for longer than five (5) days.

3. Geophysical measurements and soil, rock, vapor, and groundwater samples shall be collected from the borings prior to well construction in accordance with Section IX of this Consent Order.

4. Where appropriate, the borings shall be monitored for the presence of vapor-phase contaminants prior to well construction.

5. Based on the results of subsurface vapor monitoring, the Department may require that the Respondents construct the wells to accommodate subsurface vapor monitoring in addition to groundwater monitoring and sampling.

6. Field screening and sample collection of soil, rock, vapor, and groundwater samples shall be conducted in accordance with Section IX of this Consent Order.

7. Selected soil, rock, and sediment samples shall be submitted to an analytical laboratory for the required analyses.

8. Site- or watershed-specific work plans shall be prepared in accordance with Sections IX and XI.B of this Consent Order. The Respondents may request site-specific modifications to the required analytical suite in the site-specific investigation or monitoring work plans submitted to the Department, based on known site or watershed histories and previous investigation results, prior to the start of field activities.

9. Groundwater samples shall be submitted for the analyses required under Sections IV, V and VI of this Consent Order.

10. Groundwater monitoring data and groundwater samples shall be collected from each well at the frequencies specified in and in accordance with the requirements of this section (IV) and Section IX of this Consent Order. In accordance with Section IV.B of this Consent Order, the Respondents shall submit to the Department for review and written approval a watershed- or site-specific long-term groundwater monitoring plan for each watershed, site or area. Upon Department approval of the long-term monitoring plan for a specific watershed, site or area, the requirements of the long-term monitoring plan shall apply and shall supersede the requirements of the watershed- or site-specific section of the Interim Plan.

IV.A.3.e.iv Well Completion

The Respondents shall submit to the Department a well completion summary fact sheet within 30 days of completion of each regional aquifer well. Installation of all wells shall be considered complete when the well casing has been installed to its final position and the casing rim can be measured relative to the ground surface. Well development must be completed within 30 days of the completion of well installation. The 120-day clock for well completion report submittal for regional aquifer wells will begin 30 days after well completion, as defined above. The details of all drilling and well construction for alluvial and intermediate depth wells shall be included in the site- or canyon-specific investigation reports. Investigation reports that document the results of the site-specific investigations shall be prepared in accordance with the format described in Section XI.C of this Consent Order and the schedule set forth in Section XII of this Consent Order.

IV.A.3.f Springs

The Respondents shall submit work plans for monitoring of springs that meet the following requirements, subject to the procedures in Section III.M of this Consent Order.

1. Springs used to monitor groundwater shall be sampled as close to the source as possible and shall be sampled at the same locations during each sampling event. If field conditions change, the spring shall be sampled as close to the original location as possible, and the Respondents shall notify the Department in the periodic monitoring report that the sampling location has changed.

2. The sampling point for each spring shall be located in accordance with the survey methods described in Section IX.B of this Consent Order or by other survey methods approved by the Department.

3. Spring water flow rates shall be measured, if feasible. In addition, the seep or spring effluent pH, specific conductance, dissolved oxygen, temperature, and oxidation-reduction potential shall be measured at the sample location during each sampling event. The Respondents shall measure field water quality parameters to determine the stability of the groundwater chemistry prior to sample collection and shall follow the procedures outlined in Section IX of this Consent Order.

4. Spring samples shall be submitted to an analytical laboratory for analyses of the general chemistry, organic, and inorganic constituents listed below. The Respondents may request modification of the required analytical suite and monitoring frequency in the site-specific, canyon-specific, and Facility-wide work plans based on specific conditions and information acquired during previous investigation and monitoring activities. The Department shall approve all modifications to the monitoring and sampling methods and analytical suite prior to sample collection. General chemistry parameters shall include nitrate, nitrite, ammonia, total kjeldahl nitrogen (TKN), phosphate, sulfate, carbonate and bicarbonate, and other site-specific, watershed-specific, or groundwater zone-specific parameters listed in Section IX.B.2.i as specified in the watershed- or site-specific long-term groundwater monitoring work plan. Samples shall be collected for organic analyses that include VOCs, semivolatile organics (SVOCs), explosive compounds and their degradation products, PCBs, and dioxins/furans listed in 40 C.F.R. Part 264, Appendix IX, or analyses otherwise approved by the Department. Inorganic analyses shall include TAL metals, silicon, lithium, molybdenum, cyanide, and perchlorate, or analyses otherwise approved by the Department in writing. The Department also may require testing for additional analytes not listed above.

The Respondents shall submit periodic monitoring reports to the Department in accordance with Section IV.A.6.

IV.A.3.g Notification

By the fifteenth day of each month, the Respondents shall review the analytical data from all groundwater monitoring conducted under this Consent Order that was received during the previous month, and shall record the date of such review; provided, however, that if the fifteenth day of a month is a non-business day, then the review shall be conducted by the next business day. The Respondents shall notify the Department orally within one business day after review of the analytical data if such data show detection of a contaminant in a well screen interval or spring at a concentration that exceeds either the WQCC water quality standard or the federal maximum contaminant level if that contaminant has not previously exceeded such water quality standard or maximum contaminant level in such well screen interval or spring.

The Respondents shall notify the Department in writing within fifteen days after review of the analytical data if the data show any of the following:

1. Detection of a contaminant that is an organic compound in a spring or screened interval of a well if that contaminant has not previously been detected in the spring or screened interval.

2. Detection of a contaminant that is a metal or other inorganic compound at a concentration above the background level in a spring or screened interval of a well if that contaminant has not previously exceeded the background level in the spring or screened interval.

3. Detection of a contaminant in a spring or screened interval of a well at a concentration that exceeds either one-half the New Mexico water quality standard or one-half the federal maximum contaminant level, or if there is no such standard for the contaminant, one-half the EPA Region VI Human Health Medium-Specific Screening Level for tap water, if that contaminant has not previously exceeded one-half such standard or screening level in the spring or screened interval.

4. Detection of perchlorate in a spring or screened interval of a well at a concentration of 2 µg/L or greater if perchlorate at such concentration has not previously been detected in the spring or screened interval.

5. Detection of a contaminant that is a metal or other inorganic compound in a spring or screened interval of a well at a concentration that exceeds two times the background level for the third consecutive sampling of the spring or screened interval.

6. Detection of a contaminant in a spring or screened interval of a well at a concentration that exceeds either one-half the New Mexico water quality standard or one-half the federal maximum contaminant level, and that has increased for the third consecutive sampling of that spring or screened interval.

The written notification shall be submitted to the Department in a letter report that includes in table format, at a minimum, the date or dates of the sampling event, an identification of the well or spring, the location of the well or spring, the depth of the screened interval of the well or zone sampled, a list of the analytical data that triggered the reporting requirement, any known issues with sample quality, and the specific category for which the data is reported under this Section (IV.A.3.g). The Respondents may submit a proposal for further sampling or investigation, or the Department may require further sampling or investigation.

The Respondents shall develop and maintain an e-mail notification list to notify members of the public concerning groundwater analytical data reported under this Section (IV.A.3.g). The Respondents shall provide a link on the LANL/Environment Home Page <currently http://www.lanl.gov/environment> whereby members of the public may submit a request to be placed on this list. Within five working days of submittal to the Department of the written notification under this Section (IV.A.3.g), the Respondents shall post a notice on the LANL/Environment website and shall notify those on the e-mail notification list.

Previous data to be evaluated under this Section (IV.A.3.g) to determine whether specified levels have been exceeded, or to determine trends in data for three consecutive samples, shall include only data acquired after June 14, 2007. For the purpose of the notice requirements of this

Section (IV.A.3.g), the background level of a contaminant shall be the most recent Department-approved 95 percent upper tolerance limit for the background for that contaminant set forth in the *Groundwater Background Investigation Report* prepared under Section IV.A.3.d of this Consent Order once approved by the Department, including any approved revisions, as it may be revised or replaced with another document.

IV.A.4 Sediment Investigation

The Respondents shall conduct investigations to fully characterize the nature, extent, fate, and transport of contaminants in sediments in the canyons located within and downgradient of the Facility to determine the need for, and scope of, corrective action. The Respondents shall conduct the sediment investigations in accordance with approved work plans that meet the general requirements of this section (IV.A.4) and the specific requirements of Sections IV.B and IV.C subject to the procedures in Section III.M of this Consent Order. All monitoring and sampling shall be conducted in accordance with the investigation methods and procedures set forth in Section IX of this Consent Order. The Respondents shall implement the sediment investigation requirements set forth in the Department-approved work plans in accordance with the schedule set forth in Section XII.

The Respondents shall submit work plans for investigation of sediments that meet the following requirements, subject to the procedures in Section III.M of this Consent Order.

1. All types and sources of contaminants that were historically discharged or released to each canyon watershed shall be identified.

2. Identify the areas of sediment accumulation in each canyon from the western boundary of the Facility to the Rio Grande. Identify areas of sediment accumulation from the head to the mouth of those canyons that head within the Facility boundaries.

3. Identify reaches, as defined in this Consent Order, within each canyon based on the information collected to fulfill the requirements of Paragraph 2 above. Each reach shall be selected and investigated in accordance with Chapter 5 of the Facility's Core Document for Canyons Investigations, April 1997, approved by the Department on March 17, 1998.

4. Conduct geomorphic characterization, as defined in Chapter 5 of the Facility's Core Document for Canyons Investigations, of each reach and evaluate for the presence of contaminants within each reach.

5. Collect sediment samples from the surveyed locations for field screening and laboratory analysis as required by the Department. Sample collection shall focus on locations where contamination is detected at levels greater than established background levels and on geomorphic units where contamination is likely to accumulate.

IV.A.5 Firing Sites

IV.A.5.a General

The Respondents shall conduct the investigation and, as appropriate, implement corrective action at firing sites and surrounding areas of the Facility in accordance with this Consent Order.

The Respondents have prepared a map entitled "Los Alamos National Laboratory Firing Sites" dated October 2003, depicting active Facility firing sites and surrounding areas; this map is part of the Administrative Record for this Consent Order. The map depicts the "Fenced Area" (larger green area) and the "Testing Hazard Zone" (smaller blue-gray area) associated with active Facility firing sites. The map, as it may be revised from time to time, is incorporated herein by reference.

DOE may revise the geographic scope and location of the designated Testing Hazard Zones if necessary to support DOE's operations. If that occurs, or if any other changed circumstances or other information becomes available such that the map does not accurately depict the Fenced Area or the Testing Hazard Zone, or that uses incompatible with the range activities are occurring within the Testing Hazard Zone, the Respondents shall revise the map and submit to the Department the revised map with explanatory information, that explains and justifies the revision, within thirty (30) days. The revised version of the map shall be incorporated herein by reference and substituted for the earlier version.

IV.A.5.b Testing Hazard Zones

The Respondents shall investigate and, if appropriate, conduct corrective action for all SWMUs and AOCs identified in Table IV-1 (i.e. sites within Testing Hazard Zones to undergo corrective action under this Consent Order) located within the Testing Hazard Zone according to the schedule contained in Section XII. However, such investigation and corrective action shall be scheduled and conducted to avoid unreasonable interference with Testing Hazard Zone operations as described below.

Except as provided in the next paragraph, the Respondents may defer investigation and corrective action for any SWMU or AOC located within a Testing Hazard Zone and identified in Table IV-2 (sites within Testing Hazard Zones to be deferred), and need not include such SWMU or AOC in the relevant Aggregate Area investigation work plan. The deferral may continue until such time as the firing site that has been used to delineate the relevant Testing Hazard Zone is closed, or it is inactive and DOE has determined it is not reasonably likely to be reactivated. If requested, in writing, by the Department, DOE shall make such a determination within 60 days of receipt of the written request. If DOE decides not to make a determination, DOE shall provide the Department with a written justification for its decision. DOE's decision about the use of a firing site shall be based entirely on operation of the firing range, and shall not be subject to dispute resolution under this Consent Order. At such time as the site is closed, or it is inactive and DOE has determined it is not reasonably likely to be reactivated, the Respondents shall submit to the Department for approval an investigation work plan for the relevant Testing

Hazard Zone in accordance with the Aggregate Area investigation work plan, or on a schedule determined by the Department if the aggregate area work plan has already been submitted.

The Respondents may not defer investigation or corrective action for any SWMU or AOC if the Department finds that conditions resulting from such SWMU or AOC may present an immediate threat to human health or the environment. If the Department finds that the above condition is occurring, the Respondents shall mitigate such condition through Interim Measures (see Section VII.B) or through site-specific controls approved in advance by the Department.

When any firing site that has been used to delineate, in whole or in part, a Testing Hazard Zone is closed, or becomes inactive and DOE has determined that it is not reasonably likely to be reactivated, the Respondents shall, within thirty (30) days, submit to the Department a revised map.

IV.A.5.c Fenced Area

The Respondents shall investigate and, if appropriate, conduct corrective action for all SWMUs and AOCs located outside the Testing Hazard Zone but within the Fenced Area, without any deferral. However, such investigation and corrective action shall be scheduled and conducted to avoid unreasonable interference with Testing Hazard Zone operations as described below.

IV.A.5.d Interference With Firing Site Operations

All investigation and corrective action activities conducted within the Testing Hazard Zones and within the Fenced Area shall be scheduled and conducted to avoid unreasonable interference with Testing Hazard Zone operations. In the event that the Respondents determine that scheduled investigation or corrective action activities may unreasonably interfere with Testing Hazard Zone operations, the Respondents shall, as far in advance as is practicable, submit to the Department for approval a written request for an adjustment to the schedule, including a description of the basis for the adjustment. In assessing such request, the Department will consider the information provided by the Respondents, including safety risks to personnel, and schedules for testing and developing munitions.

Table IV-1

Non-Deferred Sites Within Testing Hazard Zones

Non-Deferred Site Identification	Brief Description
06-005	Firing site pit
06-007(a)	Material disposal area F
06-007(b)	Material disposal area F
06-007(c)	Material disposal area F
06-007(d)	Material disposal area F
06-007(e)	Material disposal area F
06-008	Underground storage tank
07-001(a)	Firing site
07-001(b)	Firing site
11-005(a)	Septic system
11-005(b)	Septic system
11-005(c)	Outfall
11-006(a)	Sump
11-006(b)	Tank and/or associated equipment
11-006(c)	Tank and/or associated equipment
11-006(d)	Tank and/or associated equipment
11-011(a)	Industrial or sanitary wastewater treatment
11-011(b)	Industrial or sanitary wastewater treatment
11-011(d)	Industrial or sanitary wastewater treatment
C-11-002	Footprint of former laboratory
C-12-001	Footprint of former building
C-12-002	Footprint of former building
C-12-003	Footprint of former building
C-12-004	Footprint of former building
14-001(g)	Firing site-Open Burn/Open Detonation (active)
14-002(c)	Building
14-002(f)	Footprint of former junction box shelter
14-003	Open burning ground
14-005	Open burn site (active)
14-006	Tank and/or associated equipment
14-007	Septic system
14-009	Surface disposal site
14-010	Sump
C-14-001	Footprint of former building
C-14-003	Footprint of former building
C-14-004	Footprint of former building

Non-Deferred Site Identification	Brief Description
C-14-005	Footprint of former building
C-14-006	Footprint of former building
C-14-007	Footprint of former building
C-14-008	Footprint of former building
C-14-009	Footprint of former building
15-001	Surface disposal
15-004(f)	Firing site E-F
15-004(h)	Firing site H
15-005(c)	Container storage area (R-41)
15-007(b)	Material disposal area Z
15-007(c)	Firing site shaft
15-007(d)	Firing site shaft
15-008(a)	Surface disposal at E/F Site
15-008(b)	Surface disposal
15-008(c)	Surface disposal
15-008(g)	Surface disposal
15-009(b)	Septic system
15-009(c)	Septic tank
15-009(e)	Septic system
15-009(g)	Septic tank (active)
15-009(h)	Septic tank
15-009(i)	Septic tank
15-010(c)	Drain line
15-014(l)	Outfall (active)
C-15-001	Surface disposal
C-15-004	Transformers
C-15-011	Former site of underground tank
C-15-013	Underground fuel tank
18-001(a)	Lagoon
27-002	Firing sites
27-003	Bazooka impact area
36-001	Material disposal area AA
36-002	Sump
36-003(a)	Septic system
36-003(b)	Septic system
36-004(c)	Firing site-open detonation (active)
36-005	Surface disposal site
36-006	Surface disposal site
36-008	Surface disposal site

Non-Deferred Site Identification	Brief Description
C-36-003	Storm drainages
37-001	Septic system
39-001(b)	Material disposal area Y
39-002(b)	Storage area
39-002(c)	Storage area
39-002(d)	Storage area
39-002(f)	Storage area
39-004(c)	Firing site 39-6 (active)-OD RCRA Unit
39-004(d)	Firing site 39-57 (active)-OD RCRA Unit
39-007(a)	Storage area
39-007(d)	Storage area
39-008	Former building footprint (soil contamination)
39-010	Excavated soil dump
40-001(b)	Septic system
40-001(c)	Septic system
40-003(a)	Scrap burn site/open detonation (completed RCRA closure)
40-003(b)	Burning area (completed RCRA closure)
40-004	Operational release
40-005	Sump
40-009	Landfill
40-010	Surface disposal site
49-001(a)	Material disposal area AB
49-001(b)	Material disposal area AB
49-001(c)	Material disposal area AB
49-001(d)	Material disposal area AB
49-001(e)	Material disposal area AB
49-001(g)	Material disposal area AB
49-002	Underground chamber
49-003	Leach field and small shot area
49-005(a)	Landfill
49-006	Sump
49-008(d)	Firing sites and underground chamber

Table IV-2

Deferred Sites In Testing Hazard Zones

Deferred Site Identification	Brief Description	Deferred Site Identification	Brief Description
06-003(a)	Firing site	15-006(a)	Firing site
06-003(h)	Firing site	15-006(b)	Firing site
C-06-019	Footprint of former	15-006(c)	Firing site
07-001(c)	Firing site	15-006(d)	Firing site
07-001(d)	Firing site	15-008(f)	Firing site
11-001(a)	Firing site	36-004(a)	Firing site
11-001(b)	Firing site	36-004(b)	Firing site
11-002	Burn site	36-004(d)	Firing site
11-003(b)	Air gun	36-004(e)	Firing site
11-004(a)	Firing site	39-004(a)	Firing site
11-004(b)	Firing site	39-004(b)	Firing site
11-004(c)	Firing site	39-004(e)	Firing site
11-004(d)	Firing site	40-006(a)	Firing site
11-004(e)	Firing site	40-006(b)	Firing site
11-004(f)	Firing site	40-006(c)	Firing site
11-009	Material disposal area S	49-008(a)	Soil contamination
11-012(c)	Footprint of former building	49-008(b)	Soil contamination (Area 6)
11-012(d)	Footprint of former building	49-008(c)	Soil contamination
C-11-001	Footprint of former laboratory		
14-001(f)	Firing site		
14-002(a)	Firing site		
14-002(d)	Firing site		
14-002(e)	Firing site		
14-002(b)	Firing site		
15-003	Firing site		
15-004(a)	Firing site		
15-004(g)	Firing site		

IV.A.6 Reporting

The Respondents shall submit to the Department periodic monitoring reports including the results of the groundwater, surface water, and springs monitoring and sampling over the previous reporting period. The reports shall be prepared in accordance with Section XI.D of this Consent Order. The reports shall be submitted within 120 days after completion of the watershed- or site-specific periodic monitoring fieldwork and in accordance with the schedule set forth in the approved monitoring plans.

IV.B CANYON WATERSHED INVESTIGATIONS

The general investigation requirements in the work plan for each canyon watershed shall include an assessment of the nature and extent of historical and current releases of contaminants from SWMUs, AOCs and other sites through investigation of:

1. canyon alluvial sediments,

2. surface water monitoring and sampling, and

3. groundwater monitoring and sampling.

The Canyon Watersheds are subdivided into watershed aggregates. The Watersheds and associated Watershed Aggregates are listed below.

WATERSHED	WATERSHED AGGREGATE
Los Alamos/Pueblo Canyon	Upper Los Alamos Canyon Middle Los Alamos Canyon DP Site Lower Los Alamos Canyon Pueblo Canyon Bayo Canyon Guaje/ Barrancas/Rendija Canyons
Sandia	Upper Sandia Canyon Lower Sandia Canyon
Mortandad	Upper Mortandad Canyon Middle Mortandad/Ten Site Canyon Lower Mortandad/Cedro Canyon Upper Cañada del Buey Middle Cañada del Buey Lower Mortandad/Cañada del Buey
Water Canyon/Cañon de Valle	Cañon de Valle

	S-Site Upper Water Canyon Lower Water/Indio Canyon Potrillo/Fence Canyon
Pajarito	Starmer/Upper Pajarito Canyon Twomile Canyon Threemile Canyon Lower Pajarito Canyon
Ancho	North Ancho Canyon South Ancho Canyon
Chaquehui	Chaquehui Canyon
Frijoles	Frijoles Canyon TA-57 (Fenton Hill)

The general investigation activities required for each canyon watershed shall primarily focus on fate and transport of contaminants from the point of origin to each canyon watershed drainage system and, if necessary, to the regional aquifer and to the Rio Grande. Canyon watershed investigations shall be conducted in accordance with this Consent Order and the canyon-specific investigation work plans approved by the Department. The source areas located on mesa tops shall be addressed in separate investigations in this section (IV), where appropriate. The Respondents shall conduct investigations of canyons pursuant to approved investigation work plans prepared in accordance with Section III.M of this Consent Order.

The Respondents shall continue to conduct an investigation of contaminants that may have been discharged or released into each canyon watershed during historical operations at the Facility. The investigation shall include defining the known or suspected source of contaminants, and reviewing existing data and other information acquired during previous investigations. The Respondents shall review available information regarding SWMUs and AOCs and other possible sources of discharges or releases of contaminants, including historical use of all existing and demolished TA buildings and other structures; pits, shafts, trenches, landfills, and surface impoundments; wastewater treatment, conveyance, and disposal systems; and subsurface utility corridors. The Respondents shall also review all investigation borings, excavations, sampling events, and other sources of information on contamination. The Respondents shall submit to the Department a historical investigation report for each canyon watershed, which shall be included as a separate submittal in conjunction with the canyon investigation work plan. If the Department determines that an investigation work plan is not required for a canyon watershed, the Respondents shall not be required to submit a historical investigation report. The report shall contain the following historical information:

1. A list of all past or present SWMUs, AOCs, and other sites in or bordering the canyon watershed that may have contributed contaminants to the canyon drainages.

2. A list of all discharge locations that may have contributed contaminants to the canyon drainages.

3. A description of the location, operational history, and present status of each such SWMU, AOC, and other site listed under Paragraph 1 and each discharge location listed under Paragraph 2. The Respondents shall depict all such locations in one or more figures.

4. A description of the known disposal history of each SWMU, AOC, and other site listed under Paragraph 1 and each discharge location listed under Paragraph 2. This description shall include all known and suspected material disposed, contaminants discharged or released; the volume of each discharge or release, if known; the flow rate of each discharge or release, if known; and the contaminants present in each discharge or release, if known. The Respondents shall report whether the disposal history of any SWMU, AOC, or other unit is unknown or incomplete and the source of the information.

5. A description of each previous investigation of the sources, extent, or characteristics of contamination in each canyon watershed, regardless of whether or not such investigation was completed.

6. A summary of any results and conclusions of each previous investigation described in Paragraph 5, including the known or suspected dates of waste disposal, discharge, or release, and the circumstances related to the discharge or release of contamination.

7. A description of the location, construction details, history, and present status of each investigation well, boring, and excavation in each canyon watershed. The Respondents shall depict all such locations in one or more figures and may reference existing documents for this information. The results of historical aquifer characterization, surface water study, and all sampling events shall be included, if available. A site map encompassing the watershed and pertinent regional investigation locations shall be included in the summary.

8. A description of the sample collection methods and the types of field and laboratory analyses performed on each medium during the previous investigations.

9. Tables summarizing the data collected during investigation activities for each investigation well, boring, and excavation. The results shall present only analyte detections and data quality exceptions reported by the analytical laboratory that may mask analyte detections.

10. A summary of data quality exceptions and interpretations of all compromised data reported under paragraph #9.

11. A summary of all contradictory investigation results and the rationale for acceptance or rejection of selected investigation results.

12. A list of general chemistry and metal background concentrations, including references to the documents that provide the methods for establishing the background values.

13. A table summarizing the field and laboratory analytical results obtained from the four most recent groundwater monitoring and sampling events. The results shall include groundwater monitoring and sampling conducted in each canyon watershed. A site plan presenting the locations of all wells and piezometers shall be included with the summary.

14. A table summarizing the field and laboratory analytical results obtained from the four most recent surface water monitoring and sampling events. The results shall include surface water monitoring and sampling conducted in each canyon watershed. A site plan presenting the locations of all surface-water monitoring and sampling stations shall be included with the summary.

15. A table summarizing the known hydraulic properties, including groundwater flow direction and velocity estimates, of the alluvial, intermediate, and regional aquifers based on testing results obtained at locations within each canyon watershed, if available. Groundwater flow directions and elevations may be presented on a map. Existing documents may be referenced for this information in lieu of inclusion in the historical investigation reports, providing that specific document titles and page numbers are cited.

The summaries shall include references to historical documents within the summary text citing the document title, page number, and table or figure number. The full reference citations shall be presented as a separate section in each summary document using the standard United States Geological Survey (USGS) format for reference citations. The Respondents shall provide complete data and information to the extent it is available, and shall identify the need for any additional data at each unit. The Department will evaluate the information and request changes as necessary. The Respondents shall submit new or updated information to the Department as soon as it becomes available.

IV.B.1 Los Alamos/Pueblo Canyons Watershed

IV.B.1.a Background

The Los Alamos/Pueblo Canyons watershed encompasses roughly 57 square miles and is located at the north end of the Facility. The watershed contains numerous springs as well as perennial and ephemeral streams and alluvial groundwater systems. Portions of Los Alamos Townsite, Los Alamos County, Santa Fe County, and Pueblo of San Ildefonso tribal lands are located within the Los Alamos/Pueblo Canyons watershed. Facility operations have discharged treated and untreated effluent into the watershed from the 1940s to the present. Runoff from SWMUs and AOCs at former and current TAs-0, 1, 2, 3, 21, 41, 43, 53, 62, 72, 73 and 74 have contributed to contaminant releases within the canyon systems. Metals, perchlorate, nitrates, hydrocarbons, other contaminants, and radionuclides, which are not addressed under this Consent Order, have been detected in the Los Alamos/Pueblo Canyons watershed groundwater.

This section (IV.B.1) of the Consent Order addresses the specific requirements for the investigation of Los Alamos and Pueblo Canyons and selected tributaries, including Acid and DP

Canyons. The Los Alamos/Pueblo Canyons watershed also includes Bayo, Guaje, Rendija, and Barrancas Canyons (collectively known as the North Canyons). The characterization and monitoring requirements for these canyons are included in Section IV.B.6 of this Consent Order. Regional aquifer wells in the Los Alamos/Pueblo Canyons watershed shall be installed according to the schedule listed in Section XII of this Consent Order. DP Canyon joins Los Alamos Canyon east of TA-21 at the east end of the Los Alamos Townsite. TAs-2, 41, and 43 are located within the Los Alamos Canyon flood plain in the vicinity of the Los Alamos Townsite. TAs-21, 73, and former TA-1, are located on the mesa, from west to east, north of Los Alamos Canyon. TAs-62, 61, 53, and 72 are located from west to east along the mesa (South Mesa) south of Los Alamos Canyon.

Pueblo Canyon is located on the north side of the Los Alamos Townsite and extends from the Jemez Mountains to its confluence with Los Alamos Canyon approximately 4.5 miles east of the Los Alamos Townsite at the intersection of State Road 502 and State Road 4. TAs-72, 73 and former TAs-1 and 45 are located from west to east along the mesa south of Pueblo Canyon. Acid Canyon joins Pueblo Canyon from the south opposite former TA-45. Facility TAs are not present on the north side of the Canyon.

Facility activities have been conducted in the vicinity of the Los Alamos Townsite and the Los Alamos/Pueblo Canyons watershed since the establishment of the Facility in the 1940s. Historical Facility operations resulted in releases of contaminants to Los Alamos and Pueblo Canyons and their tributaries. The documented discharges and releases were primarily in the form of contaminated wastewater generated during research and manufacturing operations on the surrounding mesas in the vicinity of the Los Alamos Townsite. In addition, discharges and releases of contaminants were documented in Los Alamos Canyon resulting from operations conducted at TAs-2 and 41. Releases also originate from debris generated during TA-1 demolition activities and deposited on hillsides located above Los Alamos Canyon, opposite the Townsite.

Facility operations that affected Pueblo Canyon include the release of contaminants to Pueblo Canyon via Acid Canyon from former TAs-1 and 45. Historical activities at TAs-21 and 53 and former TAs-1, 2, and 41 released contaminants into Los Alamos Canyon and its tributary side canyons (DP Canyon and the undesignated canyon located east of TA-53). Historical Facility operations released both hazardous constituents and radionuclides, which are not addressed under this Consent Order.

A work plan for the investigation of Los Alamos and Pueblo Canyons was approved by the Department in 1997. An addendum to the Los Alamos and Pueblo Canyons investigation work plan was submitted to and approved by the Department in 2002. In accordance with the approved investigation work plan and addendum, the Respondents have conducted investigations of contamination in Los Alamos and Pueblo Canyons and have prepared interim reports describing the results of these investigations. Informational copies of these reports were submitted to the Department in 1998 and 1999. These reports were not submitted to the Department for review or approval. Additional investigations have been conducted by the Respondents. A report on these investigations was submitted to the Department on April 30, 2004. In 2002, Respondents conducted an Interim Action in the South Fork of Acid Canyon (a

tributary of Pueblo Canyon) in accordance with an Interim Action Plan approved by the Department in 2002.

IV.B.1.b Los Alamos/Pueblo Canyons Investigation

IV.B.1.b.i Los Alamos/Pueblo Canyons Investigation Work Plan

The Respondents have submitted to the Department the Work Plan for Los Alamos and Pueblo Canyons, dated November 1995, and the addendum to the Work Plan, dated February 2002. The work plan and addendum were approved by the Department in June 1997 and May 2002, respectively. The Los Alamos and Pueblo Canyons Work Plan and addendum are incorporated herein by reference and made an enforceable part of this Consent Order. The Respondents state that they have completed implementation of the approved Work Plan and Work Plan addendum for Los Alamos and Pueblo Canyons. The Respondents shall report the results of sediment, biota, surface water and alluvial groundwater investigations to the Department for approval in the Los Alamos/Pueblo Canyons Investigation Report in accordance with the schedule in Section XII of this Consent Order. If, after review of the Investigation Report, the Department determines that the investigation is inadequate to fully characterize Los Alamos and Pueblo Canyons to determine the need for and scope of further corrective action, the Department will require the Respondents to submit a supplemental work plan. The supplemental work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order. If deemed necessary, the supplemental work plan shall address additional investigations of the sources of contamination and the nature and extent of contamination in sediments, surface water, and groundwater in Los Alamos and Pueblo Canyons.

The Respondents submitted a Groundwater Work Plan in December 2003, addressing the groundwater requirements listed below. The Respondents shall implement the requirements of the work plan approved by the Department pursuant to the procedures in Section III.M of this Consent Order. The Respondents shall submit an investigation report summarizing the results of the groundwater investigation in the format described in Section XI.C of this Consent Order**.**

IV.B.1.b.ii Los Alamos Canyon Intermediate Groundwater Well Installation

The Respondents submitted to the Department for review and written approval a Groundwater Work Plan in December 2003 that addresses the following intermediate groundwater well requirements. The Respondents shall implement the work requirements of the work plan approved by the Department pursuant to the procedures in Section III.M of this Consent Order.

1. One intermediate monitoring well shall be installed between LAO-4.5 and LAO-6

Pursuant to a supplemental work plan, if required, the Respondents shall install additional wells required by the Department pursuant to this Consent Order.

Based on the results of groundwater monitoring and sampling, the Department may require a supplemental work plan requiring additional monitoring wells in Los Alamos Canyon.

IV.B.1.b.iii Los Alamos/Pueblo Canyons Regional Groundwater Well Installation

The Respondents have conducted groundwater work in Pueblo Canyon pursuant to the Los Alamos Canyon and Pueblo Canyon Work Plan and addendum, approved by the Department in 1997 and 2002, respectively, and the Hydrogeologic Work Plan, approved by the Department in 1998. Respondents state that, pursuant to these approved plans, regional wells R-2, R-4, and R-5 were constructed that fulfill the regional well construction requirements for Pueblo Canyon set forth by the Department. The Respondents submitted a Groundwater Work Plan to the Department for review and written approval in December 2003. The Respondents shall implement the work requirements of the work plan approved by the Department pursuant to the procedures in Section III.M of this Consent Order.

1. The Respondents shall construct two monitoring wells associated with Los Alamos Canyon intersecting the regional aquifer as described in Section IV.A.3.e. One well shall be located in Los Alamos Canyon north of the undesignated canyon located east of TA-53. The other well shall be placed in a location suitable for obtaining background regional aquifer data.

2. Two wells intersecting the regional aquifer shall be located in Pueblo Canyon or on the mesa top east of Acid Canyon, in accordance with the Department-approved groundwater investigation work plan.

3. One well intersecting the regional aquifer shall be located immediately north of TA-73, in accordance with the Department-approved groundwater investigation work plan.

4. Pursuant to a supplemental work plan, if required, the Respondents shall install any other wells required by the Department pursuant to this Consent Order.

5. The Respondents shall investigate for the presence of intermediate perched groundwater during the drilling of the regional monitoring wells described in this section (IV.B.1.b.iii). The Respondents shall construct the regional wells to have the capability to monitor and sample intermediate perched groundwater, if present.

The Respondents shall submit an investigation report summarizing the results of the regional groundwater investigation in the format described in Section XI.C of this Consent Order.

IV.B.1.b.iv Los Alamos/Pueblo Canyons Groundwater Monitoring

The Respondents shall monitor and sample wells containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b of this Consent Order that meets the requirements listed below, subject to the procedures of Section III.M of this Consent Order. Based on the results of the investigation reported pursuant to Section IV.B.1.b.iii, and after completing the installation of all additional monitoring wells in the Los Alamos/Pueblo Canyons watershed in accordance with the approved work plan, the Respondents shall submit to the Department for review and written approval a watershed-specific long-term groundwater monitoring plan for Los Alamos and Pueblo Canyons.

Alternately, the Respondents may submit site-specific long-term monitoring plans that address specific areas within Los Alamos and Pueblo Canyons for Department approval. Upon Department approval of the watershed- or site-specific long-term monitoring plan(s) for the Los Alamos/Pueblo Canyons watershed, the requirements of the long-term monitoring plan(s) shall apply and shall supersede the requirements of the Los Alamos and Pueblo Canyons watershed sections of the Interim Plan.

1. Groundwater samples for Los Alamos Canyon shall be collected from existing alluvial monitoring wells LAO-B, LAO-0.3, LAO-0.6, LAO-0.91, LAO-1.6(g), LAO-1.8, LLAO-1b, LLAO-3, LLAO-4, LLAO-5, LAO-1.2, LAO-2, LAO-3A, LAO-4.5C, LAO-5, LAO-6, LAO-6A, LAUZ-1, and LAUZ-2; New Mexico Highway Department wells MW-3, MW-5, MW-6, and MW-9, if accessible.

2. Alluvial groundwater samples for Los Alamos Canyon shall be submitted to a laboratory for analysis of general chemistry parameters as described in Section IX.B.2.i of this Consent Order, including PCBs, perchlorate, TAL metals, cyanide, molybdenum, tungsten, VOCs, SVOCs, and for any other analytes specified by the Department.

3. Groundwater samples shall be collected from alluvial monitoring wells PAO-1, PAO-2, PAO-3, PAO-4, and APCO-1, and from all newly installed alluvial wells in Pueblo Canyon.

4. Alluvial groundwater samples for Pueblo Canyon shall be submitted to a laboratory for analysis of general chemistry parameters as described in Section IX.B.2.i of this Consent Order, including perchlorate, TAL metals, cyanide, molybdenum, tungsten, and for other analytes specified by the Department.

5. Groundwater samples shall be collected from Los Alamos Canyon intermediate monitoring wells LADP-3, R-9i, LAOI(a)-1.1, and all wells installed in the future that intersect intermediate zone groundwater in Los Alamos Canyon.

6. Groundwater samples shall be collected from intermediate monitoring wells TW-1a, TW-2a, and POI-4 in Pueblo Canyon. TW-1a and TW-2a shall be plugged and abandoned according to the procedures in Section X.D of this Consent Order. Groundwater shall be monitored from TW-1a and TW-2a until the wells are properly abandoned.

7. Intermediate zone groundwater samples shall be submitted to a laboratory for analysis of general chemistry parameters as described in Section IX.B.2.i of this Consent Order, perchlorate, TAL metals, cyanide, molybdenum, tungsten, and for other analytes specified by the Department.

8. Groundwater samples shall be obtained from regional wells R-5, R-7, R-9, TW-3, and all regional wells installed in the future in Los Alamos Canyon. TW-3 shall be plugged and abandoned according to the procedures in Section X.D. Groundwater shall be monitored from TW-3 until the well is properly abandoned.

9. Groundwater samples shall be collected from Pueblo Canyon regional monitoring wells TW-1, TW-1a, TW-2, TW-2a, and TW-4. TW-1, TW-1a, TW-2, and TW-2a shall be plugged and abandoned according to the procedures described in Section X.D of this Consent Order. Groundwater shall be monitored from TW-1, TW-1a, TW-2, and TW-2a until the wells are properly abandoned.

10. Regional groundwater samples shall be submitted to a laboratory for analysis of general chemistry parameters as described in Section IX.B.2.i of this Consent Order, perchlorate, TAL metals, cyanide, molybdenum, tungsten, and for other analytes specified by the Department.

IV.B.1.b.v Los Alamos/Pueblo Canyons Investigation Report

The Respondents shall submit an investigation report to the Department for review and written approval that presents the results of the approved Los Alamos and Pueblo Canyon Work Plan and addendum, including field activities, summaries of the data collected, and recommendations and conclusions for Los Alamos Canyon. The investigation report shall also include the results of the Pueblo Canyon investigation. The combined Los Alamos and Pueblo Canyon investigation report shall not address intermediate and regional groundwater investigations and shall fulfill the requirements of this section and Section IV.B.1.b.iv. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order.

The Respondents shall submit a well abandonment report for TW-1, TW-1a, TW-2, TW-2a, and TW-3 to the Department within thirty (30) days of completing the activity or as an appendix to the Los Alamos/Pueblo Canyon Investigation Report, if the well abandonment is performed in conjunction with field investigation activities.

Based on the results of the investigations conducted in the Los Alamos/Pueblo Canyon watershed, and after completing the installation of all additional monitoring wells in the Los Alamos/Pueblo Canyons watersheds as described in the approved work plan and in this section (IV.B), the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos and Pueblo Canyons. Upon Department approval of the long-term monitoring plans for the Los Alamos and Pueblo Canyon watersheds or specific sites within those watersheds, the requirements of the long-term monitoring plan shall apply and shall supersede the requirements of the Los Alamos and Pueblo Canyon watershed-or site-specific sections of the Interim Plan.

IV.B.2 Mortandad Canyon Watershed

IV.B.2.a Background

The Mortandad Canyon watershed is located in the central portion of the Facility and covers approximately ten square miles. Tribal lands of the Pueblo of San Ildefonso are directly adjacent to a portion of the Facility's eastern boundary and encompass the eastern end of Mortandad Canyon. The Mortandad Canyon watershed contains several tributary canyons that have received contaminants released during Facility operations. The most prominent tributary

canyons include Ten Site Canyon, "Pratt" Canyon, "Effluent" Canyon and Cañada del Buey. Although Cañada del Buey is located in the Mortandad Canyon watershed, its characterization is included in the "Work Plan for Sandia Canyon and Cañada del Buey" (LA UR-99-3610).

Current and former TAs located in the Mortandad Canyon watershed include TAs-3, 4, 5, 18, 35, 42, 46, 48, 50, 51, 52, 54, 55, and 59. The primary sources of contamination in this watershed include historic releases of contaminants from outfalls and spills at TA-35 and TA-50, including the Radioactive Liquid Waste Treatment facility at TA-50. RCRA constituents, including metals and VOCs, have historically been released into the canyons. Nitrates, perchlorate, molybdenum, manganese, and radionuclides, which are not addressed under this Consent Order, are some of the contaminants that have been detected in the Mortandad Canyon alluvial groundwater. In addition, nitrate, perchlorate, fluoride, and radionuclides, which are not addressed under this Consent Order, were detected in samples of intermediate zone groundwater during the drilling of regional aquifer well R-15 located east of the confluence of Mortandad and Ten Site Canyons. Perchlorate also was detected in core samples obtained from the vadose zone close to the top of the regional aquifer.

IV.B.2.b Mortandad Canyon Investigation

IV.B.2.b.i Mortandad Canyon Investigation Work Plan

The Respondents have submitted to the Department the Work Plan for Mortandad Canyon, dated September 1997. The Mortandad Canyon Work Plan was approved by the Department on December 12, 2002 and is incorporated herein by reference and made an enforceable part of this Consent Order. The Department determined that the scope of investigations specified in the Work Plan was inadequate to fully investigate Mortandad Canyon and issued a letter dated December 12, 2002, detailing the requirements for additional groundwater investigations. On August 30, 2003, the Respondents submitted to the Department for review and written approval a Groundwater Work Plan for Mortandad Canyon. This work plan was approved by the Department in February 2004. The Mortandad Canyon Work Plans address investigations of the sources of contamination, and the nature and extent of contamination in sediments, surface water, and groundwater in Mortandad Canyon. The Respondents shall implement the work requirements of the approved work plans.

IV.B.2.b.ii Mortandad Canyon Groundwater Monitoring

The Respondents shall monitor and sample Mortandad Canyon and Cañada del Buey wells containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b, and that meets the requirements below subject to the procedures in Section III.M of this Consent Order. Based on the results of the investigations conducted in the Mortandad Canyon watershed, and after completing the installation of all additional monitoring wells in the Mortandad Canyon watershed as described in the approved work plans, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Mortandad Canyon and Cañada del Buey. Upon Department approval of the long-term monitoring plans for the Mortandad Canyon and Cañada del Buey watersheds or for specific

sites within those watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Mortandad Canyon and Cañada del Buey watershed sections of the Interim Plan.

1. Groundwater samples shall be obtained from alluvial wells MCO-2, MCO-3, MCO-4B, MCO-5, MCO-6, MCO-6B, MCO-7, MCO-7.5, MT-4, TSWB-6, CDBO-1 through 9, and all alluvial wells installed in the future. Groundwater from MCO-2 and MCO-3 shall be monitored until the wells are properly plugged and abandoned. The MCO-2 and MCO-3 replacement wells shall be monitored once installed.

2. Groundwater samples shall be obtained from intermediate wells MCOBT-4.4 and all intermediate wells installed in the future.

3. Groundwater samples shall be obtained from regional wells R-15, TW-8, and all regional wells installed in the future. TW-8 shall be monitored until the well is properly plugged and abandoned. The TW-8 replacement well shall be monitored once installed.

4. Groundwater samples shall be collected from the alluvial, intermediate zone, and regional monitoring wells in Mortandad Canyon for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B.2.i of this Consent Order, perchlorate, TAL metals, molybdenum, tungsten, cyanide, VOCs, SVOCs, and for other analytes specified by the Department.

IV.B.2.b.iii Mortandad Canyon Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for Mortandad Canyon. In addition, the Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for Cañada del Buey. The investigation reports for Mortandad Canyon and Cañada del Buey shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the dates specified in Section XII of this Consent Order.

Based on the results of the investigations conducted in the Mortandad Canyon watershed, and after completing the installation of all additional monitoring wells in the Mortandad Canyon watershed as described in accordance with the approved work plans, Mortandad Canyon watershed- or site-specific long-term groundwater monitoring plans, that include Cañada del Buey, shall be submitted to the Department for review and written approval. Upon Department approval of the long-term monitoring plans for the Mortandad Canyon watershed or specific sites within the watershed and adjacent watersheds, as appropriate, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Mortandad Canyon watershed section of the Interim Plan.

IV.B.3 Water Canyon/Cañon de Valle Watershed

IV.B.3.a Background

The Water Canyon/Cañon de Valle watershed is located in the southern portion of the Facility and encompasses an area of approximately 19 square miles. Cañon de Valle, located on the western portion of the Pajarito Plateau, is the main tributary to Water Canyon. The heads of both canyon watersheds are located in the Sierra de Los Valles. The watershed supplies numerous springs, ephemeral and perennial surface water flow, and alluvial groundwater systems. Tributaries that may contribute contamination to Water Canyon include Indio, Fence, and Potrillo Canyons that join Water Canyon on the eastern side of the Facility. The TAs located within this watershed include TAs 9, 11, 14, 15, 16, 28, 36, 37, 39, 49, 67, 68, 70, and 71. This portion of the Facility has been used for weapons testing, explosives testing, and explosives production and has received effluent from outfalls containing explosive compounds, metals, and VOCs. Storm water runoff from firing sites, open burn/open detonation units, surface disposal sites, and other SWMUs and AOCs may have contributed to the contamination detected within the watershed. The contaminants detected in soil, rock, and sediment samples obtained from various locations within the watershed during previous investigations include barium and other RCRA metals, explosive compounds, VOCs, pesticides, and radionuclides, which are not addressed under this Consent Order. Contaminants detected in groundwater samples obtained from wells located within the watershed include barium, explosive compounds and their associated degradation products, and VOCs

IV.B.3.b Water Canyon/Cañon de Valle Investigation

IV.B.3.b.i Water Canyon/Cañon de Valle Investigation Work Plan

The Respondents shall submit to the Department for review and written approval a work plan for the investigation of contamination in Water Canyon and Cañon de Valle. The work plan shall meet the requirements of this section (IV.B.3.b), subject to the procedures in Section III.M of this Consent Order. The work plan shall incorporate proposed investigations in Potrillo and Fence Canyons and Ancho, Chaquehui, and Indio Canyons as described in Section IV.B.6.b.i of this Consent Order. The work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. The work plan shall address investigations of the sources of contamination, and the nature and extent of contamination in sediments, surface water, and groundwater in Water Canyon and Cañon de Valle.

IV.B.3.b.ii Water Canyon/Cañon de Valle Alluvial Groundwater Well Installation

Pursuant to Section IV.B.3.b.i and Section IV.A.3.e of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for Water Canyon and Cañon de Valle that meets the following alluvial groundwater well requirements subject to the procedures in Section III.M of this Consent Order. The Respondents shall implement the work requirements of the approved work plan.

1. The Beta Hole and all WCO wells shall be replaced with monitoring wells constructed in accordance with the requirements of Section X of this Consent Order. The Beta Hole and all existing WCO wells shall be abandoned after replacement in accordance with the requirements of Section X of this Consent Order.

2. Two alluvial aquifer wells shall be installed between well WCO-1 and the Water Canyon-Cañon de Valle confluence.

3. Three alluvial wells shall be installed at locations approved by the Department downstream from the active TA-16 operational areas in Cañon de Valle and its tributaries to assess extent of saturation in the alluvial aquifer system.

4. Three nested piezometers shall be installed at locations approved by the Department in the vicinity of the Burning Ground location.

5. Four nested piezometer sets shall be installed in the canyon alluvium located between SWSC Spring and monitoring well 16-2659.

6. Three nested and transected piezometer sets shall be installed to assess vertical and lateral groundwater flow directions in the middle portion of Water Cañon at a location where the canyon alluvium directly overlies the Cerro Toledo interval.

7. One alluvial aquifer well shall be installed in Water Canyon located between the mouths of Martin Spring Canyon and Cañon de Valle.

IV.B.3.b.iii Water Canyon/Cañon de Valle Regional Groundwater Well Installation

Pursuant to Section IV.B.3.b.i and Section III.M of this Consent Order, the Respondents shall submit a work plan to the Department for review and approval that meets the regional groundwater well requirements listed below. The Respondents shall implement the work requirements of the approved work plan.

1. Regional wells R-24, R-26, R-27, and R-29 shall be completed according to the schedule set forth in Section XII of this Consent Order, in the following locations:

    - R-24: North of Cañon de Valle, on the upthrown side of the Pajarito Fault
    - R-26: Upper Water Canyon, on the downthrown side of the Pajarito Fault
    - R-27: Water Canyon, at the confluence with Cañon de Valle
    - R-29: Lower Water Canyon, near the confluence with Potrillo Canyon.

2. The Respondents may prepare a plan to demonstrate to the Department that the water quality data from regional well R-25 are or will be valid and reliable. The plan shall be submitted to the Department within 90 days of the effective date of this Consent Order for Department approval, subject to the procedures of Section III.M of this Consent Order. If the Department determines that R-25 does not or will not produce valid and

reliable data, the Respondents shall properly abandon R-25 and replace it at a location approved by the Department.

IV.B.3.b.iv Water Canyon/Cañon de Valle Groundwater Monitoring

The Respondents shall monitor and sample wells containing alluvial, intermediate zone, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b, and, that meets the requirements below subject to the procedures in Section III.M. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigation and after completing the installation of all additional monitoring wells in the Water Canyon/Cañon de Valle watersheds in accordance with this section (IV.B), subject to the procedures in Section III.M, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Water Canyon/Cañon de Valle. Upon Department approval of the long-term monitoring plans for the Water Canyon/Cañon de Valle watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Water Canyon/Cañon de Valle watersheds sections or the corresponding site-specific sections of the Interim Plan.

1. Groundwater samples shall be obtained from alluvial wells 16-2655, 16-2656, 16-2657, 16-2658, 16-2659, WCO-1, WCO-2, WCO-3, Beta Hole, and all alluvial wells installed in the future.

2. Groundwater samples shall be obtained from intermediate wells CdV-15-3, CdV-37-2, and all intermediate wells installed in the future.

3. Groundwater samples shall be obtained from regional wells CdV-15-3, CdV-37-2, and all regional wells installed in the future.

4. Groundwater samples shall be collected from the alluvial, intermediate, and regional monitoring wells in Water Canyon/Cañon de Valle for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B.2.i of this Consent Order, perchlorate, TAL metals, , cyanide, molybdenum, tungsten, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department.

IV.B.3.b.v Water Canyon/Cañon de Valle Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and recommendations and conclusions for Water Canyon/Cañon de Valle. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order.

Based on the results of the investigations conducted in the Water Canyon/Cañon de Valle watershed and after completing the installation of all additional monitoring wells in the Water Canyon/Cañon de Valle watershed, Water Canyon/Cañon de Valle watershed- or site-specific

long-term groundwater monitoring plans shall be submitted to the Department for review and written approval.

IV.B.4 Pajarito Canyon Watershed

IV.B.4.a Background

The Pajarito Canyon watershed is located in the central portion of the Facility and is approximately 13 square miles in area. The head of the watershed is located in the Sierra de los Valles. Two major tributary canyons, Two Mile and Three Mile Canyons, intersect Pajarito Canyon on the Facility property. Facility-related contamination has been detected in water samples obtained from perennial and ephemeral streams, alluvial groundwater systems, and springs supplied by intermediate zone groundwater from the Bandelier Tuff. The TAs located within this watershed include TAs-3, 6, 7, 8, 9, 14, 15, 18, 22, 23, 27, 36, 40, 46, 50, 54, 55, 58, 59, 64, 65, 66, 67, and 69. The contaminant release history from approximately 379 SWMUs includes releases from outfalls, septic systems, spills, open detonations from firing sites, and MDAs.

IV.B.4.b Pajarito Canyon Investigation

IV.B.4.b.i Pajarito Canyon Investigation Work Plan

The Respondents have submitted to the Department the Work Plan for Pajarito Canyon, dated September 1998. The Work Plan for Pajarito Canyon is incorporated herein by reference and made an enforceable part of this Consent Order. The Respondents shall implement the work plan approved pursuant to the procedures in Section III.M of this Consent Order.

IV.B.4.b.ii Pajarito Canyon Alluvial Groundwater Well Installation

The Respondents shall install alluvial groundwater monitoring wells in Pajarito Canyon at the locations proposed in the work plan approved pursuant to the procedures in Section III.M of this Consent Order that meet the following requirements:

1. Proposed alluvial monitoring well 3MAO-2 shall be moved into reach TH1 East, located in the south fork of Three Mile Canyon, to investigate historic outfall discharges in the upper portion of the Three Mile Canyon sub-basin.

2. One alluvial monitoring well shall be installed in Two Mile Canyon upgradient from its confluence with Pajarito Canyon.

3. Well PCO-3 shall be redeveloped or, if required by the Department, replaced.

4. One alluvial monitoring well shall be installed in the vicinity of PCTH-5.

5. Four alluvial aquifer system piezometers, including one nested piezometer set, shall be installed in Pajarito Canyon above PCO-3, downstream from the drainages associated with TA-54.

IV.B.4.b.iii Pajarito Canyon Intermediate Groundwater Well Installation

The Respondents shall install intermediate groundwater wells in Pajarito Canyon at the locations in the approved work plan that meet both the requirements of Section IV.A.3.e of this Consent Order and the following requirements, subject to the procedures in Section III.M of this Consent Order. The Respondents shall implement the work requirements of the approved work plan.

1. Two nested piezometer sets shall be installed in the vicinity of well PCO-3 to assess the vertical gradients in the Guaje Pumice Bed and the Cerros del Rio Basalt.

2. One intermediate zone monitoring well shall be installed between the flood retention structure and proposed well PCAO-6.

3. Pursuant to the approved work plan, additional intermediate zone wells shall be installed, if required by the Department.

IV.B.4.b.iv Pajarito Canyon Regional Groundwater Well Installation

The Respondents shall install regional groundwater wells in Pajarito Canyon at the locations in the approved work plan that meet both the requirements of Section IV.A.3.e of this Consent Order and the following requirements, subject to the procedures in Section III.M of this Consent Order.

1. Regional aquifer wells R-17 and R-18 shall be installed in accordance with the schedule specified in Section XII of this Consent Order. R-17 shall be installed in Two Mile Canyon and R-18 shall be installed in Upper Pajarito Canyon.

2. Pursuant to the approved work plan, additional regional aquifer wells shall be installed, if required by the Department.

IV.B.4.b.v Pajarito Canyon Groundwater Monitoring

The Respondents shall monitor and sample all wells specified below containing alluvial, intermediate zone and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b, and, that meets the requirements listed below subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of investigations and after completing the installation of all additional monitoring wells in the Pajarito Canyon watershed in accordance with this section (IV.B), subject to the procedures in Section III.M, the Respondents shall submit to the Department for review and written approval site-specific long-term groundwater monitoring plans for Pajarito Canyon and adjacent watersheds, as appropriate. Upon Department approval of the long-term monitoring plans for the specific sites identified within Pajarito Canyon watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Pajarito Canyon watershed section of the Interim Plan.

1. Groundwater samples shall be obtained from alluvial wells BG-1, BG-4, 18-MW-5, 18-MW-7, 18-MW-8, 18-MW-9, 18-MW-10, 18-MW-11, 18-MW-12, 18-MW-16, 18-MW-17, 18-MW-18, PCO-1, PCO-2, PCO-3, and all alluvial wells installed in the future.

2. Groundwater samples shall be obtained from the intermediate zone of regional well R-19 and all intermediate zone wells installed in the future.

3. Groundwater samples shall be obtained from regional wells R-19, R-22, and all regional wells installed in the future.

4. Groundwater samples shall be collected from the alluvial, intermediate zone, and regional monitoring wells in Pajarito Canyon for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B.2.i of this Consent Order, perchlorate, TAL metals, cyanide, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department.

IV.B.4.b.vi Pajarito Canyon Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and the recommendations and conclusions for Pajarito Canyon. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order.

Based on the results of the investigations conducted in the Pajarito Canyon watershed, and after completing the installation of all additional monitoring wells in the Pajarito Canyon watershed as described in Section IV.B, subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval site-specific long-term groundwater monitoring plans for Pajarito Canyon and adjacent watersheds, as appropriate. Upon Department approval of the long-term monitoring plans for the Pajarito Canyon watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Pajarito Canyon watershed sections of the Interim Plan.

IV.B.5 Sandia Canyon Watershed

IV.B.5.a Background

The Sandia Canyon watershed is approximately 5.5 square miles in area. The head of the canyon is located on the Pajarito Plateau at TA-3. Perennial stream flow and saturated alluvial aquifer conditions occur in the upper and middle portions of the canyon system because of sanitary wastewater and cooling tower discharges to the canyon from operating facilities. A wetland of approximately seven acres has developed as a result of the wastewater and cooling tower discharges in the upper portion of the canyon. PCBs have been detected in sediment samples obtained from the wetland area and mercury has been detected in surface water samples. The only known perennial spring in the watershed (Sandia Spring) is located in lower Sandia Canyon.

TAs located in the Sandia Canyon watershed include TAs 3, 20, 53, 60, 61, and 72 and include approximately 264 SWMUs and AOCs. The types of SWMUs and AOCs vary from industrial outfalls to open-detonation firing sites.

IV.B.5.b Sandia Canyon Investigation

IV.B.5.b.i Sandia Canyon Investigation Work Plan

The Respondents have submitted to the Department the Work Plan for Sandia Canyon and Cañada del Buey, dated September 1999. The Work Plan for Sandia Canyon and Cañada del Buey is incorporated herein by reference and made an enforceable part of this Consent Order. The Department issued a Request for Supplemental Information (RSI) on May 12, 2003. The Respondents submitted a response to the RSI to the Department for approval on August 27, 2003. The Respondents shall implement the work plan approved pursuant to the procedures in Section III.M of this Consent Order and any additional requirements in the approved response to the RSI, and will report the results of the investigation in the Sandia Canyon Investigation Report.

IV.B.5.b.ii Sandia Canyon Groundwater Well Installation

The Respondents shall install groundwater monitoring wells in Sandia Canyon at the locations proposed in the work plan and RSI Response approved pursuant to the procedures in Section III.M of this Consent Order, and that meet the requirements of Section IV.A.3.e of this Consent Order and the following requirements:

1. Four piezometers shall be installed in the vicinity of the alluvial aquifer monitoring wells listed in the work plan. The piezometers shall include a minimum of one nested piezometer set near well SCAO-1 and also one nested piezometer set in the vicinity of SCAO-3 if groundwater is determined to be present.

2. One intermediate aquifer well shall be installed in the vicinity of regional aquifer well R-12.

3. Regional aquifer well R-10 shall be installed in Upper Sandia Canyon and R-11 shall be installed in Middle Sandia Canyon (below the break in slope) and according to the schedule set forth in Section XII of this Consent Order.

4. Three monitoring wells shall be installed in Cañada del Buey upgradient of CDBO-6 to investigate the source of alluvial saturation. The borings shall be advanced to the depth of the vapor-phase notch (horizontal zone of weathering between units Qbt 1v and Qbt 1g of the Bandelier Tuff.

5. Four monitoring wells shall be installed between wells CDBO-6 and CDBO-7 to identify the boundaries of alluvial saturation.

IV.B.5.b.iii Sandia Canyon Groundwater Monitoring

The Respondents shall monitor and sample all wells specified below containing alluvial, intermediate zone and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b, and that meets the requirements listed below, subject to the procedures of Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigations and after completing the installation of all additional monitoring wells in the Sandia Canyon watershed as described in this section (IV.B), subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a watershed-specific or site-specific long-term groundwater monitoring plan or plans for Sandia Canyon. Upon Department approval of the long-term monitoring plan or plans for the Sandia Canyon watershed for specific sites within the watershed and adjacent watersheds, as appropriate, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Sandia Canyon watershed section of the Interim Plan.

1. Groundwater samples shall be obtained from wells SCO-1, SCO-2, R-12, and all wells installed in the future.

2. Groundwater samples shall be collected from all monitoring wells in Sandia Canyon for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B.2.i of this Consent Order, perchlorate, TAL metals, cyanide, molybdenum, tungsten, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department. In addition, groundwater samples from the alluvial monitoring wells shall be analyzed for PCBs.

IV.B.5.b.iv Sandia Canyon Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and recommendations and conclusions for Sandia Canyon. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order. Investigations conducted in Cañada del Buey shall be reported separately from the Sandia Canyon investigations pursuant to Section IV.B.2.b.iii of this Consent Order.

Based on the results of the investigations conducted in the Sandia Canyon watershed, and after completing the installation of all additional monitoring wells in the Sandia Canyon watershed as described in Section IV.B, subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a Sandia Canyon watershed-specific or site specific long-term groundwater monitoring plans. Upon Department approval of the long-term monitoring plans for the Sandia Canyon watershed or specific sites within the watershed and adjacent watersheds, as appropriate, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Sandia Canyon watershed section of the Interim Plan.

IV.B.6 Other Canyons: Ancho, Chaquehui, Indio, Potrillo, Fence, and North Canyons (Bayo, Guaje, Barrancas, and Rendija)

IV.B.6.a Background

Ancho Canyon is located in the southern portion of the Facility and is approximately seven square miles in area. During monsoon summer rains, large floods have damaged roads and buildings within the floodplain. The Ancho Canyon watershed is located entirely within TAs 33, 39, 49, and 70. It contains approximately 33 SWMUs. Contaminants that have been detected in sediments, surface water, or shallow groundwater during previous investigations conducted in the watershed include mercury and other metals, explosive compounds, organic constituents, and radionuclides, which are not addressed under this Consent Order.

The Chaquehui Canyon watershed is located in the southeast portion of the Facility at TA-33. There are approximately 61 SWMUs and AOCs in the watershed that vary from inactive industrial outfalls to MDAs. Surface-water flow is ephemeral; however, two springs are present along the south-facing wall of the main-drainage. Contaminants above background levels have been detected in historical samples of sediments and surface water obtained in the canyon.

Indio Canyon, a south-entering sub-basin to Water Canyon, originates on Facility property and extends for about three miles to its confluence with Water Canyon. The drainage basin is located in TA-39. Contaminants above background levels have been detected in sediments and surface water samples obtained from the canyon.

Potrillo and Fence Canyons are part of the Water Canyon Watershed. The confluence of these two canyons is near State Road 4. TAs 15, 36, 68, and 71 are located within these canyons. There are approximately 53 SWMUs within the watershed. The SWMUs vary from inactive septic tanks to open-detonation firing sites. Contaminants above background levels have been detected in sediments and surface water samples obtained from the canyons.

Bayo, Guaje, Barrancas, and Rendija Canyons are part of the Los Alamos Canyon watershed. Rendija and Barrancas Canyons terminate at Guaje Canyon from the south. Guaje Canyon terminates at Los Alamos Canyon approximately one mile upstream of the Rio Grande. The only active TA in the canyons is TA-74, a portion of which is located in Bayo and Barrancas Canyons. There are approximately 18 SWMUs and AOCs in these drainages. These SWMUs and AOCs are primarily related to mortar impact areas, firing ranges, and golf course effluent discharges.

Surface-water flow in upper Guaje Canyon is perennial and extends for about three miles. In 1996, two shallow test holes were drilled approximately three miles east of the perennial flow between the Los Alamos and Guaje faults. Each borehole penetrated saturation from near ground surface to total depth (23 ft and 103 ft below ground surface, respectively). Regional aquifer water-supply wells in Guaje Canyon were first installed in the early 1950s. In recent years there have been additional replacement wells drilled. The depths to water at these wells vary depending on their location. Depth to water in the lower portion of the canyon tends to be shallow (100-200 ft and was artesian prior to early 1950s), while water levels in the upper

portion near the Rendija Canyon confluence have water-table depths ranging from 400 to 500 ft bgs.

Surface-water flow in Rendija and Barrancas Canyons is ephemeral and normally flows only during the summer monsoon season

Contaminant sources are primarily associated with upper Rendija Canyon. The results of sampling conducted in these canyons have periodically detected metals, organics, and radionuclides, which are not addressed under this Consent Order.

IV.B.6.b Investigations for the Other Canyons

IV.B.6.b.i Investigation Work Plans for the Other Canyons

The Respondents shall submit to the Department for review and written approval, pursuant to the procedures in Section III.M of this Consent Order, a work plan for the investigation of contamination in Ancho, Chaquehui, and Indio Canyons that meets the requirements of this section (IV.B). The work plan shall be incorporated into the Water Canyon/Cañon de Valle work plan described in Section IV.B.3.b.i. The work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. The work plan shall address investigations of the sources of contamination, and the nature and extent of contamination in sediments, surface water, and groundwater in Ancho, Chaquehui, and Indio Canyons. Upon Department approval, the Respondents shall implement the work plan. Upon Department approval, the work plan shall be incorporated herein by reference and become an enforceable part of this Consent Order.

The Respondents shall submit to the Department for review and written approval, pursuant to the procedures in Section III.M of this Consent Order, a work plan for the investigation of contamination in Potrillo and Fence Canyons that meets the requirements of this section (IV.B.). The work plan shall be incorporated into the Water Canyon/Cañon de Valle work plan described in Section IV.B.3.b.i. The work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. The work plan shall address investigations of the sources of contamination, and the nature and extent of contamination in sediments, surface water, and groundwater in Potrillo and Fence Canyons. Upon Department approval, the Respondents shall implement the work plan. Upon Department approval, the work plan shall be incorporated herein by reference and become an enforceable part of this Consent Order.

The Respondents have submitted to the Department the Work Plan for the North Canyons, dated September 2001. The North Canyons Work Plan is incorporated herein by reference and made an enforceable part of this Consent Order upon approval by the Department pursuant to the procedures in Section III.M of this Consent Order. The Respondents shall implement the approved work plan.

IV.B.6.b.ii Groundwater Well Installation for the Other Canyons

Pursuant to Section IV.B.6.b.i and procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan that meets the requirements listed below.

1. One alluvial monitoring well shall be installed down gradient of MDA Y at TA-39.

IV.B.6.b.iii Groundwater Monitoring for the Other Canyons

The Respondents shall monitor and sample wells specified below containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b, and that meets the requirements listed below, subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigation and after completing the installation of all additional monitoring wells in the other canyons watersheds in accordance with this section (IV.B), subject to the procedures in Section III.M, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for the other canyons. Upon Department approval of the long-term monitoring plans for the other sites or canyons watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the other canyons watersheds sections of the Interim Plan.

1. Groundwater samples shall be obtained from Ancho Canyon intermediate and regional monitoring wells DT-5a, DT-9, DT-10, R-31, and all monitoring wells installed in the future.
2. Groundwater samples shall be collected from the monitoring wells for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B.2.i of this Consent Order, perchlorate, TAL metals, cyanide, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department.

IV.B.6.b.iv Investigation Reports for the Other Canyons

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and the recommendations and conclusions for Ancho, Chaquehui, and Indio Canyons. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order.

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and the recommendations and conclusions for Potrillo and Fence Canyons. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order.

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected,

and the recommendations and conclusions for the North Canyons. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order.

Based on the results of the investigations conducted in the canyons described in this Section (IV.B.6.b.iv), and after completing the installation of all additional monitoring wells in the Other Canyon watersheds as described in Section IV.B, subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for the other canyons. The plans shall include the specifics for conducting long-term groundwater sampling in the vicinity of the specific sites or in the subject canyon watersheds, and shall replace the Interim Plans for monitoring in those canyons. Upon Department approval of the long-term monitoring plans for the other sites or canyons watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the other canyons watersheds sections of the Interim Plan. Potrillo and Fence Canyons shall be included in the Water Canyon/Cañon de Valle watershed-specific long-term groundwater monitoring work plan required in Section IV.B.3.b.v unless otherwise addressed in site-specific long-term monitoring plans.

IV.C TECHNICAL AREA INVESTIGATIONS

IV.C.1 Technical Area 54

IV.C.1.a Background

TA-54 is located at the eastern end of Mesita del Buey on the east side of the Facility. Mesita del Buey trends southeast-northwest and is bounded to the south by Pajarito Canyon and to the north by Cañada del Buey. Hazardous wastes, and mixed wastes, as well as radioactive wastes, which are not addressed under this Consent Order, have been stored at TA-54 from the 1950s to the present. TA-54 includes four MDAs designated MDA G, H, J, and L; a waste characterization, container storage, and transfer facility (transfer facility); active radioactive waste storage and disposal operations at Area G (which are not covered under this Consent Order), active hazardous and mixed waste storage operations at Area L (which are not covered under this Consent Order), and administrative and support areas. The transfer facility is located at the western end of TA-54. MDAs H and J are located approximately 500 ft and 1,000 ft southeast of the transfer facility, respectively. MDA L is located approximately one mile southeast of the transfer facility. MDA G is located within Area G approximately one-half mile southeast of MDA L.

MDA G at TA-54 Area G was used as the Facility's primary radioactive disposal facility from 1957 until 1997. Solid and liquid wastes were disposed at MDAs G, H, and L. Area L is currently a hazardous and mixed waste container storage area. Currently, Area G is used for the disposal of low-level radioactive waste in pits, and for the storage of mixed and transuranic waste. The Respondents report that hazardous and mixed wastes were disposed of in pits, trenches, and shafts at MDA G until 1990. MDA H is an inactive hazardous and radioactive waste disposal area that received classified or sensitive wastes and debris contaminated with

radioactive, hazardous, and explosive constituents between 1960 and 1989. MDA L at TA-54 Area L was used between 1959 and 1986 for disposal of mostly liquid hazardous and radioactive wastes into pits, trenches, and shafts. Environmental investigations at TA-54 show that contaminant releases have occurred at MDAs G, H, and L. None of the radioactive materials and waste management activities at TA-54 are subject to this Consent Order.

The Facility disposed of trash and other generally nonhazardous waste at MDA J. MDA J is currently being closed under the authority of the Department's Solid Waste Bureau and is not included in this Consent Order.

IV.C.1.b Historical Investigation

The Respondents shall conduct an investigation of contaminants that may have been discharged or released at MDAs G and L at TA-54 during the history of the Facility. The investigation shall include a review of existing data and other information acquired during previous investigations. Historic investigations or reports conducted under the Facility's Hazardous Waste Facility Permit, including data collected under the EPA-approved RFI work plan (and subsequent EPA-approved work plan modifications) for Operable Unit 1148, may be used to satisfy these requirements, subject to the procedures in Section III.M of this Consent Order. To the extent not previously investigated, the Respondents shall review and confirm the construction details and historical use of SWMUs and other possible sources of discharges or releases of contaminants including all existing and demolished TA buildings and other structures, pits, shafts, trenches, landfills, and surface impoundments, wastewater treatment, conveyance, and disposal systems, and subsurface utility corridors. To the extent not previously investigated, the Respondents shall also review all investigation borings, excavations, sampling events, and other sources of information on contamination. The Respondents shall submit to the Department historical investigation reports, which shall be included as appendices to the Investigation Work Plans under Sections IV.C.1.c.i and IV.C.1.e.i, respectively. The reports shall contain the following information:

1. Location, construction details, operational history, and present status of each disposal unit or other structures at MDAs G and L. All such locations shall be depicted in one or more figures.

2. A description of the disposal history of MDAs G and L. This description shall include all known and suspected materials disposed, discharged, or released; the volume of each discharge or release, if known; and the contaminants present in each discharge or release. The Respondents shall identify whether the disposal history of each SWMU is unknown or incomplete.

3. A description of each previous investigation of the sources, extent, or characteristics of contamination associated with MDAs G and L, regardless of whether or not such investigation was completed.

4. A summary of any results and conclusions of each previous investigation described in Paragraph 3, including the known or suspected dates of waste disposal, the dates of each

contaminant discharge or release, and the circumstances related to the contaminant release, if known.

5. A description of the location, construction details, history, and present status of each investigation well and boring associated with corrective action at TA-54. A description of the location, history, dimensions, and present status of each excavation associated with investigations of MDAs G and L shall also be included. The Respondents shall depict all such locations in one or more figures. A site map encompassing the entire TA and pertinent regional investigation locations shall be included in the description.

6. A description of the sample collection methods and the types of field and laboratory analyses performed on each sample obtained from each media during the previous investigations.

7. Tables summarizing the data collected from each investigation well, boring, and excavation. The results shall present only analyte detections and data quality exceptions reported by the analytical laboratory that may mask analytes.

8. A summary of data quality, including exceptions and interpretations.

9. A summary of all contradictory investigation results and the rational for acceptance or rejection of selected investigation results.

10. A list of general chemistry and metals background concentrations and documentation of the methods used for establishing the background values.

The summaries shall include references to historical documents within the summary text citing the document title, page number, and table or figure number. The full reference citations shall be presented as a separate section in each summary document using the standard USGS format for reference citations. The Respondents are responsible for providing complete information with regard to the available data and the need for additional data at each unit. The Department shall evaluate the information and request changes as necessary. The Department's evaluation and approval will address the Respondents' general approach to site characterization and plan for acquiring additional data required to complete the site investigations at TA-54.

The historic investigation report required under this Section shall summarize the results of past investigation activities conducted at MDAs G and L, including all data collected under the EPA-approved RFI work plan (and subsequent EPA-approved work plan modifications) for Operable Unit 1148.

IV.C.1.c MDA G Investigation

IV.C.1.c.i MDA G Investigation Work Plan

The Respondents submitted to the Department for review and written approval, a work plan on September 30, 2003 for the investigation of contamination at MDA G. The Department

disapproved the work plan in a letter dated December 11, 2003. The Respondents must resubmit a work plan that meets the requirements of this section (IV.C.1), subject to the procedures in Section III.M of this Consent Order. The historical investigation report appendix to the resubmitted work plan must summarize the results of past investigation activities conducted at MDA G that includes all work conducted and data collected under the EPA-approved work plan. Upon Department approval, the work conducted under the EPA-approved plan may be used to satisfy the requirements of this section (IV.C.1.c.). The work plan shall address investigations of the disposal units; migration pathways; the connections to potential receptors including groundwater; and the nature and extent of contamination in soil, rock, sediments, groundwater (where present), and subsurface vapor at MDA G, including monitoring and reporting.

The Respondents shall implement the requirements of the work plan approved by the Department, pursuant to the procedures in Section III.M of this Consent Order. The approved work plan shall be incorporated herein by reference and become an enforceable part of this Consent Order.

IV.C.1.c.ii MDA G Survey of Disposal Units

In accordance with Section IV.C.1.c.i, the Respondents shall conduct a survey of the disposal units comprising MDA G. The Respondents shall determine the dimensions and total depth of each disposal shaft and pit at MDA G into which wastes have been disposed, and the base profile, topography, low elevation point, and down-slope end of the base of each shaft and pit.

The dimensions and base elevations of each pit and shaft at MDA G shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods may be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.1.c.iii.

The Respondents shall include information collected during a survey of MDA G in the historical investigation report appendix to the work plan to be submitted to the Department.

IV.C.1.c.iii MDA G Drilling Explorations

The Respondents shall conduct subsurface explorations as specified in the approved work plan in order to acquire data to characterize the extent of contamination and to characterize fracture density, fracture orientation, and fracture fill material. The fracture characterization of the rock formations underlying MDA G shall be completed utilizing data acquired from outcrop, cores, and downhole geophysical and video data. The methods and locations for collecting rock fracture data shall be approved by the Department prior to data collection. The Respondents shall determine the following prior to the implementation of drilling explorations:

1. The dimensions and total depths of each shaft and disposal pit.

2. The base profile, topography, low elevation point, and the down-slope end of the base of each disposal pit.

The dimensions and base elevations of each disposal pit and shaft shall be determined using as-built construction drawings or boring logs, if available, ground penetrating radar, magnetic surveys, or other methods. The methods used to evaluate the dimensions of the pits and shafts shall be approved by the Department prior to implementation.

The Respondents submitted a work plan to the Department for review and written approval for completing subsurface explorations at MDA G. The Department disapproved the work plan in a letter dated December 11, 2003. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Respondents may include information associated with the 20 borings advanced in accordance with the EPA-approved work plan for OU 1148 in the investigation work plan to be submitted to the Department.

1. One boring, or the number defined in the Department-approved MDA G work plan, shall be advanced directly adjacent to the down-slope end of each disposal pit, one boring at the down slope end of each row of disposal shafts, and one boring at the low elevation point of each pit.

2. One boring per every 3,600 square ft, or as defined in the Department-approved MDA G work plan, shall be advanced in a shaft field and one boring per every 60 ft shall be advanced in a shaft row.

3. The borings shall be drilled to minimum depths of 20 ft below the base of the pits and a minimum of 20 ft below the base of the deepest shafts in a shaft row or shaft field.

4. The borings shall be advanced a minimum of 25 ft below detected vapor-phase, soil, rock, or groundwater contamination as detected by field screening or previous investigations.

5. Selected boreholes shall be characterized using geophysical logging techniques approved by the Department.

6. A general design for vapor monitoring well construction shall be submitted to the Department for approval prior to the start of subsurface explorations at TA-54.

7. Specific borings shall be completed as vapor monitoring wells. The screened intervals, and methods and materials used to construct each vapor monitoring well shall be based upon information obtained during drilling activities and open-hole vapor sampling field screening results, and shall be approved by the Department prior to well construction.

8. One boring, or the number defined in the Department-approved MDA G work plan, shall be advanced at MDA G to evaluate for the presence of perched groundwater and vapor-phase contamination at depth beneath the site.

9. Three TA-54-specific wells, or the number defined in the Department-approved MDA G work plan, shall be advanced that intersect the regional aquifer at locations approved by the Department. Two wells shall be located in Cañada del Buey, upgradient of MDA G

and MDA L and between MDA G and MDA L, respectively. One well shall be located in Pajarito Canyon downgradient of MDA L. The Respondents shall include information on regional wells associated with TA-54 that have already been installed in the work plan to be submitted to the Department. The Department will determine whether these wells are adequate to characterize the extent of groundwater contamination associated with TA-54.

10. The borings shall be advanced using hollow-stem auger drilling methods where practicable or other drilling methods approved by the Department.

11. All borings not completed as monitoring wells (vapor or groundwater monitoring wells) shall be properly plugged and abandoned. Documentation of proper well abandonment shall be submitted to the Department as an appendix to the investigation report.

IV.C.1.c.iv MDA G Soil and Rock Sampling

The Respondents submitted to the Department for review and written approval a work plan for completing soil and rock sampling during subsurface drilling explorations at MDA G. The Department disapproved the work plan in a letter dated December 11, 2003. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Soil and rock samples shall be obtained from each boring at ten-ft intervals and from the bedrock directly below the base elevation of each pit or shaft. A sample also shall be obtained at the maximum depth of each boring.

2. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

3. A detailed log of each boring shall be maintained. The results of all field screening shall be included in the corresponding boring log.

4. A minimum of six cores shall be obtained from selected borings, at depths approved by the Department, for permeability testing in accordance with Section IX.B of this Consent Order.

5. A minimum of two samples shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, pH, explosive compounds, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, and cyanide.

6. The sample displaying the greatest field screening evidence of VOC concentrations shall be selected for submittal to the analytical laboratory for chemical analysis of the analytes listed in Paragraph 5 above. If field-screening evidence of contamination is not observed in a boring, the sample obtained from the bedrock directly below the base elevation of each pit or shaft shall be submitted for chemical analysis of the analytes listed in Paragraph 5 above.

7. The sample obtained from the maximum depth of each boring also shall be submitted to an analytical laboratory for analysis of the analytes listed in Paragraph 5 above.

IV.C.1.c.v MDA G Canyon Alluvial Sediment Sampling

The Respondents shall investigate contaminant transport from MDA G to canyon alluvial sediments through the implementation of the Pajarito Canyon Investigation Work Plan required under Section IV.B.4.b.i of this Consent Order and through the implementation of the Sandia/Cañada del Buey Work Plan required under Section IV.B.5.b.i of this Consent Order. Pursuant to the EPA-approved RFI Work Plan for Operable Unit 1148, the Respondents investigated sediments in drainage channels leading from MDA G to Pajarito Canyon and Cañada del Buey [RFI Report for Channel Sediment Pathways from MDAs G, H, J, and L, at TA-54, February 27, 1996]. Only soils to depths less than 0.7 foot below ground surface were sampled during the investigation. If, after completion of the investigation of canyon sediments in Pajarito Canyon and Cañada del Buey, the nature and extent of contaminant releases from MDA G drainages to Pajarito Canyon or Cañada del Buey have not been established, the Department will require additional sediment investigations of the drainages leading from MDA G. If the Department requires such additional sediment investigation in writing, the Respondents shall submit to the Department for review and written approval a work plan for the investigation. The work implemented under the work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Soil borings shall be advanced through the alluvium into the underlying bedrock at four locations in Pajarito Canyon and two locations in Cañada del Buey approved by the Department.

2. Samples of alluvial sediments and underlying bedrock shall be collected at locations approved by the Department and in accordance with the methods described in Section IX.B of this Consent Order.

3. Samples shall be obtained from each boring between the ground surface and one ft below the ground surface (0-1.0 ft interval), at five-ft intervals, at the alluvial sediment-bedrock interface, and at the maximum depth of each boring in accordance with the methods described in Section IX.B of this Consent Order.

4. The samples shall be submitted to an analytical laboratory for analysis of explosive compounds, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, and cyanide.

5. If sediment samples collected from other intervals in the borings display field screening evidence of the presence of contaminants, then those samples shall also be submitted to an analytical laboratory for analysis of the analytes listed in Paragraph 4 above.

6. If groundwater is encountered during the additional sediment investigation, alluvial wells shall be installed in accordance with Section IV.C.1.c.vii of this Consent Order.

IV.C.1.c.vi MDA G Subsurface Vapor Monitoring

The Respondents submitted to the Department for review and written approval a work plan to collect subsurface vapor samples from discrete zones in each vapor monitoring well or boring, at depths approved by the Department, for field and laboratory analyses. The Department disapproved the work plan in a letter dated December 11, 2003. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Subsurface vapor samples shall be collected from newly drilled borings during site investigation activities.

2. An investigation vapor monitoring and sampling plan shall be submitted to the Department for approval as part of the MDA G investigation work plan.

3. Subsurface vapor sampling shall be conducted at MDA G in each existing and newly constructed vapor well and boring specified in the approved work plan.

4. Samples of subsurface vapors shall be collected from subsurface vapor monitoring points at discrete zones, selected based on investigation and monitoring results.

5. A long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for review and approval.

IV.C.1.c.vii MDA G Alluvial Groundwater Well Installation

The Respondents shall address the alluvial groundwater well installation associated with MDA G through the implementation of the Pajarito Canyon Investigation Work Plan required under Section IV.B.4.b.i of this Consent Order and through the implementation of the Sandia/Cañada del Buey Work Plan required under Section IV.B.5.b.i of this Consent Order. Any wells or piezometers identified in the Pajarito and Sandia/Cañada del Buey Work Plans that are located down gradient of MDA G shall be installed during the investigation of MDA G. If additional alluvial wells, other than those required in the Pajarito and Sandia/Cañada del Buey Work Plans, are required by the Department, the Respondents shall submit to the Department for review and approval a work plan to construct monitoring wells. Implementation of the work plan approved pursuant to the procedures in Section III.M shall meet the requirements of Section IV.A.3.e of this Consent Order and the following requirements.

1. The monitoring well borings shall be advanced to depths of five ft below the alluvium-bedrock interface.

2. The monitoring wells shall be constructed and developed in accordance with Section X of this Consent Order.

3. Groundwater samples shall be collected from each well in accordance with Sections IV.C.1. and IX of this Consent Order.

IV.C.1.c.viii MDA G Intermediate Groundwater Well Installation

The Respondents submitted to the Department for review and written approval a work plan for the construction of one intermediate depth well at MDA G to determine the presence of perched groundwater and the extent of vapor-phase contamination below the ground surface. The Department disapproved the work plan in a letter dated December 11, 2003. The work plan, when approved by the Department pursuant to the procedures in Section III.M of this Consent Order, shall meet the requirements of Section IV.A.3.e of this Consent Order and the following requirements. Subject to the procedures in Section III.M, Respondents may use data collected during installation of well R-22 to address the requirements of this section (IV.C.1.c.viii).

1. The boring shall be drilled to a depth of 700 ft below the ground surface.

2. Vapor and groundwater samples shall be collected from the boring prior to well construction.

3. A monitoring well design plan shall be submitted to the Department for approval prior to construction of the intermediate well.

4. The Department may impose specific conditions for well construction or require the drilling of additional borings that intersect the intermediate perched zones or regional aquifer based on the sampling results.

IV.C.1.c.ix MDA G Regional Groundwater Well Installation

The Respondents submitted to the Department for review and written approval a work plan for the construction of three monitoring wells associated with TA-54 and intersecting the regional aquifer. The Department disapproved the work plan in a letter dated December 11, 2003. The work plan, when approved by the Department pursuant to the procedures in Section III.M of this Consent Order, shall meet the requirements of Section IV.A.3.e of this Consent Order and the following requirements. The Respondents shall include information on regional wells associated with TA-54 that have already been installed in the work plan to be submitted to the Department. Pursuant to the Department-approved Hydrogeologic Work Plan, regional well R-21 was installed in Cañada del Buey between MDA G and MDA L, regional well R-22 was installed on Mesita del Buey downgradient of MDA G, and regional wells R-20 and R-32 were installed in Pajarito Canyon upgradient of MDA G. Subject to the procedures in Section III.M, Respondents may use data collected during installation of wells R-21, R-22, and R-32 to address the requirements of this section (IV.C.1.c.ix).

1. The wells shall be located at the locations described in Section IV.C.1.c.iii, Paragraph 9, of this Consent Order.

2. The borings shall be monitored for the presence of vapor-phase contaminants prior to well construction.

3. Based on the results of vapor monitoring, the Department may require that the Respondents construct the wells to accommodate vapor monitoring in addition to groundwater monitoring and sampling.

IV.C.1.c.x MDA G Groundwater Monitoring

The Respondents shall monitor and sample all wells containing alluvial, intermediate perched, and/or regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigations and after completing the installation of all additional monitoring wells in the Cañada del Buey, Pajarito, and Mortandad Canyons watersheds, as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for, Pajarito, and Mortandad Canyon watersheds. Upon Department approval of the long-term monitoring plans for the Cañada del Buey, Pajarito, and Mortandad Canyons watersheds or specific sites within those watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Cañada del Buey, Pajarito, and Mortandad Canyons watersheds sections of the Interim Plan.

1. Groundwater samples shall be collected from each saturated zone intersecting the monitoring wells.

2. Groundwater samples shall be submitted to a laboratory for analysis of general chemistry parameters as described in Section IX.B of this document, VOCs, SVOCs, explosive compounds, perchlorate, TAL metals, cyanide, and for other analytes specified by the Department.

3. The groundwater sampling shall be conducted in accordance with Section IX.B of this Consent Order.

IV.C.1.c.xi MDA G Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA G. The Respondents shall follow the investigation report format outlined in Section XI and the compliance schedule in Section XII.

Based on the results of the investigations conducted at TA-54, and after completing the installation of all additional monitoring wells in Pajarito and Mortandad Canyon watersheds as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Pajarito and Mortandad Canyons. Upon Department approval of the long-term monitoring plans for the Pajarito and Mortandad Canyons watersheds or specific sites within those watersheds, the requirements of the long-term

monitoring plans shall apply and shall supersede the requirements of the Cañada del Buey, Pajarito, and Mortandad Canyons watersheds sections of the Interim Plan.

IV.C.1.d MDA H Investigation

An investigation at MDA H has been concluded. The results of the investigation have been reported in the Respondent's *RFI Report for Material Disposal Area H at Technical Area 54* dated May 2001 and the Addendum to the RFI Report dated October 2002. The Department approved both the RFI Report and the associated RFI Addendum on April 11, 2003. The Respondents submitted a Corrective Measures Study (CMS) Report to the Department on May 31, 2003.

IV.C.1.d.i MDA H Vapor Monitoring

The Respondents shall collect subsurface vapor samples at MDA H for field and laboratory analyses in accordance with Section IX.B of this Consent Order.

1. Vapor samples shall be collected from existing borings on a periodic basis.

2. Samples of subsurface vapors shall be collected by the Respondents from vapor monitoring points at discrete zones, selected based on investigation and monitoring results, and as total well or boring subsurface vapor samples. The Department shall approve the depths for discrete vapor sample collection.

3. A long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for approval after the MDA H Corrective Measures Study has been approved by the Department.

IV.C.1.d.ii MDA H Groundwater Monitoring

Based on the results of the investigations conducted at TA-54, and after completing the installation of all additional monitoring wells in the Pajarito and Mortandad Canyons watersheds as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Pajarito and Mortandad Canyons. Upon Department approval of the long-term monitoring plans for the Pajarito and Mortandad Canyons watersheds or specific sites within those watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Pajarito and Mortandad Canyons watersheds sections of the Interim Plan.

IV.C.1.e MDA L Investigation

IV.C.1.e.i MDA L Investigation Work Plan

The Respondents submitted to the Department on August 31, 2003 for review and written approval a work plan for the investigation of contamination at MDA L) that addresses the requirements of this section (IV.C.1.e). The Department notified the Respondents of deficiencies

in a letter dated November 18, 2003. Respondents submitted a revised work plan in response to the deficiencies on December 23, 2003. The historical investigation report appendix to the work plan summarized results of past investigation activities conducted at MDA L and includes work conducted and data collected under the EPA-approved work plan. Upon Department approval, the work conducted under the EPA-approved plan may be used to satisfy the requirements of this section (IV.C.1.e.). The work plan shall address investigations of the disposal units; migration pathways; the connections to potential receptors including groundwater; and the nature and extent of contamination in soil, rock, sediments, groundwater (where present), and subsurface vapor at MDA L.

The Respondents shall implement the work plan approved by the Department pursuant to the procedures in Section III.M of this Consent Order.

IV.C.1.e.ii MDA L Survey of Disposal Units

In accordance with Section IV.C.1.e.i, the Respondents shall conduct a survey of the disposal units comprising MDA L. The Respondents shall determine the dimensions and total depth of each disposal shaft and pit at MDA L into which waste was disposed, and the base profile, topography, low elevation point, and down-slope end of the base of each shaft and disposal pit into which waste was disposed.

The dimensions and base elevations of each pit and shaft shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods may be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.1.e.iii.

The Respondents shall include the information collected during a survey of MDA L in the historic investigation report appendix to the work plan to be submitted to the Department under Section IV.C.1.e.i.

IV.C.1.e.iii MDA L Drilling Explorations

The Respondents shall conduct subsurface explorations, as specified in the approved work plan, in order to acquire data to characterize the extent of contamination, and to characterize fracture density, fracture orientation, and fracture fill material. The fracture characterization in the rock formations underlying MDA L shall be completed utilizing data acquired from outcrop, core data, and downhole geophysical and video data. The methods and locations for collecting rock fracture data shall be approved by the Department prior to data collection.

The Respondents submitted to the Department, for review and written approval, a work plan for completing subsurface explorations at MDA L. The Department notified the Respondents of deficiencies in a letter dated November 18, 2003. Respondents submitted a revised work plan in response to the deficiencies on December 23, 2003. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Respondents shall include information associated with the 18 borings advanced in accordance with the EPA-approved work plan for OU 1148 in the investigation work plan to be

submitted to the Department. Subject to the procedures in Section III.M, these borings may be used to satisfy the requirements of this section (IV.C.1.e.iii).

1. One boring, or the number defined in the Department-approved MDA L Investigation Work Plan, shall be advanced directly adjacent to the locations of the down-slope end of each disposal pit, one boring at the low elevation point of each disposal pit, and one boring at the downslope end of each row of disposal shafts.

2. One boring per every 60 ft, or the specific requirements defined in the Department-approved MDA L Investigation Work Plan, shall be advanced in a shaft row.

3. The borings shall be drilled to minimum depths of 20 ft below the base of the pits and a minimum of 20 ft below the base of the deepest shafts in a shaft row or shaft field.

4. The borings shall be advanced a minimum of 25 ft below detected vapor-phase, soil, rock, or groundwater contamination as detected by field screening or previous investigations.

5. The borings shall be advanced using hollow-stem auger drilling methods, where practicable, or other drilling methods approved by the Department.

6. Selected boreholes shall be characterized using geophysical logging techniques approved by the Department.

7. A general design for vapor monitoring well construction shall be submitted to the Department for approval prior to the start of subsurface explorations at MDA L.

8. Specific borings, as set out in the approved investigation work plan, shall be completed as vapor monitoring wells. The screened intervals, and methods and materials used to construct each vapor monitoring well shall be based upon information obtained during drilling activities and open-hole vapor sample field screening results, and shall be approved by the Department prior to well construction.

Three TA-54-specific wells, or the number defined in the Department-approved MDA L Investigation Work Plan, that intersect the regional aquifer shall be installed at locations approved by the Department. The well locations shall be established at the locations and under the conditions described in Section IV.C.1.e.viii. The Respondents shall include information on regional wells associated with TA-54 that have already been installed in the work plan to be submitted to the Department. The Department will determine whether these wells are adequate to characterize the extent of groundwater contamination associated with TA-54.

IV.C.1.e.iv MDA L Soil and Rock Sampling

The Respondents submitted to the Department for review and written approval a work plan for completing soil and rock sampling during subsurface explorations at MDA L. The Department notified the Respondents of deficiencies in a letter dated November 18, 2003. Respondents submitted a revised work plan in response to the deficiencies on December 23, 2003.

Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Soil and rock samples shall be collected from each boring at ten-ft intervals and from the bedrock directly below the base elevation of each pit or the deepest shaft in the shaft row. A sample also shall be obtained at the maximum depth of each boring.

2. Samples shall be collected using split-barrel samplers lined with brass sleeves or by coring methods.

3. Samples shall be screened in the field for the presence of VOCs and pH using methods approved by the Department.

4. A detailed log of each boring shall be maintained. The results of all field screening shall be included in the corresponding boring log.

5. A minimum of three cores shall be collected from selected borings, at depths approved by the Department, for permeability testing using ASTM Methods.

6. A minimum of two samples from each boring shall be selected for submittal to a laboratory for analysis of VOCs, SVOCs, pH, PCBs, dioxins, furans, explosive compounds, nitrates, perchlorate, TAL metals, and cyanide.

7. The sample displaying the greatest field screening evidence of VOC concentrations shall be selected for submittal to the analytical laboratory for analysis of the analytes listed in Paragraph 6 above. If field screening evidence of contamination is not observed in a boring, the sample obtained from the bedrock directly below the base elevation of each pit or shaft shall be submitted for chemical analysis of the analytes listed in Paragraph 6 above.

8. The sample obtained from the maximum depth of each boring shall be analyzed by a laboratory for the analytes listed in Paragraph 6 above.

IV.C.1.e.v MDA L Canyon Alluvium and Sediment Sampling

The Respondents shall investigate contaminant transport from MDA L to canyon alluvial sediments through the implementation of the Pajarito Canyon Investigation Work Plan required under Section IV.B.4.b.i of this Consent Order and through the implementation of the Sandia/Cañada del Buey Work Plan required under Section IV.B.5.b.i of this Consent Order. Pursuant to the EPA-approved RFI Work Plan for Operable Unit 1148, the Respondents investigated sediments in drainage channels leading from MDA L to Pajarito Canyon and Cañada del Buey [RFI Report for Channel Sediment Pathways from MDAs G, H, J, and L, at TA-54, February 27, 1996]. Only soils to depths less than 0.7 foot below ground surface were sampled during the investigation. If, after completion of the investigation of canyon sediments in Pajarito Canyon and Cañada del Buey, the nature and extent of contaminant releases from MDA L drainages to Pajarito Canyon or Cañada del Buey has not been established, the Department will require additional sediment investigations of the drainages leading from MDA

L. If the Department requires such additional sediment investigation in writing, the Respondents shall submit to the Department for review and written approval a work plan for the investigation. The work implemented under the work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order.

1. Soil borings shall be advanced through the alluvium into the underlying bedrock at one location in Pajarito Canyon and at one location in Cañada del Buey.

2. Samples of alluvial sediments and underlying bedrock shall be collected at locations approved by the Department and in accordance with the methods described in Section IX.B of this Consent Order.

3. Samples from each boring shall be collected between the ground surface and one ft below the ground surface (0-1.0 ft interval), at five-ft intervals, at the alluvial sediment-bedrock interface, and at the maximum depth of each boring in accordance with the methods described in Section IX.B of this Consent Order.

4. Samples shall be submitted to a laboratory for analysis of explosive compounds, PCBs, dioxin, furan, nitrate, perchlorate, TAL metals, and cyanide concentrations.

5. If groundwater is encountered during the additional sediment investigation, alluvial wells shall be installed in accordance with Section IV.C.1.e.vii of this Consent Order.

IV.C.1.e.vi MDA L Vapor Monitoring

The Respondents submitted to the Department for review and written approval a work plan for the collection of subsurface vapor samples at MDA L in each existing and newly constructed vapor well and boring, at depths approved by the Department. The Department notified the Respondents of deficiencies in a letter dated November 18, 2003. Respondents submitted a revised work plan in response to the deficiencies on December 23, 2003. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the approved work plan, shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Subsurface vapor samples shall be collected from newly drilled borings during site investigation activities.

2. An investigation vapor monitoring and sampling plan shall be submitted to the Department for approval as part of the investigation work plan.

3. Subsurface vapor sampling shall be conducted at MDA L in each existing and newly constructed vapor well and boring specified in the approved work plan.

4. Subsurface vapor samples shall be collected from subsurface vapor monitoring points at discrete zones, selected based on investigation and monitoring results, and as total well or boring subsurface vapor samples.

5. A long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for approval.

IV.C.1.e.vii MDA L Alluvial Groundwater Well Installation

The Respondents shall address the alluvial groundwater well installation associated with MDA L through the implementation of the Pajarito Canyon Investigation Work Plan required under Section IV.B.4.b.i of this Consent Order and through the implementation of the Sandia/Cañada del Buey Work Plan required under Section IV.B.5.b.i of this Consent Order. Any wells or piezometers identified in the Pajarito and Sandia/Cañada del Buey Work Plans that are located down gradient of MDA L shall be installed during the investigation of MDA L. If additional alluvial wells, other than those required in the Pajarito and Sandia/Cañada del Buey Work Plans, are required by the Department, the Respondents shall submit to the Department for review and approval a work plan to construct monitoring wells. Implementation of the approved work plan shall meet the requirements of Section IV.A.3.e of this Consent Order and the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. The monitoring well borings shall be advanced to depths of five ft below the alluvium-bedrock interface.

2. The monitoring wells shall be constructed and developed in accordance with Section X of this Consent Order.

3. Groundwater samples shall be collected from each well in accordance with Sections IV.C.1and IX of this Consent Order.

IV.C.1.e.viii MDA L Intermediate Groundwater Well Installation

The Respondents submitted to the Department for review and written approval a work plan for the installation of one intermediate depth well at MDA L to evaluate for the presence of perched groundwater and vapor-phase contamination at depths between 150 ft and 700 ft below the ground surface as described in Section IV.C.1.c.vii. The Department notified the Respondents of deficiencies in a letter dated November 18, 2003. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. The boring shall be drilled to depth of 700 ft below the ground surface.

2. Vapor and groundwater samples shall be collected from the boring prior to well construction.

3. The Department may impose specific conditions for well construction or require the drilling of additional borings that intersect the intermediate perched zones or regional aquifer based on the sampling results.

IV.C.1.e.ix MDA L Regional Groundwater Well Installation

The Respondents submitted to the Department for review and written approval a work plan for the construction of three monitoring wells associated with TA-54 intersecting the regional aquifer as described in Section IV.C.1.c.ix above. The Department notified the Respondents of deficiencies in a letter dated November 18, 2003. Implementation of the approved work plan, shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Pursuant to the Department-approved Hydrogeologic Work Plan, regional well R-20 was installed in Pajarito Canyon upgradient of MDA L; regional well R-21 was installed in Cañada del Buey between MDA G and MDA L; and regional well R-32 was installed in Pajarito Canyon downgradient of MDA L and may fulfill the requirements of this section. Respondents may use data collected during installation of wells R-20, R-21, and R-32 to address the requirements of this section (IV.C.1.e.ix).

1. Two wells shall be located in Cañada del Buey, upgradient of MDA G and MDA L and between MDA G and MDA L, respectively.

2. One well shall be located in Pajarito Canyon downgradient of MDA L.

3. The borings shall be monitored for the presence of vapor-phase contaminants prior to well construction.

4. Based on the results of vapor monitoring, the Department may require that the Respondents construct the wells to accommodate vapor monitoring in addition to groundwater monitoring and sampling.

IV.C.1.e.x MDA L Groundwater Monitoring

The Respondents shall monitor and sample all wells containing alluvial, intermediate perched, and/or regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigation and after completing the installation of all additional monitoring wells in the Cañada del Buey, Pajarito, and Mortandad Canyons watersheds as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Pajarito and Mortandad Canyon watersheds. Upon Department approval of the long-term monitoring plans for the Pajarito and Mortandad Canyons watersheds or specific sites within those watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Cañada del Buey, Pajarito, and Mortandad Canyons watersheds sections of the Interim Plan.

1. Groundwater samples shall be collected from each saturated zone intersecting the monitoring wells for analysis of general chemistry parameters as described in Section IX.B of this Consent Order and for VOCs, SVOCs,explosive compounds, perchlorate, TAL metals, and cyanide, and for other analytes specified by the Department.

2. The groundwater sampling shall be conducted in accordance with Section IX.B of this Consent Order.

IV.C.1.e.xi MDA L Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA L. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order.

Based on the results of the investigations conducted at TA-54, and after completing the installation of all additional monitoring wells in the Cañada del Buey, Pajarito, and Mortandad Canyons watersheds as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Pajarito and Mortandad Canyons. Upon Department approval of the long-term monitoring plans for the Pajarito and Mortandad Canyons watersheds or specific sites within those watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Cañada del Buey, Pajarito, and Mortandad Canyons watersheds sections of the Interim Plan.

IV.C.2 Technical Area 21

IV.C.2.a Background

TA-21 is located on DP Mesa, which is located on the northern side of the Facility. DP Mesa trends southeast-northwest and is bounded on the south by Los Alamos Canyon and on the north by DP Canyon. Los Alamos Canyon heads in the Sierra de Los Valles and DP Canyon heads on the Pajarito Plateau at the Los Alamos Townsite, which borders TA-21 to the west.

TA-21 is the former plutonium processing area. Plutonium processing operations began at TA-21 in 1945 and ceased in 1978. Radionuclides are not addressed under this Consent Order. TA-21 contains five MDAs: A, B, T, U and V. MDA A was used for disposal of liquid and solid waste from 1945 to 1949 and from 1969 to 1977. MDA A is located in the eastern portion of TA-21 approximately 0.25 miles east of the intersection of DP Road and the north perimeter road of TA-21. MDA B is the largest solid waste disposal area within TA-21. MDA B is located in the southwestern corner of TA-21 approximately 0.25 miles from the intersection of DP Road and Trinity Drive. MDA T consists of four absorption beds used to dispose of liquid waste; a retrievable waste storage area; a series of disposal shafts; an acid holding tank and acid sump; a caisson built at the northwest corner of absorption bed 1 in 1959; an inactive container storage area for alcohol, acetone, and freon; and two surface spills of radioactive paste, which are not addressed under this Consent Order. MDA T is located in the north central portion of TA-21 directly west of MDA A. MDA U consists of two absorption beds used for the subsurface disposal of liquid wastewater and an associated sump located between the two beds. MDA U is located in the northeastern corner of TA-21 approximately 500 feet north and east of MDA A.

MDA V, which operated continuously from 1945 to 1961, consists of three absorption beds used for the subsurface disposal of wastewater generated from a laundry operation. MDA V is located directly east of MDA B in the southwestern portion of TA-21.

Pursuant to the EPA-approved RFI Work Plan for OU 1106, Respondents began an area-wide hydrogeologic investigation of TA-21.

IV.C.2.b Historical Investigation

The Respondents shall conduct an investigation of contaminants that may have been discharged or released at MDAs A, B, T, U, and V at TA-21 during the historical operations at the Facility. The investigation shall include the known or suspected source of any groundwater contaminants, and a review of existing data and other information acquired during previous investigations. Historical investigations or reports conducted under the Facility's Hazardous Waste Facility Permit may be used to satisfy this requirement, subject to the procedures in Section III.M of this Consent Order. To the extent not previously investigated, the Respondents shall review and confirm the construction details and historical use of SWMUs and other possible sources of discharges or releases of contaminants including all existing and demolished TA buildings and other structures; pits, shafts, trenches, landfills, and surface impoundments, wastewater treatment, conveyance, and disposal systems; and subsurface utility corridors. To the extent not previously investigated, the Respondents shall also review all investigation borings, excavations, sampling events, and other sources of information on contamination. The Respondents shall submit to the Department an historical investigation report for MDAs B, T and V, which shall be included as appendices to the Investigation Work Plans under Sections IV.C.2.d.i, IV.C.2.e.i and IV.C.2.g.i, respectively. The Respondents shall submit to the Department historical investigation reports for MDAs A and U, which shall be submitted separately and in conjunction with the Investigation Work Plans under Sections IV.C.2.c.i and IV.C.2.f.i, respectively. To the extent not previously provided, the reports shall contain the following information:

1. Location, construction details, operational history, and present status of each disposal unit, or other structures at MDAs A, B, T, U, and V. All such locations shall be depicted in one or more figures.

2. A description of the known or suspected disposal history of each disposal unit or other structure at the MDAs listed under Paragraph 1. This description shall include all known and suspected wastes disposed, discharged, or released; the volume of each discharge or release, if known; the flow rate of each discharge or release, if known; and the contaminants present in each discharge or release, if known. The Respondents shall report whether the disposal history is incomplete or unknown.

3. A description of each previous investigation of the sources, extent, or characteristics of contamination at MDAs A, B, T, U, and V, regardless of whether or not such investigation was completed.

4. A summary of any results and conclusions of each previous investigation described in Paragraph 3, including the known or suspected dates of waste disposal, the suspected

dates of contaminant releases, and the circumstances related to the contaminant releases.

5. A description of the location, construction details, history, and present status of each investigation well and boring associated with corrective action at TA-21. A description of the location, history, dimensions, and present status of each excavation associated with investigations of MDAs A, B, T, U, and V shall also be included. All such locations shall be depicted in one or more figures. A site map encompassing the entire TA and pertinent regional investigation locations shall be included in the description.

6. A description of the sample collection methods and the types of field and laboratory analyses performed on each sample obtained from each media during the previous investigations.

7. Tables summarizing the data collected from each investigation well, boring, and excavation. The results shall present only analyte detections and data quality exceptions reported by the analytical laboratory that may mask analytes.

8. A summary of data quality, including exceptions and interpretations.

9. A summary of all contradictory or anomalous investigation results and the rationale for acceptance or rejection of the data.

10. A list of general chemistry and metals background concentrations and documentation of the methods used for establishing the background values.

The summaries shall include references to historical documents within the summary text citing the document title, page number, and table or figure number. The full reference citations shall be presented as a separate section in each summary document using the standard USGS format for reference citations. The Respondents are responsible for providing complete information with regard to the available data and the need for additional data at each unit. The Department shall evaluate the information and request changes as necessary. The Department's evaluation and approval will address the Respondents' general approach to site characterization and plan for acquiring additional data required to complete the site investigations at TA-21.

IV.C.2.c MDA A Investigation

IV.C.2.c.i MDA A Investigation Work Plan

Pursuant to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for the investigation of contamination at MDA A. Implementation of the approved work plan, shall meet the requirements of this section (IV.C.2.c), subject to the procedures in Section III.M of this Consent Order. The work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. The historical investigation report shall summarize the results of past investigation activities conducted at MDA A. Subject to the procedures in Section III.M, the work conducted under the

EPA-approved plan may be used to satisfy the requirements of this section (IV.C.2.c). The work plan shall address investigations of the disposal units, migration pathways and the connections to potential receptors including groundwater, and the nature and extent of contamination in soil, rock, sediments, groundwater (where present), and subsurface vapor (if detected) at MDA A.

The Respondents shall implement the work plan approved by the Department pursuant to the procedures in Section III.M of this Consent Order.

IV.C.2.c.ii MDA A Survey of Disposal Units

In accordance with Section IV.C.2.c.i, the Respondents shall conduct a survey of the disposal units comprising MDA A. The Respondents shall determine the dimensions and total depth of each disposal trench, absorption bed, shaft, pit, and other unit at MDA A into which waste was disposed; and the base profile, topography, low elevation point, and down-slope end of the base of each disposal trench, shaft, pit, and absorption bed at MDA A into which waste was disposed.

The dimensions and base elevations of each trench, absorption bed, pit, shaft, and other disposal unit at MDA A shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods shall be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.2.c.iii.

IV.C.2.c.iii MDA A Drilling Explorations

The Respondents shall conduct subsurface explorations as specified in the approved work plan in order to obtain sufficient data to characterize the extent of contamination, and to characterize fracture density, fracture orientation, and fracture fill material or the absence of fracture fill material in bedrock underlying MDA A. The fracture characterization of the rock formations underlying MDA A shall be completed utilizing data acquired from outcrops, cores, and downhole geophysical and video log data. A discussion of the sampling methods and potential locations for collecting rock fracture data shall be included within the required Investigation Work Plan for MDA A. The Department, prior to field investigation and data collection activities, shall approve the methods and locations for the fracture investigation activities.

Pursuant to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for subsurface investigation activities at MDA A. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Fifteen (15) borings, or the number defined in the Department-approved MDA A Investigation Work Plan, shall be advanced using hollow-stem auger drilling methods where practical or other drilling methods approved by the Department. Three of the borings shall be advanced to the base of the Cerro Toledo interval. All borings shall be drilled in accordance with Section IX of this Consent Order. The Department, prior to drilling, shall approve the location of the borings and the drilling method.

2. Selected boreholes shall be characterized using geophysical logging techniques approved by the Department.

3. A monitoring well shall be installed if groundwater (perched or regional) is encountered during drilling activities or if geophysical results indicate possible zone(s) of saturation. The wells shall be constructed in accordance with Section X of this Consent Order.

4. Vapor monitoring wells shall be installed in the borings if vapor-phase contamination is detected during drilling activities.

5. All borings not completed as monitoring wells (vapor or groundwater monitoring wells) shall be properly plugged and abandoned as described in Section X.D. Documentation of proper well abandonment shall be submitted to the Department as an appendix to the investigation report.

IV.C.2.c.iv MDA A Soil and Rock Sampling

Pursuant to Section IV.C.2.c.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for conducting soil and rock sampling during subsurface explorations activities at MDA A. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Soil samples shall be collected continuously for the first 40 ft and at ten-ft intervals there after.

2. Samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

3. A minimum of four core samples from the tuff overlying the Cerro Toledo shall be collected and submitted for laboratory permeability testing in accordance with Section IX.B of this Consent Order.

4. Field screening and laboratory sample selection shall be biased toward evidence of contamination, lithologic contacts, fractures, fracture fill material, surge beds and other higher permeability units identified during investigation activities. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

5. Sediment, soil, and rock samples shall be obtained from the intervals described in Paragraph 1 above and from the bedrock directly below the base elevation of each absorption bed or shaft. A sample also shall be obtained at the maximum depth of each boring.

6. A minimum of four samples shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, and cyanide. The sample exhibiting the highest

field screening detection; the sample obtained from the maximum depth in each boring that displays field screening evidence of contamination; the sample located immediately below the base of any pit, tank or other structure; and the sample from the total boring depth shall be submitted for laboratory analysis.

IV.C.2.c.v MDA A Sediment Sampling

The Respondents shall investigate contaminant transport from MDA A to canyon alluvial sediments through the implementation of the Work Plan for Los Alamos and Pueblo Canyons, dated November 1995, and the addendum to the Work Plan, dated February 2002, as described in Section IV.B.1.b.i of this Consent Order. The work plan and addendum were approved by the Department in June 1997 and May 2002, respectively. Pursuant to the EPA-approved RFI Work Plan for OU 1106, the Respondents investigated sediments in drainage channels leading from MDA A to DP Canyon. The investigation work plan shall include requirements for sediment sampling and characterization of drainages at MDA A in accordance with Section IV.A.4 of this Consent Order. If, after completion of the investigation of canyon sediments pursuant to the Work Plan for Los Alamos and Pueblo Canyons and addendum, the nature and extent of contaminant releases from MDA A drainages to DP Canyon have not been established, the Department will require additional sediment investigations of the drainages leading from MDA A.

IV.C.2.c.vi MDA A Subsurface Vapor Monitoring

Pursuant to Section IV.C.2.c.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan to collect subsurface vapor samples from discrete zones in each subsurface vapor monitoring well or boring at MDA A, at depths approved by the Department, for field and laboratory analyses. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Subsurface vapor samples shall be collected from all newly drilled borings during site investigation activities.

2. An investigation vapor monitoring and sampling plan shall be prepared in accordance with the format described in Section XI.B of this Consent Order and submitted by the Respondents to the Department for approval.

3. Subsurface vapor sampling shall be conducted at MDA A in each existing and newly constructed vapor well and boring specified in the approved work plan.

4. Samples of subsurface vapors shall be collected by the Respondents from subsurface vapor monitoring points at discrete zones selected based on investigation and monitoring results. The monitoring points must be approved by the Department prior to sample collection.

Based on the results of the investigation vapor monitoring, a long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for review and approval.

IV.C.2.c.vii MDA A Intermediate Groundwater Well Installation

If intermediate zone groundwater is encountered or if geophysical or other evidence suggests the presence of intermediate perched groundwater during the required subsurface investigations for MDA A, the Department may require a work plan for the installation of intermediate groundwater monitoring well(s). The minimum depth of the subsurface investigations for MDA A will be the base of the Cerro Toledo interval. If groundwater is detected, these monitoring wells shall target all potential intermediate perched water bearing intervals identified during subsurface explorations at MDA A. If perched groundwater is encountered in sufficient quantities to allow sampling, the Respondents shall sample and analyze the water in accordance with the characterization requirements in the approved work plan and provide recommendations a long-term groundwater monitoring plan in the MDA A investigation report required under Section IV.C.2.c.x.

IV.C.2.c.viii MDA A Regional Groundwater Well Installation

If the Department determines the need for additional wells intersecting the regional groundwater aquifer associated with TA-21 based on investigation data, the Respondents shall submit to the Department for review and written approval a work plan for the installation of such wells. The wells shall be installed according to the requirements in Section X of this Consent Order.

IV.C.2.c.ix MDA A Groundwater Monitoring

The Respondents shall monitor and sample all wells specified below containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigations and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

1. Groundwater samples shall be obtained from Los Alamos Canyon monitoring wells LAO-1.6(g), LAO-2, LAO-3A, LAO-4.5C, LAO-5, LAO-6, LAO-6A, LAUZ-1, LAUZ-2, LADP-3, R-9i, R-5, R-7, R-8, R-9, TW-3, and any wells installed in the future determined by the Department to be required and at the frequency described in Section XII of this Consent Order. As described in Section IV.B.1.b.iv, TW-3 shall be plugged

and abandoned according to the procedures in Section X.D. Groundwater shall be monitored from TW-3 until the well is properly abandoned.

2. The groundwater sampling shall be conducted in accordance with Section IX.B of this Consent Order.

3. Groundwater samples shall be collected from the Los Alamos Canyon monitoring wells for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B of this Consent Order, perchlorate, TAL metals, cyanide, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department.

IV.C.2.c.x MDA A Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA A. The Respondents shall follow the investigation report format outlined in Section XI.C of this Consent Order and submitted by the date specified in the schedule in Section XII of this Consent Order.

Based on the results of the investigations conducted at TA-21, and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

IV.C.2.d MDA B Investigation

IV.C.2.d.i MDA B Investigation Work Plan

A Sampling and Analysis Plan (SAP) for MDA B was approved by the Department in June 1999 and is incorporated herein by reference. Pursuant to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for the further investigation of contamination at MDA B. Implementation of the approved work plan, shall meet the requirements of this section (IV.C.2.d), subject to the procedures in Section III.M of this Consent Order. The work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. The work plan shall summarize the results of past investigation. Subject to the procedures in Section III.M, the work conducted under the Department-approved SAP and the EPA-approved RFI work plan may be used to satisfy the requirements of this section (IV.C.2.d). The work plan shall address investigations of the disposal units; migration pathways and the connections to potential receptors including groundwater; and the nature and extent of contamination in soil, rock, sediments, groundwater

(where present), and subsurface vapor (if detected) at MDA B.

The Respondents shall implement the work plan approved by the Department pursuant to the procedures in Section III.M of this Consent Order.

IV.C.2.d.ii MDA B Survey of Disposal Units

In accordance with Section IV.C.2.d.i, the Respondents shall conduct a survey of the disposal units comprising MDA B. The Respondents shall determine the dimensions and total depth of each disposal trench, absorption bed, shaft, pit, and other unit at MDA B into which waste was disposed; and the base profile, topography, low elevation point, and down-slope end of the base of each disposal trench, shaft, pit, and absorption bed at MDA B into which waste was disposed.

The dimensions and base elevations of each trench, absorption bed, pit, shaft, and other unit at MDA B shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods shall be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.2.d.iii.

IV.C.2.d.iii MDA B Drilling Explorations

The Respondents shall conduct subsurface explorations as specified in the approved work plan in order to obtain sufficient data to characterize the extent of contamination, and to characterize fracture density, fracture orientation, and fracture fill material or the absence of fracture fill material at MDA B. The fracture characterization of the rock formations underlying MDA B shall be completed utilizing data acquired from outcrops, cores, and downhole geophysical and video log data. A discussion of the sampling methods and potential locations for collecting rock fracture data shall be included within the required characterization work plan for MDA B. The Department, prior to field investigation and data collection activities, shall approve the methods and locations for the fracture investigation activities.

Pursuant to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for subsurface investigation activities at MDA B. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Respondents shall include information associated with the borings located and advanced in accordance with the EPA-approved work plan and NMED-approved SAP in the work plan to be submitted to the Department. Subject to the procedures in Section III.M, these borings may be used to satisfy the requirements of this Section (IV.C.2.d.iii).

1. Eight (8) borings, or the number defined in the Department-approved MDA B Investigation Work Plan, shall be advanced using hollow-stem auger drilling methods where practical or other drilling methods approved by the Department. Two borings shall be advanced to the base of the Cerro Toledo interval. All borings shall be drilled in accordance with Section X.B of this Consent Order. The Department, prior to drilling, shall approve the location of the borings and the drilling method.

2. Selected boreholes, as specified in the Department-approved work plan, shall be characterized using geophysical logging techniques approved by the Department.

3. A monitoring well shall be installed if groundwater (perched or regional) is encountered during drilling activities or if geophysical results indicate possible zone(s) of saturation. The wells shall be constructed in accordance with Section X of this Consent Order.

4. Vapor monitoring wells shall be installed in the borings if vapor-phase contamination is detected during drilling activities.

All borings not completed as monitoring wells (vapor or groundwater monitoring wells) shall be properly plugged and abandoned. Documentation of proper well abandonment shall be submitted to the Department as an appendix to the investigation report.

IV.C.2.d.iv MDA B Soil and Rock Sampling

Pursuant to Section IV.C.2.d.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for conducting soil and rock sampling during subsurface explorations activities at MDA B. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Soil samples shall be collected continuously for the first 40 ft and at ten-ft intervals thereafter.

2. Samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

3. A minimum of three core samples from the tuff overlying the Cerro Toledo shall be collected and submitted for laboratory permeability testing in accordance with Section IX.B of this Consent Order.

4. Field screening and laboratory sample selection shall be biased toward evidence of contamination, lithologic contacts, fractures, fracture fill material, surge beds, and other higher permeability units identified during investigation activities. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

5. Sediment, soil, and rock samples shall be obtained from each boring at the intervals described in Paragraph 1 above and from the bedrock directly below the base elevation of each absorption bed or shaft. A sample also shall be obtained at the maximum depth of each boring.

6. A minimum of four samples shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, and cyanide. The sample exhibiting the highest field screening detection; the sample obtained from the maximum depth in each boring

that displays field screening evidence of contamination; the sample located immediately below the base of any pit, tank, or other structure; and the sample from the total boring depth shall be submitted for laboratory analysis. The Department may require that additional samples, collected from the borings, be submitted for laboratory analyses.

IV.C.2.d.v MDA B Sediment Sampling

The Respondents shall investigate contaminant transport from MDA B to canyon alluvial sediments through the implementation of the Work Plan for Los Alamos and Pueblo Canyons, dated November 1995, and the addendum to the Work Plan, dated February 2002, as described in Section IV.B.1.b.i of this Consent Order. The work plan and addendum were approved by the Department in June 1997 and May 2002, respectively. Respondents state that, pursuant to the EPA-approved RFI Work Plan for OU 1106, the Respondents investigated sediments in drainage channels leading from MDA B to Los Alamos Canyon. The investigation work plan shall include requirements for sediment sampling and characterization of the drainages at MDA B in accordance with Section IV.A.4 of this Consent Order. If, after completion of the investigation of canyon sediments pursuant to the Work Plan for Los Alamos and Pueblo Canyons and addendum, the nature and extent contaminant releases from MDA B drainages to Los Alamos Canyon have not been established, the Department will require additional sediment investigations of the drainages leading from MDA B.

IV.C.2.d.vi MDA B Subsurface Vapor Monitoring

Pursuant to Section IV.C.2.d.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan to collect subsurface vapor samples from discrete zones in each subsurface vapor monitoring well or boring at MDA B, at depths approved by the Department, for field and laboratory analyses. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Subsurface vapor samples shall be collected from all newly drilled borings during site investigation activities.

2. An investigation vapor monitoring and sampling plan shall be prepared in accordance with the format described in Section XI.B of this Consent Order and submitted by the Respondents to the Department for approval.

3. Subsurface vapor sampling shall be conducted at MDA B in each existing and newly constructed vapor well and boring specified in the approved work plan.

4. Samples of subsurface vapors shall be collected by the Respondents from subsurface vapor monitoring points at discrete zones selected based on investigation and monitoring results. The monitoring points must be approved by the Department prior to sample collection.

Based on the results of the investigation vapor monitoring, a long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for review and approval.

IV.C.2.d.vii MDA B Intermediate Groundwater Well Installation

If intermediate zone groundwater is encountered or if geophysical or other evidence suggests the presence of intermediate perched groundwater during the required subsurface investigations for MDA B, the Department will require a work plan for the installation of intermediate groundwater monitoring well(s). The minimum depth of the subsurface investigations for MDA B will be the base of the Cerro Toledo interval. If groundwater is detected, these monitoring wells shall target all potential intermediate perched water bearing intervals identified during subsurface explorations at MDA B. If perched groundwater is encountered in sufficient quantities to allow sampling, the Respondents shall sample and analyze the water in accordance with characterization requirements in the approved work plan and provide recommendations for a long-term groundwater monitoring plan in the Investigation Report described in Section IV.C.2.d.x.

IV.C.2.d.viii MDA B Regional Groundwater Well Installation

If the Department determines the need for additional wells intersecting the regional groundwater aquifer associated with TA-21 based on investigation data, the Respondents shall submit to the Department for review and written approval a work plan for the installation of such wells. The wells shall be installed according to the requirements in Section X of this Consent Order.

IV.C.2.d.ix MDA B Groundwater Monitoring

The Respondents shall monitor and sample all wells specified below containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigations and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

1. Groundwater samples shall be obtained from Los Alamos Canyon monitoring wells LAO-1.2, LAO-1.8, LAO-1.6(g), LAO-2, LAO-3A, LAO-4.5C, LAO-5, LAO-6, LAO-6A, LADP-3, R-9i, R-5, R-7, R-8, R-9, TW-3, and any wells installed in the future determined by the Department to be required and at the frequency described in Section XII of this Consent Order. As described in Section IV.B.1.b.iv, TW-3 shall be plugged

and abandoned according to the procedures in Section X.D. Groundwater shall be monitored from TW-3 until the well is properly abandoned.

2. The groundwater sampling shall be conducted in accordance with Section IX.B of this Consent Order.

3. Groundwater samples shall be collected from the Los Alamos Canyon monitoring wells for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B of this Consent Order, perchlorate, TAL metals, cyanide, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department.

IV.C.2.d.x MDA B Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA B. The Respondents shall follow the investigation report format outlined in Section XI and the compliance schedule in Section XII.

Based on the results of the investigations conducted at TA-21, and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed-or site-specific long-term groundwater monitoring plans for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plan shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

IV.C.2.e MDA T Investigation

IV.C.2.e.i MDA T Investigation Work Plan

The Respondents submitted to the Department on February 27, 2004 for review and written approval a work plan for the investigation of contamination at MDA T to address the requirements of this section (IV.C.2.e). Implementation of the approved work plan shall meet the requirements of this section (IV.C.2.e), subject to the procedures in Section III.M of this Consent Order. The investigation work plan included a historical investigation report appendix to the work plan summarizing results of past investigation activities conducted at MDA T, including work conducted and data collected under the EPA-approved work plan. All additional relevant sediment, groundwater, surface water and storm water data shall be included in the work plan. Subject to the procedures in Section III.M, work conducted under the SAP and the EPA-approved work plan may be used to satisfy the requirements of this section (IV.C.2.e). The work plan shall address investigations of the disposal units; migration pathways and the connections to potential receptors including groundwater; and the nature and extent of contamination in soil, rock, sediments, groundwater (where present), and subsurface vapor (if detected) at MDA T.

The Respondents shall implement the work plan approved by the Department pursuant to the procedures of Section III.M of this Consent Order.

IV.C.2.e.ii MDA T Survey of Disposal Units

In accordance with Section IV.C.2.e.i, the Respondents shall conduct a survey of the disposal units comprising MDA T. The Respondents shall determine the dimensions and total depth of each disposal trench, absorption bed, shaft, pit, and other unit at MDA T into which waste was disposed, and the base profile, topography, low elevation point, and down-slope end of the base of each disposal trench, shaft, pit, and absorption bed at MDA T into which waste was disposed.

The dimensions and base elevations of each trench, absorption bed, pit, shaft, and other disposal unit at MDA T shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods shall be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.2.e.iii.

IV.C.2.e.iii MDA T Drilling Explorations

The Respondents shall conduct subsurface explorations, as specified in the approved work plan, in order to obtain sufficient data to characterize the extent of contamination, and to characterize fracture density, fracture orientation, and fracture fill material or the absence of fracture fill material at MDA T. The fracture characterization of the rock formations underlying MDA T shall be completed utilizing data acquired from outcrops, cores, and downhole geophysical and video log data. A discussion of the sampling methods and potential locations for collecting rock fracture data shall be included within the required Investigation Work Plan for MDA T. The Department, prior to field investigation and data collection activities, shall approve the methods and locations for the fracture investigation activities.

The Respondents submitted to the Department for review and written approval a work plan for completing subsurface investigation activities at MDA T. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Respondents shall include information associated with the borings advanced in accordance with the SAP submitted to the Department in 1996 in the investigation work plan to be submitted to the Department. Subject to the procedures in Section III.M, these borings may be used to satisfy the requirements of this section (IV.C.2.e.iii).

1. Eleven (11) borings, or the number defined in the Department-approved MDA T Investigation Work Plan, shall be advanced using hollow-stem auger drilling methods, where practicable, or other drilling methods approved by the Department. Three of the borings shall be advanced to the base of the Cerro Toledo interval. All borings shall be drilled in accordance with Section X.B of this Consent Order. The Department shall approve the locations of the borings and the drilling methods prior to drilling.

2. Selected boreholes, as specified in the Department-approved work plan, shall be characterized using geophysical logging techniques approved by the Department.

3. A monitoring well(s) shall be installed if groundwater (perched or regional) is encountered during drilling activities or if geophysical results indicate possible zone(s) of saturation. The wells shall be constructed in accordance with Section X of this Consent Order.

4. Vapor monitoring wells shall be installed in the borings if vapor-phase contamination is detected during drilling activities.

All borings not completed as monitoring wells (vapor or groundwater monitoring wells) shall be properly plugged and abandoned. Documentation of proper well abandonment shall be submitted to the Department as an appendix to the investigation report.

IV.C.2.e.iv MDA T Soil and Rock Sampling

The Respondents submitted to the Department for review and written approval a work plan for conducting soil and rock sampling during subsurface exploration activities at MDA T. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Soil samples shall be collected continuously for the first 40 ft and at ten-ft intervals thereafter.

2. Samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

3. A minimum of three core samples from the tuff overlying the Cerro Toledo shall be collected and submitted for laboratory permeability testing in accordance with Section IX.B of this Consent Order.

4. Field screening and laboratory sample selection shall be biased towards evidence of contamination, lithologic contacts, fractures, fracture fill material, surge beds, and other higher permeability units identified during investigation activities. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

5. Soil and rock samples shall be obtained from each boring at the intervals described in Paragraph 1 above and from the bedrock directly below the base elevation of each absorption bed or shaft. A sample also shall be obtained at the maximum depth of each boring.

6. A minimum of four samples shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, and cyanide. The sample exhibiting the highest field screening detection; the sample obtained from the maximum depth in each boring

that displays field screening evidence of contamination; the sample located immediately below the base of any pit, tank, or other structure; and the sample from the total boring depth shall be submitted for laboratory analysis. The Department may require that additional samples, collected from the borings, be submitted for laboratory analyses.

IV.C.2.e.v MDA T Sediment Sampling

The Respondents shall investigate contaminant transport from MDA T (SWMU 21-016(a)-99) to canyon alluvial sediments through the implementation of the Work Plan for Los Alamos and Pueblo Canyons, dated November 1995, and the addendum to the Work Plan, dated February 2002, as described in Section IV.B.1.b.i of this Consent Order. The work plan and addendum were approved by the Department in June 1997 and May 2002, respectively. Respondents state that, pursuant to the EPA-approved RFI Work Plan for OU 1106, the Respondents investigated sediments in drainage channels leading from MDA T to DP Canyon. The investigation work plan shall include requirements for sediment sampling and characterization of the drainages at MDA T in accordance with Section IV.A.4 of this Consent Order. If, after completion of the investigation of canyon sediments pursuant to the Work Plan for Los Alamos and Pueblo Canyons and addendum, the nature and extent of contaminant releases from MDA T drainages to DP Canyon have not been established, the Department will require additional sediment investigations of the drainages leading from MDA T.

IV.C.2.e.vi MDA T Vapor Monitoring and Sampling

The Respondents submitted to the Department for review and written approval a work plan to collect subsurface vapor samples from discrete zones in each subsurface vapor monitoring well or boring, at depths approved by the Department, for field and laboratory analyses. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Subsurface vapor samples shall be collected from all newly drilled borings during site investigation activities.

1. An investigation vapor monitoring and sampling plan shall be prepared in accordance with the format described in Section XI.B of this Consent Order and submitted by the Respondents to the Department for approval.

2. Subsurface vapor sampling shall be conducted at MDA T in each existing and newly constructed vapor well and boring specified in the approved work plan.

3. Samples of subsurface vapors shall be collected by the Respondents from subsurface vapor monitoring points at discrete zones selected based on investigation and monitoring results. The monitoring points must be approved by the Department prior to sample collection.

Based on the results of the investigation vapor monitoring, a long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for review and approval.

IV.C.2.e.vii MDA T Intermediate Groundwater Well Installation

If intermediate zone groundwater is encountered or if geophysical or other evidence suggests the presence of intermediate perched groundwater during the required subsurface investigations for MDA T, the Department may require a work plan for the installation of intermediate groundwater monitoring well(s). The minimum depth of the subsurface investigations for MDA T will be the base of the Cerro Toledo interval. If groundwater is detected, these monitoring wells shall target all potential intermediate perched water bearing intervals identified during subsurface explorations at MDA T. If perched groundwater is encountered in sufficient quantities to allow sampling, the Respondents shall sample and analyze the water in accordance with characterization requirements in the Approved MDA T Work Plan and then provide recommendations for a long-term groundwater monitoring plan in the MDA T Investigation Report described in Section IV.C.2.e.x.

IV.C.2.e.viii MDA T Regional Groundwater Well Installation

If the Department determines the need for additional wells intersecting the regional groundwater aquifer associated with TA-21 based on investigation data, the Respondents shall submit to the Department for review and written approval a work plan for the installation of such wells. The wells shall be installed according to the requirements in Section X of this Consent Order.

IV.C.2.e.ix MDA T Groundwater Monitoring

The Respondents shall monitor and sample all wells specified below containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigations and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plan for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

1. Groundwater samples shall be obtained from Los Alamos Canyon monitoring wells LAO-1.6(g), LAO-2, LAO-3A, LAO-4.5C, LAO-5, LAO-6, LAO-6A, LAUZ-1, LAUZ-2, LADP-3, R-9i, R-5, R-7, R-8, R-9, TW-3, and any wells installed in the future determined by the Department to be required and at the frequency described in Section XII of this Consent Order. As described in Section IV.B.1.b.iv, TW-3 shall be plugged and abandoned according to the procedures in Section X.D. Groundwater shall be monitored from TW-3 until the well is properly abandoned.

2. The groundwater sampling shall be conducted in accordance with Section IX.B of this Consent Order.

3. Groundwater samples shall be collected from the Los Alamos Canyon monitoring wells for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B of this Consent Order, perchlorate, TAL metals, cyanide, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department.

IV.C.2.e.x MDA T Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA T. The Respondents shall follow the investigation report format outlined in Section XI and the compliance schedule in Section XII.

Based on the results of the investigations conducted at TA-21, and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

IV.C.2.f MDA U Investigation

IV.C.2.f.i MDA U Investigation Work Plan

Pursuant to Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for the investigation of contamination in MDA U. Implementation of the approved work plan shall meet the requirements of this section (IV.C.2.f), subject to the procedures in Section III.M of this Consent Order. The work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. The historical investigation report for the work plan shall summarize the results of past investigation activities that includes all data collected pursuant to the Sampling and Analysis Plan submitted to NMED in September 1998 for Potential Release Site (PRS) 21-017(a,b,c) and other work conducted under the 1992 EPA-approved RFI work plan for OU 1106. All additional relevant sediment, groundwater, surface water and storm water data shall be included in the work plan. Subject to the procedures in Section III.M, work conducted under the SAP and EPA-approved work plan may be used to satisfy the requirements of this section (IV.C.2.f). The work plan shall address investigations of the disposal units; migration pathways and the connections to potential receptors including groundwater; and the nature and extent of contamination in soil, rock, sediments, groundwater (where present), and subsurface vapor (if detected) at MDA U.

The Respondents shall implement the work plan approved by the Department pursuant to the procedures in Section III.M of this Consent Order.

IV.C.2.f.ii MDA U Survey of Disposal Units

In accordance with Section IV.C.2.f.i, the Respondents shall conduct a survey of the disposal units comprising MDA U. The Respondents shall determine the dimensions and total depth of each disposal trench, absorption bed, shaft, pit, and other unit at MDA U into which waste was disposed, and the base profile, topography, low elevation point, and down-slope end of the base of each disposal trench, shaft, pit, and absorption bed at MDA U into which waste was disposed.

The dimensions and base elevations of each trench, absorption bed, pit, shaft, and other disposal unit at MDA U shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods shall be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.2.f.iii.

IV.C.2.f.iii MDA U Drilling Explorations

The Respondents shall conduct subsurface explorations as specified in the approved work plans in order to obtain sufficient data to characterize the extent of contamination, and to characterize fracture density, fracture orientation, and fracture fill material or the absence of fracture fill material at MDA U. The fracture characterization of the rock formations underlying MDA U shall be completed utilizing data acquired from outcrops, cores, and downhole geophysical and video log data. A discussion of the sampling methods and potential locations for collecting rock fracture data shall be included within the required Investigation Work Plan for MDA U. The Department, prior to field investigation and data collection activities, shall approve the methods and locations for the fracture investigation activities.

Pursuant to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for completing subsurface investigation activities at MDA U. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Respondents shall include information associated with these borings located and advanced in accordance with the SAP submitted to the Department in 1998 in the historical investigation report for the work plan to be submitted to the Department. Subject to the procedures in Section III.M, these borings may be used to satisfy the requirements of this section (IV.C.2.f.iii).

1. Twelve (12) borings, or the number defined in the Department-approved MDA U Investigation Work Plan, shall be advanced, using hollow-stem auger drilling methods where practical or by other drilling methods approved by the Department. Three of the borings shall be advanced to the base of the Cerro Toledo interval. All borings shall be drilled in accordance with Section X.B of this Consent Order. The Department, prior to drilling, shall approve the location of the borings and the drilling method.

2. Selected boreholes, as specified in the Department-approved work plan, shall be characterized using geophysical logging techniques approved by the Department.

3. A monitoring well(s) shall be installed if groundwater (perched or regional) is encountered during drilling activities or if geophysical results indicate possible zone(s) of saturation. The wells shall be constructed in accordance with Section X of this Consent Order.

4. Vapor monitoring wells shall be installed in the borings if vapor-phase contamination is detected during drilling activities.

All borings not completed as monitoring wells (vapor or groundwater monitoring wells) shall be properly plugged and abandoned. Documentation of proper well abandonment shall be submitted to the Department as an appendix to the investigation report.

IV.C.2.f.iv MDA U Soil and Rock Sampling

Pursuant to Section IV.C.2.f.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for conducting soil and rock sampling during subsurface explorations activities at MDA U. Implementation of the work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Soil samples shall be collected continuously for the first 40 ft and at ten-ft intervals there after.

2. Samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

3. A minimum of one core sample from the tuff overlying the Cerro Toledo shall be collected and submitted for laboratory permeability testing in accordance with Section IX.B of this Consent Order.

4. Field screening and laboratory sample selection shall be biased toward evidence of contamination, lithologic contacts, fractures, fracture fill material, surge beds, and other higher permeability units identified during investigation activities. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

5. Sediment, soil, and rock samples shall be obtained from each boring at the intervals described in Paragraph 1 above and from the bedrock directly below the base elevation of each absorption bed or shaft. A sample also shall be obtained at the maximum depth of each boring.

6. A minimum of four samples shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, and cyanide. The sample exhibiting the highest

field screening detection; the sample obtained from the maximum depth in each boring that displays field screening evidence of contamination; the sample located immediately below the base of any pit, tank, or other structure; and the sample from the total boring depth shall be submitted for laboratory analysis. The Department may require that additional samples, collected from the borings, be submitted for laboratory analyses.

IV.C.2.f.v MDA U Sediment Sampling

The Respondents shall investigate contaminant transport from MDA U to canyon alluvial sediments through the implementation of the Work Plan for Los Alamos and Pueblo Canyons, dated November 1995, and the addendum to the Work Plan, dated February 2002, as described in Section IV.B.1.b.i of this Consent Order. The work plan and addendum were approved by the Department in June 1997 and May 2002, respectively. Respondents state that, pursuant to the EPA-approved RFI Work Plan for OU 1106, the Respondents investigated sediments in drainage channels leading from MDA U to DP Canyon. The investigation work plan shall include requirements for sediment sampling and characterization of the drainages at MDA U in accordance with Section IV.A.4 of this Consent Order. If, after completion of the investigation of canyon sediments pursuant to the Work Plan for Los Alamos and Pueblo Canyons and addendum, the nature and extent of contaminant releases from MDA U to DP Canyon have not been established, the Department will require additional sediment investigations of the drainages leading from MDA U.

IV.C.2.f.vi MDA U Vapor Monitoring

Pursuant to Section IV.C.2.f.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan to collect subsurface vapor samples from discrete zones in each subsurface vapor monitoring well or boring, at depths approved by the Department, for field and laboratory analyses. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Subsurface vapor samples shall be collected from all newly drilled borings during site investigation activities.

2. An investigation vapor monitoring and sampling plan shall be prepared in accordance with the format described in Section XI.B of this Consent Order and submitted by the Respondents to the Department for approval.

3. Subsurface vapor sampling shall be conducted at MDA **U** in each existing and newly constructed vapor well and boring specified in the approved work plan.

4. Samples of subsurface vapors shall be collected by the Respondents from subsurface vapor monitoring points at discrete zones selected based on investigation and monitoring results. The monitoring points must be approved by the Department prior to sample collection.

Based on the results of the investigation vapor monitoring, a long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for review and approval.

IV.C.2.f.vii MDA U Intermediate Groundwater Well Installation

If intermediate zone groundwater is encountered or if geophysical or other evidence suggests the presence of intermediate perched groundwater during the required subsurface investigations for MDA U, the Department will require a work plan for the installation of intermediate groundwater monitoring well(s). The minimum depth of the subsurface investigations for MDA U will be the base of the Cerro Toledo interval. If groundwater is detected, these monitoring wells shall target all potential intermediate perched water bearing intervals identified during subsurface explorations at MDA U. If perched groundwater is encountered in sufficient quantities to allow sampling, the Respondents shall sample and analyze the water in accordance with characterization requirements in the Approved MDA U Work Plan and then provide recommendations for a long-term groundwater monitoring plan in the Investigation Report described in Section IV.C.2.f.x.

IV.C.2.f.viii MDA U Regional Groundwater Well Installation

If the Department determines the need for additional wells intersecting the regional groundwater aquifer associated with TA-21 based on investigation data, the Respondents shall submit to the Department for review and written approval a work plan for the installation of such wells. The wells shall be installed according to the requirements in Section X of this Consent Order.

IV.C.2.f.ix MDA U Groundwater Monitoring

The Respondents shall monitor and sample all wells specified below containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigations and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

1. Groundwater samples shall be obtained from Los Alamos Canyon monitoring wells LAO-1.6(g), LAO-2, LAO-3A, LAO-4.5C, LAO-5, LAO-6, LAO-6A, LAUZ-2, LADP-3, R-9i, R-5, R-7, R-8, R-9, TW-3, and any wells installed in the future determined by the Department to be required and at the frequency described in Section XII of this Consent Order. As described in Section IV.B.1.b.iv, TW-3 shall be plugged and abandoned

according to the procedures in Section X.D. Groundwater shall be monitored from TW-3 until the well is properly abandoned.

2. The groundwater sampling shall be conducted in accordance with Section IX.B of this Consent Order.

3. Groundwater samples shall be collected from the Los Alamos Canyon monitoring wells for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.b.2.i of this Consent Order, perchlorate, TAL metals, cyanide, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department.

IV.C.2.f.x MDA U Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA U. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII.

Based on the results of the investigations conducted at TA-21, and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

IV.C.2.g MDA V Investigation

IV.C.2.g.i MDA V Investigation Work Plan

Pursuant to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for the further investigation of contamination in MDA V. Implementation of the approved work plan, shall meet the requirements of this section (IV.C.2.g), subject to the procedures in Section III.M of this Consent Order. The work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. The historical investigation report shall summarize the results of past investigation activities. Subject to the procedures of Section III.M, work conducted under the EPA-approved work plan may be used to satisfy the requirements of this section (IV.C.2.g). The work plan shall address investigations of the disposal units; migration pathways and the connections to potential receptors including groundwater; and the nature and extent of contamination in soil, rock, sediments, groundwater (where present), and subsurface vapor (if detected) at MDA V.

The Respondents shall implement the work plan approved by the Department pursuant to the procedures of Section III.M of this Consent Order.

IV.C.2.g.ii MDA V Survey of Disposal Units

In accordance with Section IV.C.2.g.i, the Respondents shall conduct a survey of the disposal units comprising MDA V. The Respondents shall determine the dimensions and total depth of each disposal trench, absorption bed, shaft, pit, and other unit at MDA V into which waste was disposed, and the base profile, topography, low elevation point, and down-slope end of the base of each disposal trench, shaft, pit, and absorption bed at MDA V into which waste was disposed.

The dimensions and base elevations of each trench, absorption bed, pit, shaft, and other disposal unit at MDA V shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods shall be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.2.g.iii of this Consent Order.

IV.C.2.g.iii MDA V Drilling Explorations

The Respondents shall conduct subsurface explorations as specified in the approved work plan in order to obtain sufficient data to characterize the extent of contamination, and to characterize fracture density, fracture orientation, and fracture fill material or the absence of fracture fill material at MDA V. The fracture characterization of the rock formations underlying MDA V shall be completed utilizing data acquired from outcrops, cores, and downhole geophysical and video log data. A discussion of the sampling methods and potential locations for collecting rock fracture data shall be included within the required Investigation Work Plan for MDA V. The Department, prior to field investigation and data collection activities, shall approve the methods and locations for the fracture investigation activities.

Pursuant to Section IV.C.2.g.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit a work plan to the Department for review and written approval for completing subsurface investigation activities at MDA V. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Respondents shall include information associated with the borings located and advanced in accordance with the EPA-approved work plan in the historical investigation report for the work plan to be submitted to the Department. Subject to the procedures in Section III.M, the borings may be used to satisfy the requirements of this section (IV.C.2.g.iii).

1. Fifteen (15) borings, or the number defined in the Department-approved MDA V Investigation Work Plan, shall be advanced using hollow-stem auger drilling methods, where practicable, or other drilling methods approved by the Department. Three of the borings shall be advanced to the base of the Cerro Toledo interval. All borings shall be drilled in accordance with Section X.B of this Consent Order. The Department shall approve the location of the borings and the drilling method prior to drilling.

2. Selected boreholes, as specified in the Department-approved work plan, shall be advanced using geophysical logging techniques approved by the Department.

3. A monitoring well(s) shall be installed if groundwater (perched or regional) is encountered during drilling activities or if geophysical results indicate possible zone(s) of saturation. The wells shall be constructed in accordance with Section X of this Consent Order.

4. Vapor monitoring wells shall be installed in the borings if vapor-phase contamination is detected during drilling activities.

All borings not completed as monitoring wells (vapor or groundwater monitoring wells) shall be properly plugged and abandoned. Documentation of proper well abandonment shall be submitted to the Department as an appendix to the investigation report.

IV.C.2.g.iv MDA V Soil and Rock Sampling

Pursuant to Section IV.C.2.g.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for conducting soil and rock sampling during subsurface explorations activities at MDA V. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Soil samples shall be collected continuously for the first 40 ft and at ten-ft intervals thereafter.

2. Samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

3. A minimum of one core sample from the tuff overlying the Cerro Toledo shall be collected and submitted for permeability testing in accordance with Section IX.B of this Consent Order.

4. Field screening and confirmatory sample collection shall be biased toward evidence of contamination, lithologic contacts, fractures, fracture fill material, surge beds, and other higher permeability units identified during investigation activities. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

5. Sediment, soil, and rock samples shall be obtained from each boring at the intervals described in Paragraph 1 above and from the bedrock directly below the base elevation of each absorption bed or shaft. A sample also shall be obtained at the maximum depth of each boring.

6. A minimum of four samples shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, and cyanide. The sample exhibiting the highest

field screening detection; the sample obtained from the maximum depth in each boring that displays field screening evidence of contamination; the sample located immediately below the base of any pit, tank, or other structure; and the sample from the total boring depth shall be submitted for laboratory analysis. The Department may require that additional samples, collected from the borings be submitted for laboratory analyses.

IV.C.2.g.v MDA V Sediment Sampling

The Respondents shall investigate contaminant transport from MDA V to canyon alluvial sediments through the implementation of the Work Plan for Los Alamos and Pueblo Canyons, dated November 1995, and the addendum to the Work Plan, dated February 2002, as described in Section IV.B.1.b.i of this Consent Order. The work plan and addendum were approved by the Department in June 1997 and May 2002, respectively. Respondents state that, pursuant to the EPA-approved RFI Work Plan for OU 1106, the Respondents investigated sediments in drainage channels leading from MDA V to DP Canyon. The investigation work plan shall include requirements for sediment sampling and characterization of the drainages at MDA V in accordance with Section IV.A.4 of this Consent Order. If, after completion of the investigation of canyon sediments pursuant to the Work Plan for Los Alamos and Pueblo Canyons and addendum, the nature and extent of contaminant releases from MDA V to DP Canyon have not been established, the Department will require additional sediment investigations of the drainages leading from MDA V.

IV.C.2.g.vi MDA V Vapor Monitoring

Pursuant to Section IV.C.2.g.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan to collect subsurface vapor samples from discrete zones in each subsurface vapor monitoring well or boring, at depths approved by the Department, for field and laboratory analyses. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Subsurface vapor samples shall be collected from all newly drilled borings during site investigation activities.

2. An investigation vapor monitoring and sampling plan shall be prepared in accordance with the format described in Section XI.B of this Consent Order and submitted by the Respondents to the Department for approval.

3. Subsurface vapor sampling shall be conducted at MDA V in each existing and newly constructed vapor well and boring specified in the approved work plan.

4. Samples of subsurface vapors shall be collected by the Respondents from subsurface vapor monitoring points at discrete zones selected based on investigation and monitoring results. The monitoring points must be approved by the Department prior to sample collection.

Based on the results of the investigation vapor monitoring, a long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for review and approval.

IV.C.2.g.vii MDA V Intermediate Groundwater Well Installation

If intermediate zone groundwater is encountered or if geophysical or other evidence suggests the presence of intermediate perched groundwater during the required subsurface investigations for MDA V, the Department will require a work plan for the installation of intermediate groundwater monitoring well(s). The minimum depth of the subsurface investigations for MDA V will be the base of the Cerro Toledo interval. If groundwater is identified, these monitoring wells shall target all potential intermediate perched water bearing intervals identified during subsurface explorations at MDA V. If perched groundwater is encountered in sufficient quantities to allow sampling, the Respondents shall sample and analyze the water in accordance with characterization requirements in the approved Work Plan and then provide recommendations for a long-term groundwater monitoring plan in the Investigation Report described in Section IV.C.2.g.x.

IV.C.2.g.viii MDA V Regional Groundwater Well Installation

If the Department determines the need for additional wells intersecting the regional groundwater associated with TA-21 based on investigation data, the Respondents shall submit to the Department for review and written approval a work plan for the installation of such wells. The wells shall be installed according to the requirements in Section X of this Consent Order.

IV.C.2.g.ix MDA V Groundwater Monitoring

The Respondents shall monitor and sample all wells specified below containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigations and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

1. Groundwater samples shall be obtained from Los Alamos Canyon monitoring wells LAO-1.2, LAO-1.8, LAO-1.6(g), LAO-2, LAO-3A, LAO-4.5C, LAO-5, LAO-6, LAO-6A, LADP-3, R-9i, R-5, R-7, R-8, R-9, TW-3, and any wells installed in the future determined by the Department to be required and at the frequency described in Section XII of this Consent Order. As described in Section IV.B.1.b.iv, TW-3 shall be plugged

and abandoned according to the procedures in Section X.D. Groundwater shall be monitored from TW-3 until the well is properly abandoned.

2. The groundwater sampling shall be conducted in accordance with Section IX.B of this Consent Order.

3. Groundwater samples shall be collected from the Los Alamos Canyon monitoring wells for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B of this Consent Order, perchlorate, TAL metals, cyanide, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department.

IV.C.2.g.x MDA V Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA V. The investigation report shall be prepared in accordance with Section XI of this Consent Order and submitted by the date specified in Section XII of this Consent Order.

Based on the results of the investigations conducted at TA-21, and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

IV.C.3 Technical Area 50: MDA C

IV.C.3.a Background

MDA C is located within TA-50 at the head of Ten Site Canyon. TA-50 is bound on the north by Effluent and Mortandad Canyons, on the east by the upper reaches of Ten Site Canyon (a tributary of Mortandad Canyon), on the south by Two Mile Canyon and on the west by TA-55. The operations at TA-50 include a Radioactive Wastewater Treatment facility, a Waste Reduction Characterization facility, several container storage areas, SWMUs, and MDA C. The wastewater treatment plant has been in operation since 1963 and discharges treated effluent under a Clean Water Act NPDES permit. The treated water discharges to Effluent Canyon, a tributary to Mortandad Canyon.

MDA C is an inactive 11.8-acre landfill consisting of six disposal pits, a chemical disposal pit, and 107 shafts. Hazardous waste and mixed waste, as well as radioactive waste, which are not addressed under this Consent Order, were disposed in the landfill between 1948 and 1974.

Results of the investigations conducted under the EPA-approved work plan indicate that VOCs and radionuclides, which are not addressed under this Consent Order, are present in the vadose zone. The vertical and horizontal extent of contamination is not defined. VOCs were detected beneath MDA C at concentrations up to 12.9 parts per million of vapor (ppmv) at depths of 200 ft bgs.

IV.C.3.b Historical Investigation

The Respondents shall conduct an investigation of contaminants that may have been discharged or released at MDA C. The investigation shall include the known or suspected source of any groundwater contaminants, and a review of existing data and other information acquired during previous investigations. Historic investigations or reports conducted under the Facility's Hazardous Waste Facility Permit, may be used to satisfy this requirement in accordance with procedures in Section III.M of this Consent Order. To the extent not previously investigated, the Respondents shall review and confirm the construction details and historical use of SWMU and other possible sources of discharges or releases of contaminants, including all existing and demolished TA buildings and other structures; pits, shafts, trenches, landfills, and surface impoundments; wastewater treatment, conveyance, and disposal systems; and subsurface utility corridors. To the extent not previously investigated, the Respondents shall also review all investigation borings, excavations, sampling events, and other sources of information on contamination. The Respondents shall submit to the Department a historical investigation report for MDA C, which shall be submitted as an appendix to the MDA C Investigation Work Plan under Section IV.C.3.c.i. To the extent not previously provided, the report shall contain the following information:

1. Location, construction details, operational history, and present status of each disposal unit at MDA C. All such locations shall be depicted in one or more figures.

2. A description of the known or suspected disposal history of each pit, shaft, or other structure at MDA C. This description shall include all known and suspected materials disposed, discharged or released, the volume of each discharge or release, if known, and the contaminants present in each discharge or release. The Respondents shall report whether the disposal history is incomplete or unknown.

3. A description of each previous investigation of the sources, extent, or characteristics of contamination associated with MDA C, regardless of whether or not such investigation was completed.

4. A summary of any results and the conclusions of each previous investigation described in Paragraph 3, including the known or suspected dates of waste disposal, the dates of contaminant releases, and the circumstances related to the contaminant releases.

5. A description of the location, construction details, history, and present status of each investigation well and boring associated with MDA C. A description of the location, history, dimensions, and present status of each excavation associated with investigations of MDA C shall also be included. All such locations shall be depicted in one or more

figures. A site map encompassing TA-50 and pertinent regional investigation locations shall be included in the description.

6. A description of the sample collection methods and the types of field and laboratory analyses performed on each sample obtained from each media during the previous investigations.

7. Tables summarizing the data collected from each investigation well, boring, and excavation. The results shall present only analyte detections and data quality exceptions reported by the analytical laboratory that may mask analytes.

8. A summary of data quality, including exceptions and interpretations.

9. A summary of all contradictory investigation results and the rationale for acceptance or rejection of selected investigation results.

10. A list of general chemistry and metals background concentrations and documentation of the methods used for establishing the background values.

The summary shall include references to historical documents within the summary text citing the document title, page number, and table or figure number. The full reference citations shall be presented as a separate section in the summary document using the standard USGS format for reference citations. The Respondents are responsible for providing complete information with regard to the available data and the need for additional data at each unit. The Department shall evaluate the information and request changes as necessary. The Department's evaluation and approval will address the Respondents' general approach to site characterization and plan for acquiring additional data required to complete the site investigation at MDA C.

IV.C.3.c MDA C Investigation

IV.C.3.c.i MDA C Investigation Work Plan

The Respondents submitted to the Department on July 31, 2003 for review and written approval a work plan for the investigation of contamination at MDA C to address the requirements of this section (IV.C.3.c). The investigation work plan included a historical investigation report appendix to the work plan summarizing results of past investigation activities conducted at MDA C, including work conducted and data collected under the EPA-approved work plan. The Department disapproved the work plan in a letter dated September 4, 2003. The Respondents submitted a revised work plan to the Department on November 7, 2003. The Department reviewed the revised work plan and disapproved the plan in a letter dated November 19, 2003 and issued a notice of deficiency on December 16, 2003. The Respondents submitted a response to the notice of deficiency on January 23, 2004. Upon Department approval, work conducted under the EPA-approved work plan may be used to satisfy the requirements of this section (IV.C.3.c). The work plan shall address investigations of the disposal units; migration pathways and the connections to potential receptors including groundwater; and the nature and extent of contamination in soil, rock, sediments, groundwater (where present) and subsurface vapor at

MDA C.

The Respondents shall implement the work plan approved by the Department pursuant to the procedures of Section III.M of this Consent Order.

IV.C.3.c.ii MDA C Survey of Disposal Units

In accordance with Section IV.C.3.c.i, the Respondents shall conduct a survey of the disposal units at MDA C. The Respondents shall determine the dimensions and total depth of each shaft and pit at MDA C into which contaminants were disposed, and the base profile, topography, low elevation point, and down-slope end of the base of each shaft and disposal pit at MDA C into which waste was disposed.

The dimensions and base elevations of each pit and shaft at MDA C shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods shall be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.3.c.iii. Subject to the procedures in Section III.M, the results of the 2001 and 2002 geophysical surveys conducted by Respondents may be used to satisfy these requirements. The Respondents shall include this survey information in the work plan to be submitted to the Department.

IV.C.3.c.iii MDA C Drilling Explorations

The Respondents shall conduct subsurface investigations as specified in the approved work plan to characterize the extent of contamination, and to characterize fracture density, fracture orientation, and fracture fill material at MDA C. The fracture characterization shall be completed utilizing data acquired from outcrops, cores, and downhole geophysical and video data. The methods and locations for collecting rock fracture data shall be approved by the Department prior to data collection.

The Respondents submitted to the Department for review and written approval a work plan for completing subsurface explorations of MDA C. The Department disapproved the work plan in a letter dated September 4, 2003. The Respondents submitted a revised work plan to the Department on November 7, 2003. The Department reviewed the revised work plan and disapproved the plan in a letter dated November 19, 2003 and issued a notice of deficiency on December 16, 2003. The Respondents submitted a response to the notice of deficiency on January 23, 2004. The work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Respondents shall include information on the borings located and advanced in accordance with the EPA-approved work plan in the historical investigation report appendix to the work plan. Subject to the procedures in Section III.M, the borings may be used to satisfy the requirements of this section (IV.C.3.c.iii).

1. One boring, or the number defined in the Department-approved MDA C Investigation Work Plan, shall be advanced at the following locations: 1) directly adjacent to the down-slope end of each pit; 2) at the lowest base elevation point of each disposal pit; 3) at the corners of each disposal pit, at 100-ft intervals along the sides of disposal pits 1 through

6; 4) at 70 ft intervals along the sides of the chemical pit; 5) at the ends of each shaft row; 6) at 50-ft intervals along each shaft row; and 7) adjacent to the location of the strontium-90 disposal shaft. Where practical, boring locations may be combined to address more than one of the requirements listed above.

2. Angled borings shall be advanced beneath pits where access for drilling of vertical borings is restricted.

3. The Department must approve all borehole locations prior to the start of drilling activities.

4. The borings shall be advanced using hollow-stem auger drilling methods, where practicable, or other drilling methods approved by the Department.

5. The borings shall be drilled to minimum depths of 20 ft below the base of the pits and a minimum of 20 ft below the base of the deepest shafts in a shaft row or shaft field.

6. The borings shall be advanced a minimum of 25 ft below the deepest detected vapor-phase, soil, rock, or groundwater contamination as detected by field screening or previous investigations, whichever is deeper.

7. Selected boreholes shall be characterized using geophysical logging techniques approved by the Department.

8. A general design for vapor monitoring well construction shall be submitted to the Department for approval prior to the start of subsurface explorations at MDA C.

9. Specific borings, as set out in the Department approved work plan, shall be completed as vapor monitoring wells. The screened intervals or sample port locations and methods and materials used to construct each vapor monitoring well shall be based upon information obtained during drilling activities and open-hole vapor sampling field screening results, and shall be approved by the Department prior to well construction.

10. One boring, or the number defined in the Department-approved MDA C Investigation Work Plan, shall be advanced at MDA C to evaluate the presence of intermediate perched groundwater and vapor-phase contamination at depth beneath the site. The boring location, depth, the drilling and sampling program, and the well design shall be approved by the Department prior to the start of drilling activities.

11. One TA-50-specific well shall be installed that intersects the regional aquifer at a location approved by the Department. The well shall be located generally east or southeast of MDA C. The Respondents shall include information on Regional well R-14 in the work plan to be submitted to the Department.

IV.C.3.c.iv MDA C Soil and Rock Sampling

The Respondents submitted to the Department for review and written approval a work plan for completing soil and rock sampling during subsurface drilling explorations at MDA C. The Department disapproved the work plan in a letter dated September 4, 2003. The Respondents submitted a revised work plan to the Department on November 7, 2003. The Department reviewed the revised work plan and disapproved the plan in a letter dated November 19, 2003 and issued a notice of deficiency on December 16, 2003. The Respondents submitted a response to the notice of deficiency on January 23, 2004. Implementation of the approved the work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Soil and rock samples shall be obtained from each boring at ten-ft intervals, from the bedrock directly below the base elevation of each pit or shaft, and from the maximum depth of each boring.

2. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

3. One core shall be collected from each stratigraphic unit for permeability testing in accordance with Section IX.B of this Consent Order.

4. A minimum of two samples per 100 ft of drilling depth shall be selected from each boring for laboratory analysis. The samples submitted for laboratory analyses shall be analyzed for VOCs, SVOCs, pH, explosive compounds, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, and cyanide. The selection of the samples shall include those locations outlined in Paragraphs 5 through 9 below.

5. The samples displaying the greatest field screening evidence of contamination shall be selected for submittal to the analytical laboratory for analysis of the analytes listed in Paragraph 4 above.

6. If field-screening evidence of contamination is not observed in a boring, the sample obtained from the bedrock directly below the base elevation of each pit or shaft shall be submitted for chemical analysis of the analytes listed in Paragraph 4 above.

7. The sample obtained from the maximum depth of each boring also shall be submitted to an analytical laboratory for analysis of the analytes listed in Paragraph 4 above.

8. The sample obtained from the maximum depth in each boring that displays field screening evidence of contamination shall be submitted to an analytical laboratory for analysis of the analytes listed in Paragraph 4 above.

9. Samples obtained from high permeability units such as surge beds, fracture zones, and pumice beds shall be submitted to an analytical laboratory for analysis of the analytes listed in Paragraph 4 above.

IV.C.3.c.v MDA C Subsurface Vapor Monitoring

The Respondents submitted to the Department for review and written approval a work plan for the collection of subsurface vapor samples from discrete zones in each subsurface vapor monitoring well or boring at MDA C, at depths approved by the Department, for field and laboratory analyses. The Department disapproved the work plan in a letter dated September 4, 2003. The Respondents submitted a revised work plan to the Department on November 7, 2003. The Department reviewed the revised work plan and disapproved the plan in a letter dated November 19, 2003 and issued a notice of deficiency on December 16, 2003. The Respondents submitted a response to the notice of deficiency on January 23, 2004. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Subsurface vapor samples shall be collected from all newly drilled borings during site investigation activities.

2. An investigation vapor monitoring and sampling plan shall be prepared in accordance with the format described in Section XI.B of this Consent Order and submitted to the Department for approval as part of the investigation work plan.

3. Subsurface vapor sampling shall be conducted at MDA C in each existing and newly constructed vapor well and boring.

4. Subsurface vapors shall be collected by the Respondents from subsurface vapor monitoring points at discrete zones selected based on investigation and monitoring results. The monitoring points must be approved by the Department prior to sample collection.

5. Based on the results of the investigation vapor monitoring, a long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for approval.

IV.C.3.c.vi MDA C Intermediate Groundwater Well Installation

The Respondents submitted to the Department for review and written approval a work plan for the construction of one intermediate depth groundwater monitoring well at MDA C, if evidence of perched groundwater, in quantities sufficient to allow sampling, is observed during the drilling of the two borings drilled to evaluate for the presence of intermediate perched groundwater or during drilling of the regional groundwater monitoring well. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. The borings shall be drilled to a depth of 800 ft below the ground surface.

2. Vapor samples and groundwater samples (if encountered) shall be collected from each boring prior to well construction or borehole abandonment.

3. A monitoring well design plan shall be submitted to the Department for approval prior to construction of the intermediate well(s) if perched water is found during construction of the borehole in quantities sufficient to allow sampling.

4. The Department may impose specific conditions for well construction, or require the drilling of additional borings that intersect the intermediate perched zones or regional aquifer based on the sampling results.

IV.C.3.c.vii MDA C Regional Groundwater Well Installation

The Respondents submitted to the Department for review and written approval a work plan for the construction of one monitoring well associated with MDA C and TA-50 intersecting the regional aquifer in accordance with Section X of this Consent Order. The Department disapproved the work plan in a letter dated September 4, 2003. The Respondents submitted a revised work plan to the Department on November 7, 2003. The Department reviewed the revised work plan and disapproved the plan in a letter dated November 19, 2003 and issued a notice of deficiency on December 16, 2003. The Respondents submitted a response to the notice of deficiency on January 23, 2004. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. Pursuant to the Department-approved Hydrogeologic Work Plan, regional well R-14 was installed in Ten Site Canyon downgradient of MDA C. Subject to the procedures in Section III.M of this Consent Order, the Respondents may use data collected during installation of well R-14 to address the requirements of this Section (IV.C.3.c.vii). Subject to the procedures in Section III.M of this Consent Order, the Respondents shall include information on regional well R-14 in the work plan to be submitted to the Department.

1. The boring shall be monitored for the presence of intermediate perched groundwater and vapor-phase contaminants prior to well construction.

2. Based on the results of vapor monitoring, the Department may require that the Respondents construct the wells to accommodate vapor monitoring in addition to groundwater monitoring and sampling.

IV.C.3.c.viii MDA C Groundwater Monitoring

The Respondents shall monitor and sample all wells containing alluvial, intermediate perched, and/or regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigation and after completing the installation of all additional monitoring wells in the Mortandad and Pajarito Canyons watersheds as described in approved work plans, the Respondents shall submit to the Department for review and written approval a site-specific long-term groundwater monitoring plan for MDA C. Upon Department approval of the long-term monitoring plan for MDA C, the requirements of the long-term monitoring plan shall apply and shall supersede the requirements related to MDA C included in the Mortandad Canyon watershed section of the Interim Plan.

1. Groundwater samples shall be collected from each saturated zone intersecting the monitoring wells for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B of this document, including VOCs, SVOCs, explosive compounds, perchlorate, TAL metals, and cyanide, and for any other analytes specified by the Department.

2. A groundwater monitoring and sampling work plan shall be submitted to the Department for approval prior to implementation of the groundwater sampling program at MDA C.

IV.C.3.c.ix MDA C Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA C. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and submitted by the date specified in Section XII of this Consent Order.

IV.C.4 Technical Area 49

IV.C.4.a Background

TA-49 (formerly Operable Unit 1144), also known as Frijoles Mesa Site, occupies approximately 1,280 acres on the southern-central boundary of the Facility. TA-49 is bounded by Bandelier National Monument on the south and west and TAs-16, 37, 15, and 39 on the north and east. Water Canyon is located along the northern boundary of TA-49. Ancho Canyon originates within TA-49 and runs eastward to White Rock Canyon.

TA-49 has been used since the mid-1940s and is currently being used as a buffer zone for activities at adjacent firing sites (TA-15 and TA-39). Underground hydronuclear and related experiments were conducted at TA-49 from 1959 through August 1961. TA-49 contains 20 SWMUs: four underground shaft areas (Areas 1-4, including Areas 2A and 2B); a central control area (Area 5) to monitor underground experiments; a crafts area, an open burning/landfill operation (Area 6); an underground calibration chamber (Area 10); a radiochemistry and small scale shot area (Area 11); and the Bottle House and Cable Test Pull Facility (Area 12). For the purpose of this Consent Order, MDA AB will be referred to as Areas 2, 2A, and 2B, and SWMU 49-001(g). The Department will require investigation of MDA AB (Areas 2, 2A, 2B, and SWMU 49-001(g)) independent of Areas 1, 3, and 4. This Section of the Consent Order (IV.C.4) addresses all SWMUs grouped into the consolidated unit 49-001(a)-00 and Areas 11 and 12 located within the boundaries of TA-49.

Activities conducted at MDA AB included nuclear device safety tests and HE detonations conducted in 37 shafts at depths ranging from 30 to 78 ft. Materials released at MDA AB include HE, lead, beryllium, and radionuclides, which are not addressed under this Consent Order.

Area 1 was developed for containment studies in shafts, and later used for downhole studies involving radionuclides, which are not addressed under this Consent Order. Area 3 was used

exclusively for development of confinement and sample recovery techniques that were subsequently used at Areas 1, 2 (including 2A and 2B), and 4. Area 4 was used for containment experiments. Beryllium and lead contamination, as well as radionuclide contamination, which is not addressed under this Consent Order, have been detected at Area 4.

Activities conducted at Area 11 consisted of radiochemistry operations and small-scale shot experiments involving HE detonations (some containing lead, and radionuclides, which are not addressed under this Consent Order) in shallow shafts. Area 12 was used for confinement experiments, consisting of HE detonations in sealed metal "bottles", in 1960 and 1961.

Respondents state they conducted investigations at SWMUs 49-001(a)-00 and 49-003 and AOCs 49-008(c-d) pursuant to the EPA-approved RFI Work Plan for OU 1144. These investigations included a survey of disposal units; drilling explorations, including installation of 13 boreholes; soil and rock sampling, including collection and analysis of core samples from boreholes; sediment sampling in the drainages leading from the SWMUs and AOCs to Water Canyon, and surface and shallow subsurface soil sampling.

IV.C.4.b Historical Investigation

The Respondents shall conduct an investigation of contaminants that may have been discharged or released at MDA AB (Areas 2, 2A, and 2B), Experimental Shaft Areas (Areas 1, 3, and 4), Radiochemistry and Small Shot Area (Area 11), and the Bottle House (Area 12) at TA-49 during historical operations at the Facility. The investigation shall include a review of existing data and other information acquired during previous investigations. Historical investigations or reports conducted under the Facility's Hazardous Waste Facility Permit may be used to satisfy this requirement pursuant to the procedures in Section III.M of this Consent Order. To the extent not previously investigated, the Respondents shall review and confirm the construction details and historical use of SWMUs and other possible sources of discharges or releases of contaminants including TA buildings and other structures; pits, shafts, trenches, landfills, and surface impoundments; wastewater treatment, conveyance, and disposal systems; and subsurface utility corridors. To the extent not previously investigated, the Respondents shall also review all investigation borings, excavations, sampling events, and other sources of information on contamination. The Respondents shall submit to the Department a historical investigation report for MDA AB, Areas 1, 3, 4, 11, and 12, which shall be submitted separately and in conjunction with the MDA AB, Areas 1, 3, 4, 11, and 12 Investigation Work Plan under Section IV.C.4.c.i. To the extent not previously provided, the report shall contain the following information:

1. A description of the location, construction details, operational history, and present status of each such pit, shaft, or other structure at MDA AB, Areas 1, 3, 4, 11, and 12. The Respondents shall depict all such locations in one or more figures.

2. A description of the known disposal history of each pit, shaft, or other structure listed under Paragraph 1. This description shall include all known and suspected wastes disposed, discharged, or released; the volume of each discharge or release, if known; and the contaminants present in each discharge or release, if known. The Respondents shall report whether the disposal history is incomplete or unknown.

3. A description of each previous investigation of the sources, extent, or characteristics of contamination at MDA AB, Areas 1, 3, 4, 11, and 12,regardless of whether or not such investigation was completed.

4. A summary of any results and conclusions of each previous investigation described in Paragraph 3, including the known or suspected dates of waste disposal, the suspected dates of contaminant releases, and the circumstances related to the contaminant releases.

5. A description of the location, construction details, history, and present status of each investigation well and boring associated with MDA AB, Areas 1, 3, 4, 11, and 12. A description of the location, history, dimensions, and present status of each excavation associated with investigations of MDA AB, Areas 1, 3, 4, 11, and 12 shall also be included. The Respondents shall depict all such locations in one or more figures. A site map encompassing the entire TA and pertinent regional investigation locations shall be included in the description.

6. An evaluation of the condition and well completion information, including well logs, for Deep Test Well No. 5A (DT-5A), Deep Test Well No. 9 (DT-9), and Deep Test Well No. 10 (DT-10).

7. A description of the sample collection methods and the types of field and laboratory analyses performed on each sample obtained from each media during the previous investigations.

8. Tables summarizing the data collected from each investigation well, boring, and excavation. The results shall present only analyte detections and data quality exceptions reported by the analytical laboratory that may mask analytes.

9. A summary of data quality, including exceptions and interpretations.

10. A summary of all contradictory or anomalous investigation results and the rationale for acceptance or rejection of the data.

11. A list of general chemistry and metals background concentrations and documentation of the methods used for establishing the background values.

The summaries shall include references to historical documents within the summary text citing the document title, page number, and table or figure number. The full reference citations shall be presented as a separate section in each summary document using the standard USGS format for reference citations. The Respondents are responsible for providing complete information with regard to the available data and the need for additional data at each unit. The Department shall evaluate the information and request changes as necessary. The Department's evaluation and approval will address the Respondents' general approach to site investigation and plan for acquiring additional data required to complete the site investigations at TA-49.

IV.C.4.c Technical Area 49 Investigation

IV.C.4.c.i Technical Area 49 Investigation Work Plan

Pursuant to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a supplemental work plan for the completion of the investigation of contamination at TA-49. Implementation of the approved supplemental work plan, shall meet the requirements of this section (IV.C.4.c), subject to the procedures in Section III.M of this Consent Order. The supplemental work plan shall provide for the completion of the RCRA Facility Investigation (RFI) Work Plan for Operable Unit 1144 for MDA AB (Areas 2, 2A, and 2B), dated May 1992, which is incorporated herein by reference and made an enforceable part of this Consent Order. The supplemental work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. The supplemental work plan shall address investigations of the sources of contamination, and the nature and extent of contamination in soils, sediments, surface water, and groundwater at TA-49. It shall also provide for investigation of Areas 1, 3, 4, 11, and 12 in TA-49.

The Respondents shall implement the supplemental work plan approved by the Department pursuant to the procedures in Section III.M and IV.A.2 of this Consent Order.

IV.C.4.c.ii Technical Area 49 Survey of Disposal Units

In accordance with Section IV.C.4.c.i, the Respondents shall conduct a survey of the disposal units comprising MDA AB and Areas 1, 3, 4, 11, and 12. The Respondents shall determine the dimensions and total depth of each disposal shaft, pit or other unit at SWMUs 49-001(a)-99 and 49-003 and AOCs 49-008(c-d) into which contaminants were disposed, and the base profile, topography, low elevation point, and down-slope end of the base of each disposal pit, shaft, and other unit at MDA AB and Areas 1, 3, 4, 11, and 12 into which waste was disposed.

The dimensions and base elevations of each pit, shaft, and other unit at MDA AB and Areas 1, 3, 4, 11 and 12 shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods may be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.4.c.iii.

IV.C.4.c.iii Technical Area 49 Drilling Explorations

The Respondents shall conduct subsurface explorations at MDA AB and Areas 1, 3, 4 11, and 12 as specified in the approved supplemental work plan in order to acquire data to characterize the extent of contamination and to characterize fracture density, fracture orientation, fracture fill material. The fracture characterization of the rock formations underlying TA-49 shall be completed by utilizing data acquired from outcrop, cores, down hole geophysical and video data, and by evaluating samples of soils, rock, subsurface vapor, and groundwater (where present) by field screening and laboratory chemical analysis.

Pursuant to Section IV.C.4.c.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a supplemental work plan for completing subsurface explorations at MDA AB and Areas 1, 3, 4, 11, and 12. Implementation of the supplemental work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order:

1. Two borings, or the number defined in the Department-approved MDA AB and Areas 1, 3, 4, 11, and 12 supplemental Investigation Work Plan, shall be advanced at MDA AB. One boring shall intersect stratigraphic Unit 5 of the Tshirege Member of the Bandelier Tuff (surge bed) that occurs at a depth of approximately 60 to 80 ft bgs. Unit 5 shall be characterized to evaluate its potential as a migration pathway. One boring shall be installed to a minimum depth of 900 ft to evaluate for the presence of intermediate perched groundwater, to characterize the high permeability zones observed at depths of 285 to 300 ft during the previous drilling (CH-2 and DT-5A), and to assess the potential of the contact between the Tshirege and Otowi formations to act as a hydraulic barrier.

2. Four borings, or the number defined in the Department-approved MDA AB and Areas 1, 3, 4, 11, and 12 supplemental Investigation Work Plan, shall be advanced a maximum distance of 25 ft from the perimeter of each of the experimental shaft areas at Areas 1, 3, and 4. Each boring shall be installed to depths of 50 ft below the deepest shaft.

3. Two borings, or the number defined in the Department-approved MDA AB and Areas 1, 3, 4, 11, and 12 supplemental Investigation Work Plan, shall be advanced at the Small Shot Area at Area 11. One boring shall intersect stratigraphic Unit 5 of the Tshirege Member of the Bandelier Tuff (surge bed) that occurs at a depth of 60 to 80 ft below the ground surface. The other boring shall be installed to a minimum depth of 35 ft.

4. Vapor samples shall be collected from each boring advanced at the Small Shot Area at Area 11 and analyzed for VOCs. If contaminants are detected the Respondents shall install a vapor monitoring well in each boring.

5. Four borings, or the number defined in the Department-approved MDA AB and Areas 1, 3, 4, 11, and 12 supplemental Investigation Work Plan, shall be advanced at the Area 11 leach field in accordance with the requirements of Section IX of this Consent Order. The Respondents shall collect samples continuously in each borehole during drilling.

6. The former locations of sumps or drains associated with the radiochemistry building at Area 11 shall be located. If located, discrete samples shall be collected from directly below the base elevation of the structure and ten ft below the base elevation of the structure in the native soil.

7. Five borings, or the number defined in the Department-approved MDA AB and Areas 1, 3, 4, 11, and 12 supplemental Investigation Work Plan, shall be advanced within the footprint of the radiochemistry building at Area 11 to a depth of ten ft and in accordance with the requirements of Section IX of this Consent Order.

8. Surface samples shall be collected (0 to 12 inches) on a 25-ft center grid pattern, or as defined in the Department-approved MDA AB and Areas 1, 3, 4, 11, and 12 supplemental Investigation Work Plan, over the Area 11 small shot area and radiochemistry building footprint.

9. Two borings, or the number defined in the Department-approved MDA AB and Areas 1, 3, 4, 11, and 12 supplemental Investigation Work Plan, shall be advanced at Area 12. One boring shall be installed within ten ft from the Bottle House building. Each boring shall be advanced to depths of 50 ft below the base of the deepest shaft. One boring shall be installed beneath the location of the former Cable Test Pull facility to an approximate depth of 25 ft.

10. Surface samples shall be collected (0 to 12 inches) at Area 12 on a grid pattern approved by the Department.

11. Vapor samples shall be collected from each boring installed at the Bottle House at Area 12 and analyzed for VOCs.

12. Vapor monitoring wells shall be installed in borings if vapor-phase contamination is detected during drilling activities.

13. A monitoring well shall be installed if groundwater (perched or regional) is encountered during drilling activities or if geophysical results indicate possible zones of saturation. The wells shall be constructed in accordance with Section X of this Consent Order.

14. All borings not completed as vapor or groundwater monitoring wells shall be properly plugged and abandoned. Documentation of proper well abandonment shall be submitted to the Department as an appendix to the investigation report.

15. The Department must approve all borehole locations prior to the start of drilling activities.

16. The borings shall be advanced using hollow-stem auger drilling methods, where practicable, or other drilling methods approved by the Department.

17. The borings shall be advanced a minimum of 20 ft, or the depth defined in the Department-approved supplemental work plan, below the deepest detected soil, rock, vapor, or groundwater contamination as detected by field screening or during previous investigations.

18. Selected boreholes, as specified in the Department-approved supplemental work plan, shall be characterized using geophysical logging techniques approved by the Department prior to data collection. At the Small Shot Area at Area 11, the deep borehole shall be characterized using geophysical logging techniques approved by the Department.

IV.C.4.c.iv Technical Area 49 Soil and Rock Sampling

Pursuant to Section IV.C.4.c.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a supplemental work plan for completing soil and rock sampling during subsurface drilling explorations at MDA AB and Areas 1, 3, 4, 11, and 12. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the supplemental work plan shall meet the following requirements, subject to the procedures in process of Section III.M of this Consent Order:

At MDA AB and Areas 1, 3, and 4, soil samples shall be collected in each boring at ten-ft intervals. At Area 11 and Area 12, soil samples shall be collected in each boring at five-ft intervals.

1. Samples shall be collected and screened in accordance with the methods specified in Section IX.B of this Consent Order.

2. At MDA AB and Areas 1, 3, and 4, one core sample collected from each boring shall be collected and submitted for laboratory permeability testing. At Area 11, cores shall be obtained from selected borings, if deemed appropriate and at depths approved by the Department. Permeability testing shall be performed in accordance with Section IX.B of this Consent Order.

3. Field screening and laboratory sample selection shall be biased toward evidence of contamination, lithologic contacts, fractures, fracture fill material, surge beds, and other higher permeability units identified during investigation activities. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

4. Soil and rock samples shall be obtained from the intervals described in Paragraph 1 above and from the bedrock at the base elevation of each shaft or pit. A sample also shall be obtained from the maximum depth of each boring.

5. At MDA AB and Areas 1, 3, and 4, four samples shall be selected from each boring for submittal to a laboratory for analysis of explosive compounds, perchlorate, TAL metals, and cyanide. The sample exhibiting the highest field screening detection; the sample obtained from the maximum depth in each boring that displays field screening evidence of contamination; the sample located at the base of any pit, shaft, tank, or other structure; and the sample obtained from the maximum boring depth shall be submitted for laboratory analysis.

6. At Area 11, two samples shall be selected from each boring for laboratory analysis of explosive compounds, perchlorate, TAL metals, cyanide, VOCs, and SVOCs. At all locations, the sample exhibiting the highest field screening detection; the sample obtained from the maximum depth in each boring that displays field screening evidence of contamination; the sample located at the base of any pit, shaft, tank, or other structure; and the sample from the total boring depth shall be submitted for laboratory analysis.

7. At the Bottle House at Area 12, two samples shall be selected from the borings for submittal to a laboratory for analysis of explosive compounds, perchlorate, TAL metals, cyanide, VOCs, and SVOCs. Two samples shall be selected from the boring located at the Cable Test Pull Facility for submittal to a laboratory for analysis of VOCs, SVOCs, and diesel and oil range organics. The sample exhibiting the highest field screening detection; the sample obtained from the maximum depth in each boring that displays field screening evidence of contamination; the sample located immediately below the base elevation of any shaft, pit, tank, or other structure; and the sample obtained from the maximum boring depth shall be submitted for laboratory analysis.

IV.C.4.c.v Technical Area 49 Vapor Monitoring

Pursuant to Section IV.C.4.c.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a supplemental work plan to determine if vapor-phase contamination is present beneath MDA AB and Areas 1, 3, 4, and 12. Implementation of the approved supplemental work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. If vapor-phase contamination is detected, the Respondents shall install vapor-monitoring wells in the borings and conduct vapor monitoring and sampling as outlined in Section IX.B. In addition, the Respondents shall submit a vapor monitoring and sampling plan for approval by the Department prior to well construction. If vapor-phase contamination is detected, the Respondents shall collect vapor samples from discrete zones in each vapor monitoring well or boring at depths approved by the Department. These data will be used to evaluate the need for additional monitoring and investigation.

In addition, the Respondents shall continue the moisture monitoring and reporting at MDA AB, as required by the Respondents' *Stabilization Plan for Installing Best Management Practices at Potential Release Sites 49-001(b, c, d, and g),* dated June 1998 or other approved monitoring plan.

IV.C.4.c.vi Technical Area 49 Intermediate Groundwater Well Installation

Pursuant to Section IV.C.4.c.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a supplemental work plan for the installation of one groundwater monitoring well that intersects intermediate perched groundwater, if such groundwater is present beneath the site. Implementation of the approved supplemental work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order. This well shall be installed within the boundaries of TA-49 and downgradient from MDA AB (SWMUs 49-001(b-d, g) at a location approved by the Department. Respondents may use data collected during installation of borehole 49-2901 to address the requirements of this section (IV.C.4c.vi). The Respondents shall include information relating to borehole #49-2901 in the supplemental work plan to be submitted to the Department.

IV.C.4.c.vii Technical Area 49 Regional Groundwater Well Installation

Pursuant to Section IV.C.4.c.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a supplemental work plan for the installation of a regional aquifer well at TA-49, downgradient from MDA AB, in accordance with the schedule set forth in Section XII of this Consent Order. Implementation of the approved supplemental work plan shall meet the following requirement, subject to the procedures in Section III.M of this Consent Order.

1. Install one monitoring well that intersects the regional aquifer downgradient of TA-49.

Respondents may address this requirement through the installation of Regional well R-30.

IV.C.4.c.viii Technical Area 49 Groundwater Monitoring

The Respondents shall monitor and sample all wells associated with MDA AB containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. Based on the results of the investigations and after completing the installation of all additional monitoring wells in the Water Canyon/Cañon de Valle and Ancho Canyons watersheds as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Water Canyon/Cañon de Valle and Ancho Canyons. Upon Department approval of the long-term monitoring plans for the Water Canyon/Cañon de Valle and Ancho Canyon watersheds or specific sites within those watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Water Canyon/Cañon de Valle and Ancho Canyon watersheds sections of the Interim Plan.

1. Groundwater samples shall be collected from each saturated zone intersecting the alluvial aquifer from wells Beta Hole, WCO-1, WCO-2, WCO-3, and all alluvial wells installed in the future.

2. Groundwater samples shall be collected from each zone intersecting the intermediate perched water from well CdV-37-2 and all intermediate wells installed in the future.

3. Groundwater samples shall be collected from each saturated zone intersecting the regional aquifer wells CdV-37-2, DT-5A, DT-9, DT-10, and all regional wells installed in the future.

4. Samples shall be submitted to a laboratory for analysis of general chemistry parameters as described in Section IX of this document and for VOCs, SVOCs, HE compounds, perchlorate, TAL metals, cyanide, and for other analytes specified by the Department.

5. A groundwater monitoring and sampling work plan shall be submitted to the Department for approval prior to implementation of the groundwater sampling program at MDA AB.

The groundwater monitoring requirements outlined in this section (IV.C.4.c.viii) shall be used to capture all other current groundwater monitoring requirements in this Consent Order for TA-49 (Areas 1, 3, 4, 11, and 12).

IV.C.4.c.ix Technical Area 49 Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA AB and Areas 1, 3, 4, 11, and 12. The investigation report shall be prepared in accordance with Section XI of this Consent Order and submitted by the date specified in Section XII of this Consent Order.

Based on the results of the investigations conducted at TA-49, and after completing the installation of all additional monitoring wells in the Water Canyon/Cañon de Valle and Ancho Canyons watersheds as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Water Canyon/Cañon de Valle and Ancho Canyons. Upon Department approval of the long-term monitoring plans for the Water Canyon/Cañon de Valle and Ancho Canyon watersheds or specific sites within those watersheds, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Water Canyon/Cañon de Valle and Ancho Canyon watersheds sections of the Interim Plan.

IV.C.5 Technical Area 10

IV.C.5.a Background

Former TA-10, also known as the Bayo Canyon site, is located in Bayo Canyon adjacent to the western boundary of TA-74 and approximately four miles west of the intersection of Bayo and Los Alamos Canyons. Bayo Canyon is situated between Otowi and Kwage Mesas and is a tributary of Los Alamos Canyon. The Respondents conducted open-detonation explosive tests and radiochemical operations related to the development of nuclear weapons at the Bayo Canyon site from 1943 to 1961. Radiochemical operations were conducted at the TA-10 Radiochemistry Laboratory (Lab), Building TA-10-1. Radiation sources for blast diagnostics were prepared at the Lab. The explosive detonation work dispersed uranium isotopes, lanthanum, and strontium-90 outward from shot pads up to 350 to 650 ft away via aerosols and solid debris. Radionuclides are not addressed under this Consent Order. Liquid wastes from the storage tanks were periodically discharged to the Bayo Canyon stream channel. Groundwater monitoring has not been conducted at this site.

Pursuant to the RFI Work Plan for Operable Unit 1079, approved by EPA on March 15, 1993, Respondents conducted an investigation of SWMUs 10-002(a-b), 10-003(a-o), 10-004(b), 10-005, and 10-007 at TA-10. The Respondents documented the results of the investigation of releases of hazardous wastes and hazardous constituents at these SWMUs in the RFI Report for TA-10: PRSs 10-002(a,b), 10-003(a,b,c,d,e,f,g,h,i,j,k,l,m,n,o), 10-004(a,b), 10-005, 10-007 submitted to the Department on April 18, 1996. This RFI report recommended no further action

for SWMUs 10-002(a-b), 10-003(a-o), 10-004(b), 10-005, and 10-007. Additional investigations required at any SWMUs or AOCs at TA-10 will be addressed in the Bayo Canyon Aggregate Area Work Plan required under Section XII of this Consent Order. The work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. The work shall meet the requirements of this section (IV.C.5.c), and follow the procedures in Section III.M of this Consent Order.

IV.C.5.b Historical Investigation

The Respondents shall conduct an investigation of contaminants that may have been discharged or released at SWMUs and AOCs atTA-10 during historical operations at the Facility. The investigation shall include a review of existing data and other information acquired during previous investigations. In conducting the investigation, the Respondents shall review and confirm the construction details and historical use of all existing and demolished former TA-10 buildings and other structures; pits, shafts, trenches, landfills, surface impoundments, and other SWMUs; wastewater treatment, conveyance, and disposal systems; subsurface utility corridors; and other possible sources of discharges or releases of contaminants. The Respondents shall also review all investigation borings, excavations, sampling events, and other sources of information on contamination. The Respondents shall submit to the Department a historical investigation report for SWMUs and AOCs at TA-10, which shall be submitted separately and in conjunction with the Investigation Work Plan under Section IV.C.5.c.i. The report shall contain the following information:

1. A list of all past or present SWMUs, AOCs, pit, leachfield, and other sites in or bordering the Bayo Canyon site that may have contributed contaminants to the canyon drainages.

2. A list of all past or present discharge locations that may have contributed contaminants to the canyon drainages.

3. A description of the location, construction details, operational history, and present status of each such SWMU, AOC, pit, leachfield, and other site listed under Paragraph 1 and each discharge location listed under Paragraph 2. The Respondents shall depict all such locations in one or more figures.

4. A description of the known disposal history of each SWMU, AOC, pit, leachfield, and other site listed under Paragraph 1 and each discharge location listed under Paragraph 2. This description shall include all known and suspected material disposed, discharged, or released; the volume of each discharge or release; the flow rate of each discharge or release; and the contaminants present in each discharge or release. The Respondents shall report whether the disposal history is incomplete or unknown.

5. A description of each previous investigation of the sources, extent, or characteristics of contamination at the Bayo Canyon site, regardless of whether or not such investigation was completed.

6. A summary of any results and conclusions of each previous investigation described in

Paragraph 5, including the known or suspected dates of waste disposal, including the known or suspected dates of each release of contamination, and the circumstances related to the release of contamination.

7. A description of the location, construction details, history, and present status of each investigation well and boring associated with the SWMUs and AOCs at TA-10. A description of the location, history, dimensions, and present status of each excavation associated with investigations of SWMUs and AOCs at TA-10 shall also be included. The Respondents shall depict all such locations in one or more figures. A site map encompassing the entire TA and pertinent regional investigation locations shall be included in the description.

8. A description of the sample collection methods and the types of field and laboratory analyses performed on each medium during the previous investigations.

9. Tables summarizing the data collected from each investigation well, boring, and excavation. The results shall present only analyte detections and data quality exceptions reported by the analytical laboratory that may mask analytes.

10. A summary of data quality, including exceptions and interpretations.

11. A summary of all contradictory investigation results and the rationale for acceptance or rejection of selected investigation results.

12. A list of general chemistry and metals background concentrations and documentation of the methods used for establishing the background values.

The summaries shall include references to historical documents within the summary text citing the document title, page number, and table or figure number. The full reference citations shall be presented as a separate section in each summary document using the standard USGS format for reference citations. The Respondents shall provide complete data and information, to the extent it is available, and shall identify the need for any additional data at each SWMU and AOC. The Department shall evaluate the information and request changes as necessary. The Respondents shall submit new or updated information to the Department as soon as it becomes available.

IV.C.5.c Technical Area 10 Investigation

IV.C.5.c.i Technical Area 10 Investigation Work Plan

The Respondents shall submit to the Department for review and written approval a work plan for the investigation of contamination at TA-10. The work plan shall be included as part of the Bayo Canyon Aggregate Area Work Plan. The work plan shall be prepared in accordance with Sections IX and XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. Implementation of the approved work shall meet the requirements of this section (IV.C.5.c), subject to the procedures in Section III.M of this Consent Order. The work plan shall address investigations of the disposal units; migration pathways and

the connections to potential receptors including groundwater; and the nature and extent of contamination in soil, rock, sediments, groundwater (where present), and soil vapor at TA-10. Upon Department approval, the Respondents shall implement the work plan.

IV.C.5.c.ii Technical Area 10 Survey of Disposal Units

The Respondents shall conduct a survey of the disposal units at TA-10. The Respondents shall determine the dimensions and total depth of each disposal shaft, pit, and other unit into which contaminants were disposed, and the base profile, topography, low elevation point, and down-slope end of the base of each disposal shaft, pit, and other unit into which waste was disposed.

The dimensions and base elevations of each pit, shaft, and other unit shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods shall be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.5.c.iii.

IV.C.5.c.iii Technical Area 10 Drilling Explorations

The Respondents shall submit to the Department for review and approval a work plan that meets requirements listed below and Section IX.B for completing subsurface explorations at TA-10. The work shall be conducted in accordance with Section IX.B. Implementation of the approved work plan shall meet the following requirements, subject to the procedures of Section III.M of this Consent Order:

1. The type and concentrations of contaminants present at, and off site from, each SWMU and/or AOC; and

2. The presence of subsurface moisture and the extent of any zones of saturation in the canyon alluvium or bedrock above the regional aquifer.

Prior to the implementation of drilling explorations, the Respondents shall determine the locations, dimensions, remaining structures, and total depths of facility-related features at each SWMU and AOC, and the types of contaminants released from each SWMU and AOC. The dimensions and base elevations of each unit shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys or other methods shall be used.

The characterization shall be completed utilizing data acquired from samples, drill cuttings, cores, and down-hole geophysical data. The subsurface conditions shall be characterized by evaluating samples of soil, rock, sediments, and groundwater (where present) for field screening and laboratory chemical analysis. The methods and locations for collecting data shall be approved by the Department prior to data collection. The following are requirements for completing subsurface explorations:

1. The exact location of former SWMU 10-002(b) shall be identified and a minimum of ten borings shall be advanced to depths of 25 ft bgs in the vicinity of the former disposal pit.

2. Ten borings shall be advanced to depths of 30 ft bgs in the vicinity of the leach field [formerly SWMU 10-003(n)].

3. The presence or absence of drain lines at former SWMU 10-004(b) shall be determined. If present, the drain lines shall be removed, and samples shall be collected from the excavation at 20-ft intervals for field screening and laboratory analyses. If the drain line is not excavated, borings shall be advanced at 25-ft intervals along the entire length of the drain line to depths of five ft below the base of the drain line trench.

4. The drilling activities shall be conducted in accordance with Section X of this Consent Order.

5. The boring locations shall be approved by the Department prior to the start of drilling activities. The borings shall be advanced using hollow-stem auger drilling methods, where practicable, or other drilling methods approved by the Department.

6. Two borings shall be advanced to first water to evaluate for fractures in rock beneath the alluvium and the presence of perched groundwater at depth beneath the site.

IV.C.5.c.iv Technical Area 10 Soil and Rock Sampling

The Respondents shall submit to the Department for review and approval a work plan for completing soil and rock sampling during subsurface drilling explorations at TA-10. The work shall be conducted in accordance with Section IX.B. Implementation of the work plan shall meet the following requirements, subject to the procedures of Section III.M of this Consent Order:

1. Soil and rock samples shall be obtained from each boring at five-ft intervals and from the native material directly below the base of each SWMU or AOC structure or excavation. A sample also shall be obtained at the maximum depth of each boring.

2. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.

3. Two cores, or the number specified in the Department-approved work plan, shall be obtained from selected borings, at depths approved by the Department, for permeability testing in accordance with Section IX.B of this Consent Order.

4. Two samples, or the number specified in the Department-approved work plan, shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, explosive compounds, perchlorate, TAL metals, and cyanide.

5. The sample displaying the greatest field screening evidence of VOC concentrations shall be selected for submittal to the analytical laboratory for chemical analysis listed in Paragraph 4 above.

6. If field screening evidence of contamination is not observed in a boring, the sample obtained from the native material located directly below the limits of the original

construction excavation shall be submitted for the chemical analyses listed in Paragraph 4 above.

7. The sample obtained from the maximum depth of each boring also shall be submitted to an analytical laboratory for the analyses listed in Paragraph 4 above.

8. All borings not completed as monitoring wells shall be properly plugged and abandoned in accordance with Section X.D of this Consent Order. The Respondents shall provide a status report describing the details of borehole abandonment to the Department as an appendix to the investigation report.

9. Evaluate the need for removal of the landfill material at SWMU 10-007 for disposal at an approved landfill. Collect samples from the limits of the excavation at locations specified by the Department.

IV.C.5.c.v Technical Area 10 Groundwater Well Installation

The Respondents shall submit to the Department for review and approval a work plan for groundwater well installation at TA-10. The work shall be conducted in accordance with Section IX.B. Implementation of the approved work plan shall meet the following requirements, subject to the procedures of Section III.M of this Consent Order:

1. Two borings shall be advanced to depths intersecting the first significant presence of intermediate zone perched groundwater downgradient of the former liquid waste treatment facility at locations approved by the Department. The respondents shall construct monitoring wells in the borings in accordance with Section X of this Consent Order if groundwater is observed in zones above the regional aquifer.

2. One well shall be installed intersecting the regional aquifer at a location approved by the Department.

3. Core and groundwater samples shall be collected from the boring prior to well construction. The core samples shall be collected to evaluate hydraulic parameters, K_d, and for potential contaminants.

The Department may impose specific conditions for well construction or require the drilling of additional borings that intersect the intermediate perched zones or regional aquifer based on the sampling and/or geophysical logging results.

IV.C.5.c.vi Technical Area 10 Groundwater Monitoring

The Respondents shall monitor and sample all wells specified below containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to the procedures in Section III.M of this Consent Order. Such monitoring and sampling shall also be conducted in accordance with Section IX of this Consent Order. After completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described

in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon Watershed. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plans shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

1. Groundwater samples shall be collected from each saturated zone intersecting the newly–installed monitoring wells.

2. Groundwater samples shall be submitted to a laboratory for analysis of general chemistry parameters as described in Section IX.B of this Consent Order, perchlorate, TAL metals, cyanide, VOCs, SVOCs, and for other analytes specified by the Department.

The Respondents shall complete the work at TA-10 in accordance with the schedule provided in Section XII of this Consent Order. The Respondents shall report results from the monitoring and sampling plan in accordance with the requirements outlined in Section XI of this Consent Order.

IV.C.5.c.vii Technical Area 10 Investigation Report

The Respondents shall submit to the Department for approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for SWMUs and AOCs at TA-10. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and submitted by the date specified in Section XII of this Consent Order.

Based on the results of the investigations conducted at TA-10, and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval watershed- or site-specific long-term groundwater monitoring plans for Los Alamos Canyon Watershed. Upon Department approval of the long-term monitoring plans for the Los Alamos Canyon watershed or specific sites within the watershed, the requirements of the long-term monitoring plan shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan.

V. INVESTIGATION FOR OTHER SWMUS AND AOCS

V.A INTRODUCTION

This section (V) sets forth requirements for the investigation of all SWMUs and AOCs that are not addressed in Sections IV and VI of this Consent Order, including any additional SWMUs or AOCs discovered after the effective date of this Consent Order.

V.B AGGREGATE AREAS

Within 180 days of the effective date of this Consent Order, the Respondents shall submit to the Department a list identifying all Aggregate Areas. That list shall also identify all SWMUs and AOCs located within each Aggregate Area, including those listed in the Facility Operating Permit (the Aggregate Area list). The Respondents shall also submit maps depicting all current and former TAs, SWMUs, and AOCs.

V.C NEWLY IDENTIFIED SWMUS AND AOCS

Within fifteen (15) days after the discovery of any newly identified SWMU or AOC, the Respondents shall notify the Department in writing of such discovery. The notification shall include, at a minimum, the location of the SWMU or AOC and all available information pertaining to the nature of any release of contaminants from the SWMU or AOC, including the contaminants released, the magnitude of the release, and the media affected by the release.

Within ninety (90) days after submitting such notification, the Respondents shall submit to the Department for review and written approval a SWMU Assessment Report (SAR) for each newly identified SWMU or AOC. The SAR shall include the following information, to the extent available:

1. Location of each unit on a topographic map of appropriate scale;

2. Type and function of each unit;

3. General dimensions, capacities, and structural description of each unit (including any available plans/drawings);

4. Dates of operation for each unit;

5. Identification of all wastes that have been managed at or in each unit, to the extent available. Include any available data on hazardous constituents in the wastes; and

6. All available information pertaining to any release of contaminants from each unit, including groundwater data, soil analyses, air sampling or monitoring data, and surface water data.

Based on the results of the SAR, the Department will determine the need for further investigations at the SWMUs or AOCs identified in the SAR, including the need for an investigation report under Section V.E.3.

To the extent a new SWMU or AOC is identified pursuant to this section (V.C), Respondents shall provide the Department with updates to those portions of the Aggregate Area list, identified in Section V.B, that are affected by the newly identified SWMU or AOC within 120 days of discovery.

V.D NEWLY DISCOVERED RELEASES FROM SWMUS OR AOCS

Within fifteen (15) days after the discovery of any previously unknown release of a contaminant from a SWMU or AOC, the Respondents shall notify the Department in writing of such discovery. The Department will determine whether further investigation of the release of contaminants is needed, including the need for an investigation report under Section V.E.3.

V.E SITE INVESTIGATIONS

V.E.1 Investigation Work Plan

The Department may determine that further investigation is needed at any of the SWMUs or AOCs on the Aggregate Area list identified in Section V.B of this Consent Order. If the Department makes such a determination, it will notify the Respondents in writing. The Respondents shall submit to the Department for review and written approval an investigation work plan or plans for those SWMUs and AOCs needing further investigation to the extent those SWMUs and AOCs are not otherwise addressed in the Aggregate Area-specific work plans required by Section V.H of this Consent Order. An individual work plan may cover several SWMUs or AOCs within an Aggregate Area. The work plans shall be prepared in accordance with Section XI.B of this Consent Order and shall be submitted by the date specified in the Department's written notification. Additional characterization required by the Department that is not already covered in an approved work plan, or that is not addressed during implementation of field activities conducted under an existing approved work plan, shall be proposed in a supplemental work plan submitted to the Department for approval in accordance with Section III.M. The supplemental work plan shall be prepared in accordance with Section XI.B of this Consent Order and may reference the applicable approved investigation work plan and corresponding investigation report for background information.

V.E.2 Site Investigation

The Respondents shall perform the site investigations in accordance with the approved investigation work plan or supplemental work plan. The Respondents shall notify the Department a minimum of fifteen (15) days prior to the commencement of any field activity under the approved investigation or supplemental work plan.

V.E.3 Investigation Report

The Respondents shall submit to the Department for review and written approval an investigation report that presents the results of field activities, summarizes the data collected, and presents the recommendations and conclusions of the investigation. An individual report may cover several SWMUs or AOCs within an Aggregate Area. The reports shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in the approved investigation or supplemental work plan.

V.F CORRECTIVE ACTION

V.F.1 Corrective Measures Evaluation

The Department will notify the Respondents in writing if the Department determines that a corrective measures evaluation is required for a SWMU(s) or AOC(s) on the Aggregate Area list described in Section V.B. of this Consent Order. Following such written notification, the Respondents shall submit to the Department, by the date specified in the written notification, a corrective measures evaluation report, in compliance with the requirements of Section VII of this Consent Order.

V.G INTERIM MEASURES

Interim Measures shall be conducted, where the Respondents identify the need or where required by the Department, at SWMUs and AOCs in accordance with Section VII of this Consent Order.

V.H AGGREGATE REQUIREMENTS

The Respondents shall submit a work plan to the Department for review and written approval to investigate each Aggregate Area in accordance with the schedule provided in Section XII of this Consent Order. These Aggregate Area Work Plans shall not include duplicative requirements contained in this Consent Order for SWMUs, AOCs, or Aggregate Areas specifically addressed in Sections IV or VI of this Consent Order. The work plans shall be prepared in accordance with Section XI.B of this Consent Order. Upon review of the work plans, the Department will determine the submittal dates for the aggregate area-specific investigation reports. The Respondents shall follow the protocol for site investigation, monitoring, and reporting established in this Consent Order.

VI. ON-GOING INVESTIGATIONS

VI.A INTRODUCTION

This section (VI) provides for both the continuing investigation of several MDAs, SWMUs, and AOCs, and for the implementation of corrective measures at some of these sites. Additional investigations or corrective measures at any of these sites may be required. The results of investigations performed pursuant to LANL's Hazardous Waste Facility Permit may be used to satisfy the requirements of this section.

VI.B SWMU 3-010(A)

VI.B.1 Background

SWMU 3-010(a) is located at TA-3. The SWMU was used for the disposal of vacuum oil from the pump repair area at Building TA-3-30. The disposal site was used between 1950 and 1957. It was approximately 40 ft long by 15 ft wide and is located on a moderately steep hillside on the west side of Building TA-3-30. The drainage from the hillside flows into a tributary of Two-Mile Canyon. A recreational footpath runs through the tributary west of the site. Phase I RFI sampling conducted in 1992 and 1993 identified elevated levels of lead, mercury, and total petroleum hydrocarbons in soil and sediment.

Respondents removed contaminated soil in 1994 during a voluntary corrective action. Confirmatory samples collected following soil removal revealed the presence of VOCs in the tuff. Subsequently, the Respondents performed a Phase II RFI and found water in boreholes at the site. Groundwater was encountered at approximately 23 ft bgs during drilling activities and a well was installed in one of the boreholes. Water samples were collected from the well, which showed VOCs above SALs and MCLs, and tritium, which is not addressed under this Consent Order. The Respondents also collected water samples from a seep located in the tributary. Metals (lead and mercury) were detected in several of those water samples. The Respondents have submitted a RFI Report for Field Unit 1, SWMU 3-010(a), LAUR 94-1485, dated April 28, 1995; and an Addendum to the RFI Report, dated October 2000.

Pursuant to the response to an RSI, approved by the Department on April 1, 2002, Respondents conducted geophysical investigations to determine the extent of groundwater contamination, groundwater source(s), groundwater flow direction, and will determine any connection between the shallow groundwater and deeper zones, and any other contaminant sources.

VI.B.2 SWMU 3-010(a) Continued Investigation

The Respondents shall continue the investigation of SWMU 3-010(a) pursuant to the aforementioned RSI response. The investigation shall identify other potential sources of groundwater contamination; fully characterize the vertical and lateral extent of groundwater contamination; determine the groundwater source and groundwater flow rates; and determine

whether there is any connection between the alluvial aquifer and the intermediate or regional aquifer.

The Respondents shall submit to the Department for review and written approval a groundwater investigation work plan for SWMU 3-010(a) that includes the results of the Respondent's geophysical investigation. The work plan shall be prepared in accordance with Section XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. Upon written notice of Department approval, the Respondents shall implement the groundwater investigation work plan. Upon Department approval, the work plan shall be incorporated herein by reference and become an enforceable part of this Consent Order.

After completing implementation of the approved plan, the Respondents shall submit to the Department for review and written approval a groundwater investigation report that presents the results of field activities, summarizes the data collected, and presents recommendations and conclusions of the investigation for SWMU 3-010(a). The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order. The report shall be submitted to the Department for review in accordance with the procedures in Section III.M of this Consent Order.

VI.C SWMU 16-003(O)

VI.C.1 Background

SWMU 16-003(o), also known as the "fish ladder", is the former outfall associated with Building TA-16-340 at TA-16. Building 16-340 is the largest of approximately five structures that operated to produce plastic-bonded explosive powders starting in the early 1950s and lasting until October 1999 when operations in the building ceased. Between 1951 and 1988, all explosives-contaminated wastewater that was discharged was untreated. Beginning in the early 1980s and lasting through 1998, various methods were employed to reduce VOC concentrations in the effluent. The use of the outfall was discontinued and the outfall was plugged on July 20, 1998.

Contaminants identified at the site are HMX, RDX, TNT, VOCs, SVOCs, barium, and uranium. The extent of VOCs, explosives, uranium (which is not addressed in this Consent Order), and other metals contamination in sediments and groundwater is unknown. The Respondents initiated the investigation of SWMU 16-003(o) under the RFI Work Plan for Operable Unit 1082, approved December 22, 1994, to characterize the vertical and lateral extent of potential sediment and groundwater contamination. The Department has not received an investigation report for these activities.

VI.C.2 SWMU 16-003(o) Continued Investigation

The Respondents shall continue the investigation of SWMU 16-003(o). The investigation shall fully characterize the vertical and lateral extent of sediment and groundwater contamination.

The Respondents shall submit to the Department for review and written approval an investigation work plan for SWMU 16-003(o). The work plan shall be prepared in accordance

with Section XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. Upon written notice of Department approval, the Respondents shall implement the investigation work plan. Upon Department approval, the work plan shall be incorporated herein by reference and become an enforceable part of this Consent Order.

After completing implementation of the approved plan, the Respondents shall submit to the Department for review and written approval an investigation report that presents the results of field activities, summarizes the data collected, and presents recommendations and conclusions for SWMU 16-003(o). The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order. The report shall be submitted to the Department for review in accordance with the procedures in Section III.M of this Consent Order.

VI.D SWMU 16-008(A)

VI.D.1 Background

SWMU 16-008(a) is an inactive, unlined pond approximately 200 ft in diameter located at TA-16 and is part of the consolidated SWMU 16-008(a)-99. The pond received liquid waste from the sumps and drainlines at process buildings TA-16-89, 90, and 91. The discharge occurred from as early as 1949 and lasted into the mid-1950s. At various times during the history of the discharge, the waste contained explosives, barium, uranium (which is not addressed in this Consent Order), VOCs, and machining oils. Respondents initiated the investigation of SWMU 16-008(a) under the RFI Work Plan for Operable Unit 1082, approved by EPA on December 22, 1994. However, the Department has not received an investigation report on these activities.

Several soil and water samples have been collected from within the pond; however, no data has been collected from the tuff below the pond floor. The analytical results indicate the presence of some metals above their respective SALs.

VI.D.2 SWMU 16-008(a) Continued Investigation

The Respondents shall continue the investigation of SWMU 16-008(a). The investigation shall fully characterize the vertical and lateral extent of surface, vadose, and any groundwater contamination. The Respondents shall submit to the Department for review and written approval an investigation work plan for SWMU 16-008(a). The work plan shall be prepared in accordance with Section XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. Upon written notice of Department approval, the Respondents shall implement the investigation work plan. Upon Department approval, the work plan shall be incorporated herein by reference and become an enforceable part of this Consent Order.

After completing implementation of the approved plan, the Respondents shall submit to the Department for review and written approval an investigation report that presents the results of field activities, summarizes the data collected, and presents recommendations and conclusions for SWMU 16-008(a). The investigation report shall be prepared in accordance with Section

XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order. The report shall be submitted to the Department for review in accordance with the procedures in Section III.M of this Consent Order.

VI.E SWMU 16-018 (MDA P) AND TA-16-387

VI.E.1 Background

SWMU 16-018 (MDA P) is located in TA-16. The SWMUs incorporated into MDA P closure activities include the former barium nitrate pile (SWMU 16-016(c)), the TA-16-386 flash pad (SWMU 16-010(a)), the TA-16-387 flash pad (SWMU 16-010(b)), and the septic tank drain field and outfall (SWMU 16-006(e)).

MDA P operated from the early 1950s until 1984 as a disposal site for debris originating from the burning of explosives and explosives-contaminated material at TA-16. In 1995, the Respondents submitted a closure plan to the Department for MDA P proposing that MDA P be clean closed in accordance with 20.4.1.265 NMAC. The Department approved the closure plan for MDA P on February 20, 1997 and approved the closure plan for the TA-16-387 Flash Pad on April 28, 2000. The Respondents submitted a closure certification report for MDA P and the TA-16-387 flash pad to the Department on January 31, 2003. On April 30, 2003, the Department requested that the document be reformatted and resubmitted. The Respondents submitted one of four required documents that comprise the reformatted closure report to the Department on July 9, 2003.

VI.E.2 SWMU 16-018 (MDA P) and TA-16-387 Continued Investigation

The Respondents shall submit to the Department for approval the remaining three documents that comprise the closure report for MDA P. The report shall also include the results of the VCA activities for SWMU 16-016(c). The Respondents shall also revise the closure report(s) to supplement information regarding risk-based clean closure. The revised closure report was submitted to the Department for review and approval on November 26, 2003.

VI.F SWMUS 16-021(C) AND 16-003(K)

VI.F.1 Background

SWMUs 16-021(c) and 16-003(k) consist of the outfall, drainage, and associated sumps and drain lines from an active explosives machining building (TA-16-260). TA-16-260 has operated since 1951 and has processed large quantities of explosives. Machine turnings and explosives wash water are routed to the 13 sumps located along the east side of the building. From 1951 to November 1996, these sumps discharged to the outfall. The sumps remain active, but have been plugged so that they no longer discharge to the environment.

The TA-16-260 drainage runs for approximately 600 ft north from the outfall to its confluence with Cañon de Valle. In 1995 the Respondents conducted a Phase I RFI in accordance with the RFI work plan approved by the EPA (RFI Work Plan for Operable Unit 1082) on December 22, 1994, pursuant to LANL's Hazardous Waste Facility Permit. The RFI Report for TA-16: PRS

16-021(c) and 16-003(k) was submitted to the Department on September 23, 1996 and approved by the Department on January 20, 1998.

In 1996 and 1997, the Respondents conducted a Phase II RFI to characterize the site further and determine extent of contamination. The Respondents submitted the Phase II RFI Report and a CMS Plan to the Department on September 30, 1998. The RFI Report and CMS Plan were approved by the Department on September 8, 1999. In 1999, the Respondents began implementing the CMS and Phase III RFI. In September 1999, the Respondents submitted an addendum to the CMS Plan and in March 2003, Respondents submitted Revision 1 to the CMS addendum to the Department. The revision was developed to investigate the intermediate and regional aquifers in the area. The Department approved the addendum revision on March 24, 2003. Regional aquifer well CdV-R-15-3 was installed in 2000 about 1.5 miles east of Building 260. Regional aquifer well CdV-R-37-2 was installed in 2001 to the southeast of this SWMU.

In 2000 and 2001, Respondents conducted an interim measure to remove residual contaminated sediments in accordance with an Interim Measures Plan submitted to the Department on February 14, 2000 and approved on April 18, 2002. The Respondents submitted the Interim Measures Report to the Department on July 31, 2002, and the Department approved the Report on January 13, 2003.

The primary contaminants at these SWMUs are RDX, HMX, TNT, and barium. Soil, sediments, the alluvial groundwater system, and regional groundwater are contaminated. Also present above background levels are cadmium, copper, lead, nickel, vanadium, uranium (which is not addressed in this Consent Order), zinc, anthracene, phthalates, major cations such as calcium and magnesium. Prior to the implementation of the interim measures in 2000, RDX was detected in the outfall area at concentrations as high as 200,000 ppm. Barium concentrations detected in Cañon de Valle sediments ranged up to 40,000 ppm and concentrations detected in the soil in the outfall area ranged up to 33,000 ppm. The interim measure required excavation to remove the highest concentrations of RDX and barium in soil from the former pond area and drainage. After implementation of the interim measure, RDX has been detected in Cañon de Valle soils at concentrations less than 50 ppb, and RDX has been detected in Cañon de Valle surface water at concentrations greater than 800 ppb. Barium concentrations detected in Cañon de Valle surface water range up to seven ppm.

VI.F.2 SWMUs 16-021(c) and 16-003(k) Continued Investigation

The Respondents shall continue to implement the CMS at SWMUs 16-021(c) and 16-003(k), shall continue conducting additional investigations to characterize potential intermediate and regional groundwater contamination, and shall implement appropriate corrective measures in accordance with the approved CMS plan. After completing the approved plan, Respondents shall submit a CMS Report for surface water and alluvial groundwater to the Department for review and written approval. The CMS Report shall be submitted by the date specified in Section XII of this Consent Order. Upon review and written approval of the CMS Report for surface water and alluvial groundwater, Respondents shall prepare a Corrective Measures Implementation (CMI) Plan for surface water and alluvial groundwater. The CMI Plan shall be submitted to the Department by the date specified in Section XII of this Consent Order. Pursuant

to the procedures in Section III.M of this Consent Order, the Department will provide written notice of approval and the Respondents shall implement the CMI Plan.

The Respondents shall submit to the Department for review and written approval a Phase III RFI Report for SWMU 16-021(c) that includes a risk assessment as an addendum. This risk assessment will address the source area and the canyon bottom, but will not include the groundwater pathway. The Phase III RFI Report shall be submitted by the date specified in Section XII of this Consent Order.

The Respondents shall submit to the Department for review and written approval an investigation report for intermediate and regional groundwater. This investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order. Upon review and written approval of the investigation report for intermediate and regional groundwater, the Respondents shall prepare and submit a CMS Report for intermediate and regional groundwater to the Department for review and written approval. The CMS Report shall be submitted by the date specified in Section XII of this Consent Order. Upon review and written approval of the CMS Report for intermediate and regional groundwater, Respondents shall prepare a CMI Plan for intermediate and regional groundwater, subject to the procedures in Section III.M of this Consent Order. The CMI Plan shall be submitted to the Department by the date specified in Section XII of this Consent Order. Pursuant to the procedures in Section III.M of this Consent Order, the Respondents shall implement the CMI Plan.

The Respondents shall evaluate corrective measures and implement any selected corrective measures in accordance with Section VII.D of this Consent Order to address contamination in soil, sediment, surface water and alluvial, intermediate, and regional groundwater.

VI.G SWMU 21-011(K)

VI.G.1 Background

SWMU 21-011(k) was an outfall for treated industrial wastewater from Buildings TA-21-35 and TA-21-257, the former industrial wastewater treatment plants at TA-21. The SWMU consists of a drain line from two wastewater treatment tanks that discharged to an outfall ditch, which channeled wastewater to the canyon rim and down the hillside into DP Canyon. Building TA-21-35 was the first wastewater treatment plant at the Facility, which began operation in 1952 and operated until 1967, when it was replaced by TA-21-257. The treated wastes consisted of liquids remaining after plutonium extraction and processing of radioactive materials for nuclear weapons and space research projects. The treatment process mixed raw waste with lime, ferric sulfate, and coagulant agents. The discharged wastewater contained both chemical and radioactive constituents, which are not addressed under this Consent Order.

Respondents investigated SWMU 21-011(k) in 1992 and 1993 under the TA-21 Operable Unit RFI Work Plan approved by the EPA pursuant to LANL's Hazardous Waste Facility Permit on January 9, 1992. Respondents submitted the results of the investigation to the Department in the 1995 Final Draft OU 1106 Addendum to Phase 1B, 1C Report.

In 1996 and 1997, Respondents implemented the Interim Action Plan for SWMU 21-011(k), and removed an estimated 390 cubic yards of soil. Respondents submitted the Interim Action Report for SWMU 21-011(k) to the Department on April 10, 1997. In November 2000 and March 2001, an in-situ gamma survey and additional waste characterization sampling were conducted, respectively.

The Respondents submitted a VCM Plan to the Department in 2002 and 2003, and began implementing the plan in November 2002. The Department approved the plan July 14, 2003. Under the plan, the Respondents removed and disposed of additional contaminated soils.

VI.G.2 SWMU 21-011(k) Continued Investigation

The Respondents shall complete the implementation of the Voluntary Corrective Measures Plan, and shall submit to the Department for review and written approval a remedy completion report for SWMU 21-011(k). The remedy completion report was submitted to the Department for review and approval on October 31, 2003.

VI.H TA-35 (MIDDLE MORTANDAD/TEN SITE AGGREGATE AREA)

VI.H.1 Background

TA-35 is located on a finger mesa between Mortandad Canyon and Ten Site Canyon. Releases of contaminants from TA-35 have occurred from outfalls, air stack emissions, cooling water, and septic system discharges related to weapons research operations. The wastewater treatment facility operated from 1951 until 1963 and discharged effluent into Ten Site Canyon. Spills occurred from leaks in pipelines, structures, and container storage areas. Documented large volume releases include an oil spill at SWMU 35-015(a) and leaks from wastewater storage tanks at SWMU 35-003(d) that released radioactively contaminated wastewater into Ten Site canyon. Potential contaminants associated with the Middle Mortandad/Ten Site aggregate include metals, PCBs, VOCs, and radionuclides. Radionuclides are not addressed under this Consent Order.

On March 29, 2002, Respondents submitted to the Department a SAP integrating most of the Middle Mortandad/Ten Site Aggregate Area SWMUS and AOCs into one aggregate for data gathering purposes and to prioritize sub-areas of the aggregate for any necessary corrective measures. The Department approved the SAP on June 9, 2003. The need for corrective measures will be based on the risk to human health and the environment after an evaluation of the Middle Mortandad/Ten Site Aggregate Area.

VI.H.2 TA-35 Continued Investigation

The Respondents shall continue the investigation of the Middle Mortandad/Ten Site Aggregate Area and, if determined to be necessary by the Department, implement corrective measures selected pursuant to Section VII of this Consent Order.

The Respondents shall submit a supplemental work plan to the Aggregate Area SAP for the Middle Mortandad/Ten Site Aggregate Area in accordance with Section XI.B of this Consent

Order for the Department's review and written approval. The supplemental work plan shall address investigation for the remaining SWMUs and AOCs in the Aggregate Area not addressed in the March 29, 2002 SAP for the Middle Mortandad/Ten Site Aggregate Area. The supplemental work plan shall be submitted by the date specified in Section XII of this Consent Order.

After completing implementation of the approved SAP and supplemental work plan, the Respondents shall submit to the Department for review and written approval an investigation report for the Middle Mortandad/Ten Site Aggregate Area. The report shall be submitted to the Department for review in accordance with the procedures in Section III.M of this Consent Order. This investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order.

VI.I TA-49: AREAS, 5, 6, AND 10

VI.I.1 Background

TA-49 has been used for research, development and testing of military munitions, including non-nuclear components of nuclear weapons, and for general support activities, an open burning operation, and surface disposal. It has also been used and continues to be used in part to support those activities at adjacent TAs. Area 5 consists of SWMU 49-006 and AOCsC-49-005(b) and C-49-008(a). SWMU 49-004 and AOC C-49-008(b) is part of Area 6. AOC C-49-002 and SWMU 49-005(a) are in Area 10. Respondents conducted a Phase I RFI at SWMUs in Areas 5, 6, and 10 in 1995 pursuant to the RFI Work Plan for Operable Unit 1144 approved by the EPA on April 15, 1993. Respondents submitted a RFI Report for TA-49: Areas 5, 6, 10, and 11 to the Department on August 25, 1997.

VI.I.2 TA-49, Areas, 5, 6, and 10 Continued Investigation

The Respondents shall continue the investigation of TA-49: Areas 5, 6, and 10 to fully characterize the vertical and lateral extent of any potential surface and subsurface contamination. Pursuant to the procedures in Section III.M, the Respondents shall submit to the Department for review and written approval an investigation work plan for TA-49: Areas 5, 6, and 10. The work plan shall be prepared in accordance with Section XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. Upon written notice of Department approval, the Respondents shall implement the investigation work plan. Upon Department approval, the work plan shall be incorporated herein by reference and become an enforceable part of this Consent Order.

Upon completing implementation of the approved work plan, the Respondents shall submit to the Department for review and written approval an investigation report that presents the results of field activities, summarizes the data collected, and presents recommendations and conclusions for the investigation of TA-49: Areas 5, 6, and 10. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and shall be submitted by the date specified in Section XII of this Consent Order.

VI.J SWMUS 53-002(A AND B)

VI.J.1 Background

SWMU 53-002(a) is comprised of two impoundments (northeast and northwest) constructed in 1969, each measuring 210 ft by 210 ft by six ft deep. The impoundments were surface retention structures that received sanitary, radioactive and industrial wastewater from various TA-53 facilities. After their construction, the impoundments were occasionally filled to capacity and overflow was discharged to a drainage channel that flows east into a tributary of Los Alamos Canyon. Liquid waste was either pumped to the impoundments through waste lines or brought to the impoundment by truck. SWMU 53-002(b) is a third impoundment (southern) constructed in 1985 measuring approximately 305 ft by 148 ft by six ft deep. In 1989 the impoundment became a total retention radioactive liquid waste storage impoundment and the northeast and northwest impoundments began receiving sanitary wastewater only. All three impoundments are now inactive. The radioactive portion of the wastewater is not addressed under this Consent Order.

A SAP to characterize the sludge in all three impoundments was approved by the Department on August 8, 2000 and subsequently implemented by Respondents. The Respondents conducted a voluntary corrective action at the southern impoundment in 2000 and at the northern impoundments in 2002. The Respondents submitted an Interim Action Plan for the northern impoundments to the Department in November 2001, followed by an addendum to the RFI Work Plan and SAP in July 2002. The Respondents implemented the Plans in 2001 and 2002. The Respondents removed the sludge and liners from all three impoundments, collected confirmatory samples beneath the liners of each impoundment, and collected characterization samples from the perimeter around each impoundment and from drainage channels leading from the southern impoundment. The Department has not received a formal report on these activities.

VI.J.2 SWMUs 53-002(a and b) Continued Investigation

The Respondents submitted to the Department for review and written approval an investigation report that presents the results of field activities, summarizes the data collected, and presents recommendations and conclusions for the investigation of SWMUs 53-002(a and b). The investigation report shall be prepared in accordance with Section XI.C of this Consent Order and was submitted to the Department for review and approval on February 2, 2004.

VI.K SWMUS 73-001(A-D) AND 73-004(D)

VI.K.1 Background

The Airport Landfill is comprised of five SWMUs: a main landfill (73-001(a)), a waste oil pit (73-001(b)), bunker debris pits (73-001(c)), a debris disposal area (73-001(d)), and a septic system (73-004(d)). DOE began operation at the main landfill in 1943. Trash was collected from the town site and various locations from the Facility and burned on the edge of a hanging valley. Burning continued from 1943 until 1965, when Los Alamos County assumed operation of the landfill. The County continued to operate the landfill until June 30, 1973. From 1984 to 1986, the western portion of the landfill was excavated and moved to the debris disposal pit (73-001(d)) to allow for construction of the existing airport hangers and tie-down areas. The

Respondents conducted RFI activities at these SWMUs between 1994 and 1997, in accordance with the RFI for Operable Unit 1071, approved by the EPA on December 14, 1993. The Respondents submitted an RFI Report on these SWMUs to the Department on December 1, 1998. The Department agreed with the Respondents' request to proceed with a presumptive remedy on December 8, 1999.

The Respondents will conduct further investigation of the Airport Landfill mesa top area using a two-phased approach. The first phase consisted of gathering additional data for assessment of the mesa top tract and submitting the results in a Phase I VCM Plan, which the Department conditionally approved on April 1, 2003. The Phase I VCM Plan identified additional characterization or investigation required in order to design an appropriate cover for the landfill. Landfill cover design will be conducted under Phase II VCM activities.

The DOE submitted an Interim Measures Plan for removal of debris from drainages associated with the Airport Landfill to the Department on June 13, 2003. The Department approved the Plan on July 23, 2003. The Respondents removed the drainage debris and collected confirmatory samples. Results of the drainage debris removal will be detailed in the final IM report and in the final VCM report.

VI.K.2 SWMUs 73-001(a-d) and 73-004(d) Continued Investigation

The Respondents submitted to the Department for review and written approval a Phase II VCM Plan for SWMUs 73-001(a-d) and 73-004(d). The Phase II VCM Plan shall propose a final design and address construction of a cover for the SWMUs. The Phase II VCM plan shall be submitted in accordance with Section VII.E.2 of this Consent Order and in accordance with the dates specified in Section XII of this Consent Order. Upon written notice of approval, the Phase II VCM shall be incorporated herein by reference and become an enforceable part of this Consent Order. Upon written notice of approval, the Respondents shall implement the Phase II VCM plan in accordance with Section VII.D of this Consent Order.

After completing implementation of the approved IM Plan and the approved VCM Plan, the Respondents shall submit to the Department for review and written approval an interim measures report in accordance with Section VII.B.6 of this Consent Order and a VCM Completion Report in accordance with Section VII.E.6.a of this Consent Order. The VCM completion report shall be submitted by the date specified in Section XII of this Consent Order.

VI.L SWMU 73-002

VI.L.1 Background

SWMU 73-002 is the ash pile from a former incinerator at TA-73 and is located adjacent to the Los Alamos County Airport. The incinerator was in use for a short period of time to burn documents and municipal trash. The incinerator equipment and stack were removed prior to 1973. The ash and debris surface disposal area is located on the slope below the canyon rim to the immediate north of the former incinerator. RFI activities were conducted at this SWMU in 1996 and 1997 in accordance with a RFI work plan approved by the EPA on December 14, 1993.

Respondents submitted the RFI results to the Department for review and approval in a Phase II SAP in 1997. The Department approved the Plan on February 28, 2000.

VI.L.2 SWMU 73-002 Continued Investigation

The Respondents shall continue the investigation of SWMU 73-002. The investigation shall fully characterize the vertical and lateral extent of contamination and the potential for migration of contaminants through fractures.

The Respondents shall submit to the Department for review and written approval the Pueblo Canyon Aggregate Area Work Plan, which will include the investigation requirements for SWMU 73-002. The work plan shall be prepared in accordance with Section XI.B of this Consent Order, and shall be submitted by the date specified in Section XII of this Consent Order. Upon notice of written approval, the Respondents shall implement the approved work plan. Upon Department approval, the work plan shall be incorporated herein by reference and become an enforceable part of this Order.

After completing implementation of the approved work plan, the Respondents shall submit to the Department for review and written approval an investigation report that presents the results of field activities, summarizes the data collected, and presents recommendations and conclusions for the Pueblo Aggregate Area, which will include SWMU 73-002. The investigation report shall be prepared in accordance with Section XI.C of this Consent Order. The report shall be submitted to the Department for review in accordance with the procedures in Section III.M of this Consent Order.

VII. CORRECTIVE MEASURES

The Respondents shall implement corrective measures at the Facility, as necessary, in accordance with the requirements of this section (VII).

The results of the investigations required in this Consent Order, and other relevant information available to the Department, will be used as the basis for determining whether further investigation and corrective measures are necessary under this Consent Order. The general procedures for implementing corrective measures are described in this section (VII).

VII.A EROSION CONTROL AND MONITORING

This Consent Order does not provide for monitoring of surface water discharges that are subject to a permit under section 402 of the federal Clean Water Act, 33 U.S.C. § 1342. However, the Department may require corrective measures at any SWMU or AOC if the Department determines, based on surface water monitoring data or other relevant information, that there has been a release of Contaminants into the environment at or from the SWMU or AOC and that corrective action is necessary to protect human health or the environment from such a release.

VII.B INTERIM MEASURES

VII.B.1 General

The Department will require interim measures, if the Department determines that such measures are necessary, to reduce or prevent migration of contaminants which have or may result in an unacceptable human or environmental receptor exposure to contaminants while long-term corrective action remedies are evaluated and implemented. Upon making such determination, the Department will notify the Respondents in writing. Alternately, the Respondents may identify the need to conduct interim measures and may submit proposed interim measures in writing to the Department for approval. The Respondents may initiate emergency interim measures without prior approval of the Department pursuant to Section VII.B.5 of this Consent Order.

VII.B.2 Interim Measures Work Plan

Within ninety (90) days after receiving notification from the Department that interim measures are required or interim measures proposed by the Respondents have been approved by the Department, the Respondents shall submit to the Department for review and written approval an Interim Measures Work Plan that shall include an implementation schedule.

VII.B.3 Approval of Interim Measures Work Plan

The Department will review and approve the Interim Measures Work Plan in accordance with the procedures in Section III.M of this Consent Order.

VII.B.4 Interim Measures Implementation

The Respondents shall implement the interim measures in accordance with the approved Interim Measures Work Plan and implementation schedule unless Respondents are implementing the interim measures without prior Department approval, in accordance with Section VII.B.5 of this Consent Order.

VII.B.5 Emergency Interim Measures

The Respondents may determine, during implementation of site investigation activities, that emergency interim measures are necessary to address an immediate threat of harm to human health or the environment. The Respondents shall notify the Department within three business days of discovery of the facts giving rise to the threat, and shall propose emergency interim measures to address the threat. The Department will respond to such proposal within three business days of receipt of the proposal. If the Department approves the emergency interim measures in writing, the Respondents may implement the proposed emergency interim measures without submitting an interim measures work plan. If circumstances arise resulting in an immediate threat to human health or the environment such that initiation of emergency interim measures are necessary prior to obtaining written approval from the Department, Respondents shall notify the Department within one business day of taking the emergency interim measure. The notification shall contain a description of the emergency situation, the types and quantities of contaminants involved, the emergency interim measures taken, and contact information for the emergency coordinator who handled the situation. The notification shall also include a written statement justifying the need to take the emergency action without prior written approval from the Department.

VII.B.6 Interim Measures Report

Within ninety (90) days after completion of interim measures, or as otherwise specified in the implementation schedule contained in the approved Interim Measures Plan, the Respondents shall submit to the Department an IM Report summarizing the results of the interim measures, that shall include copies of the results of all field screening, monitoring, sampling, analysis, and other data generated as part of the interim measures implementation. The Department will review and approve the Interim Measures Work Plan in accordance with the procedures in Section III.M of this Consent Order.

VII.C RISK ASSESSMENT

The Respondents shall attain the cleanup goals outlined in Section VIII of this Consent Order including, as necessary, performance of risk analysis to establish alternate cleanup goals, at each site for which the Department determines, under Section VII.D.1, that corrective measures are necessary. The Respondents shall submit to the Department for approval a Risk Assessment Report in accordance with Section XI.E for sites where risk analyses are conducted.

VII.D CORRECTIVE MEASURES EVALUATION

VII.D.1 General

The Department will require corrective measures at a SWMU or AOC if the Department determines, based on the Investigation Report and other relevant information available to the Department, that there has been a release of contaminants into the environment at the SWMU or AOC and that corrective action is necessary to protect human health or the environment from such a release. Upon making such a determination, the Department will notify the Respondents in writing. The Department will specify a date for the submittal of the necessary reports and evaluations in the written notification.

VII.D.2 Corrective Measures Evaluation Report

Following written notification from the Department that a corrective measures evaluation is required, the Respondents shall submit to the Department for approval a Corrective Measures Evaluation Report. The Respondents shall follow the Corrective Measures Evaluation Report format outlined in Section XI.F of this Consent Order. The corrective measures evaluation shall evaluate potential remedial alternatives and shall recommend a preferred remedy that will be protective of human health and the environment and attain the appropriate cleanup goals. The Corrective Measures Evaluation Report shall, at a minimum, comply with Section XI.F of this Consent Order and include the following:

1. A description of the location, status, and current use of the site.

2. A description of the history of site operations and the history of releases of contaminants.

3. A description of site surface conditions.

4. A description of site subsurface conditions.

5. A description of on- and off-site contamination in all affected media.

6. An identification and description of all sources of contaminants.

7. An identification and description of contaminant migration pathways.

8. An identification and description of potential receptors.

9. A description of cleanup standards or other applicable regulatory criteria.

10. An identification and description of a range of remedy alternatives.

11. Remedial alternative pilot or bench scale testing results.

12. A detailed evaluation and rating of each of the remedy alternatives, applying the criteria set forth in Section VII.D.4.

13. An identification of a proposed preferred remedy or remedies.

14. Design criteria of the selected remedy or remedies.

15. A proposed schedule for implementation of the preferred remedy.

VII.D.3 Cleanup Standards

The Respondents shall select corrective measures that are capable of achieving the cleanup standards and goals outlined in Section VIII of this Consent Order including, as applicable, approved alternate cleanup goals established by a risk assessment.

VII.D.4 Remedy Evaluation Criteria

VII.D.4.a Threshold Criteria

The Respondents shall evaluate each of the remedy alternatives for the following threshold criteria. To be selected, the remedy alternative must:

1. Be protective of human health and the environment.

2. Attain media cleanup standards.

3. Control the source or sources of releases so as to reduce or eliminate, to the extent practicable, further releases of contaminants that may pose a threat to human health and the environment.

4. Comply with applicable standards for management of wastes.

VII.D.4.b Remedial Alternative Evaluation Criteria

The Respondents shall evaluate each of the remedy alternatives for the factors described in this section (VII.D.4.b). These factors shall be balanced in proposing a preferred alternative.

VII.D.4.b.i Long-Term Reliability and Effectiveness

The remedy shall be evaluated for long-term reliability and effectiveness. This factor includes consideration of the magnitude of risks that will remain after implementation of the remedy; the extent of long-term monitoring, or other management that will be required after implementation of the remedy; the uncertainties associated with leaving contaminants in place; and the potential for failure of the remedy. Respondents shall give preference to a remedy that reduces risks with little long-term management, and that has proven effective under similar conditions.

VII.D.4.b.ii Reduction of Toxicity, Mobility, or Volume

The remedy shall be evaluated for its reduction in the toxicity, mobility, and volume of contaminants. Respondents shall give preference to remedy that uses treatment to more completely and permanently reduce the toxicity, mobility, and volume of contaminants.

VII.D.4.b.iii Short-Term Effectiveness

The remedy shall be evaluated for its short-term effectiveness. This factor includes consideration of the short-term reduction in existing risks that the remedy would achieve; the time needed to achieve that reduction; and the short-term risks that might be posed to the community, workers, and the environment during implementation of the remedy. Respondents shall give preference to a remedy that quickly reduces short-term risks, without creating significant additional risks.

VII.D.4.b.iv Implementability

The remedy shall be evaluated for its implementability or the difficulty of implementing the remedy. This factor includes consideration of installation and construction difficulties; operation and maintenance difficulties; difficulties with cleanup technology; permitting and approvals; and the availability of necessary equipment, services, expertise, and storage and disposal capacity. Respondents shall give preference to a remedy that can be implemented quickly and easily, and poses fewer and lesser difficulties.

VII.D.4.b.v Cost

The remedy shall be evaluated for its cost. This factor includes a consideration of both capital costs, and operation and maintenance costs. Capital costs shall include, without limitation, construction and installation costs; equipment costs; land development costs; and indirect costs including engineering costs, legal fees, permitting fees, startup and shakedown costs, and contingency allowances. Operation and maintenance costs shall include, without limitation, operating labor and materials costs; maintenance labor and materials costs; replacement costs; utilities; monitoring and reporting costs; administrative costs; indirect costs; and contingency allowances. All costs shall be calculated based on their net present value. Respondents shall give preference to a remedy that is less costly, but does not sacrifice protection of health and the environment.

VII.D.5 Approval of Corrective Measures Evaluation Report

Subject to the procedures in Section III.M of this Consent Order, if the Department disapproves the Corrective Measures Evaluation Report, the Department will notify the Respondents in writing of the Corrective Measures Evaluation Report's deficiencies and specify a due date for submission of a revised Corrective Measures Evaluation Report. Upon receipt of such notification of disapproval, the Respondents shall submit to the Department, within the specified time, a revised Corrective Measures Evaluation Report that corrects the deficiencies. If the Department approves the Corrective Measures Evaluation Report, the Department will notify the Respondents in writing.

VII.D.6 Relationship to Corrective Action Requirements

The Corrective Measures Evaluation shall serve as a Corrective Measures Study for the purposes of RCRA compliance. *See* 55 Fed. Reg. 30875-77 (July 27, 1990) (proposed 40 C.F.R. §§ 264.520-264.524).

VII.D.7 Statement of Basis

Upon approval of the Corrective Measures Evaluation Report, the Department will select a remedy or remedies for the SWMU or AOC. The Department may choose a different remedy from that recommended by the Respondents. The Department will issue a Statement of Basis for selection of the remedy, and will receive public comment on the remedy. The public comment period will extend for at least sixty (60) days from the date of the public notice of the Statement of Basis. The Department will provide an opportunity for a public hearing on the remedy, at which all interested persons will be given a reasonable chance to submit data, views or arguments orally or in writing and to examine witnesses testifying at the hearing. The comment period will automatically be extended to the close of the public hearing. The public hearing will follow the hearing requirements under section 20.4.1.901.F NMAC. The Department will select a final remedy and issue a response to public comments to all commenters within ninety (90) days, or other appropriate time, after the end of the public comment period. In selecting a remedy, the Department will follow the public participation requirements applicable to remedy selection under sections 20.4.1.900 NMAC incorporating 40 C.F.R. § 270.41 and 20.4.1.901 NMAC.

The administrative record for the Facility will be made available to the public for review at the Department's offices in the Santa Fe, New Mexico. All significant written and signed comments, including emailed comments, will be considered by the Department prior to approving a final remedy or remedies.

The Department's decision on the final remedy or remedies shall follow the requirements under section 20.4.1.901.G NMAC, Secretary's Decision. The Department will issue a response to public comments at the time of the Department's final decision.

VII.E CORRECTIVE MEASURES IMPLEMENTATION

VII.E.1 General

The Respondents shall implement the final remedy selected by the Department.

VII.E.2 Corrective Measures Implementation Plan

Within ninety (90) days after the Department's selection of a final remedy, or as otherwise specified by the schedule contained in the approved Corrective Measure Evaluation Report or as specified by a schedule required by the Department in the written approval notification, the Respondents shall submit to the Department for approval a Corrective Measures Implementation Plan outlining the design, construction, operation, maintenance, and performance monitoring for the selected remedy, and a schedule for its implementation. The implementation plan shall be submitted to the Department for review in accordance with the procedures in Section III.M of this Consent Order. The Corrective Measures Implementation Plan shall, at a minimum, include the following elements:

1. A description of the selected final remedy.

2. A description of the cleanup goals and remediation system objectives.

3. An identification and description of the qualifications of all persons, consultants, and contractors that will be implementing the remedy.

4. Detailed engineering design drawings and systems specifications for all elements of the remedy.

5. A construction work plan.

6. An operation and maintenance plan.

7. The results of any remedy pilot tests.

8. A plan for monitoring the performance of the remedy, including sampling and laboratory analysis of all affected media.

9. A waste management plan.

10. A proposed schedule for submission to the Department of periodic progress reports.

11. A proposed schedule for implementation of the remedy.

VII.E.3 Health and Safety Plan

The Respondents shall conduct all activities in accordance with a site-specific or Facility-wide Health and Safety Plan during all construction, operation, maintenance, and monitoring activities conducted during corrective measures implementation.

VII.E.4 Community Relations Plan

The Respondents shall involve the public in all corrective measures selections and implementations in accordance with the most recent version of the LANL ER Public Involvement Plan. The Respondents shall provide the Department with the most recent version of the LANL ER Public Involvement Plan within 90 days of the effective date of this Consent Order and any updates within 30 days after modification(s).

VII.E.5 Progress Reports

The Respondents shall submit to the Department progress reports in accordance with the schedule approved in the Corrective Measures Implementation Plan. The progress reports shall, at a minimum, include the following information:

1. A description of the remedy work completed during the reporting period.

2. A summary of problems, potential problems, or delays encountered during the reporting period.

3. A description of actions taken to eliminate or mitigate the problems, potential problems, or delays.

4. A discussion of the remedy work projected for the next reporting period, including all sampling events.

5. Copies of the results of all monitoring, including sampling and analysis, and other data generated during the reporting period.

6. Copies of all waste disposal records generated during the reporting period.

VII.E.6 Remedy Completion

VII.E.6.a Remedy Completion Report

Within ninety (90) days after completion of remedy, the Respondents shall submit to the Department a Remedy Completion Report. The report shall, at a minimum, include the following items:

1. A summary of the work completed.

2. A statement, signed by a registered professional engineer, that the remedy has been completed in accordance with the Department approved work plan for the remedy.

3. As-built drawings and specifications signed and stamped by a registered professional engineer.

4. Copies of the results of all monitoring, including sampling and analysis, and other data generated during the remedy implementation, if not already submitted in a progress report.

5. Copies of all waste disposal records, if not already submitted in a progress report.

6. A certification, signed by a responsible official of both DOE and the co-operator, stating: "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 assure 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 and imprisonment for knowing violations."

VII.E.6.b Certification of Completion

The Respondents may request a Certificate of Completion for any SWMU or AOC. With such request, Respondents shall submit an appropriate report (e.g., investigation report, corrective

measures implementation report or other report prepared under this Consent Order) documenting completion of all work required at the SWMU or AOC. Upon receipt of an appropriate report and request for a Certificate of Completion, the Department will determine whether the requirements of this Consent Order for corrective action for the SWMU or AOC have been satisfied. The Department may conduct an inspection of the SWMU or AOC or request additional information from the Respondents to make this determination. If the Department determines that the requirements have not been satisfied for the SWMU or AOC, it will notify the Respondents in writing of the actions that are necessary to correct the deficiencies. The Respondents shall implement such actions in accordance with the notification. If the Department determines that the requirements of this Consent Order have been satisfied for the SWMU or AOC, it will issue to the Respondents a written Certificate of Completion, which shall state that Corrective Action is Complete With Controls or that Corrective Action is Complete Without Controls.

If an AOC is designated as Corrective Action Complete With Controls, then the AOC shall be considered a SWMU and added to the Permit. See Section III.W of this Consent Order (Integration with Permit).

VII.F ACCELERATED CLEANUP PROCESS

If the Respondents identify a corrective action or measure that, if implemented voluntarily, will reduce risks to human health and the environment to levels acceptable to the Department, will reduce cost and/or will achieve cleanup of a SWMU or AOC ahead of schedule, the Respondents may implement the corrective action or measure as provided in this Section VII.F, in lieu of the process established in Sections VII.A through VII.D. The accelerated cleanup process shall be used at sites to implement presumptive remedies at small-scale and relatively simple sites where groundwater contamination is not a component of the accelerated cleanup, where the remedy is considered to be the final remedy for the site, and where the field work will be accomplished within 180 days of the commencement of field activities. The proposed accelerated cleanup will be documented in an Accelerated Corrective Action Work Plan or Accelerated Corrective Measure Work Plan, which shall include: (1) a description of the proposed remedial action, including details of the unit or activity that is subject to the requirements of this Consent Order; (2) an explanation of how the proposed cleanup action is consistent with the overall corrective action objectives and requirements of this Consent Order, (3) the methods and procedures for characterization and remediation sample collection and analyses, and (4) a schedule for implementation and reporting on the proposed cleanup action The Respondents shall notify the Department of the planned accelerated corrective action or measure a minimum of 15 days prior to the commencement of any accelerated field activity. The notification shall include the submittal of the Plan if not already submitted to the Department.

VII.F.1 Accelerated Corrective Measures Work Plan

The Respondents shall obtain approval of an Accelerated Corrective Measures Work Plan prior to implementation. The Respondents shall prepare the Work Plan in accordance with the requirements of Section XI.B of this Consent Order. The Work Plan shall be submitted to the Department for review in accordance with the procedures in Section III.M of this Consent Order.

If the Department disapproves the Accelerated Corrective Measures Work Plan, the Department will notify the Respondents in writing of the Plan's deficiencies and specify a due date for submission of a revised Accelerated Corrective Measures Work Plan. The Respondents shall include an implementation schedule in the revised Accelerated Corrective Measures Work Plan.

VII.F.2 Accelerated Corrective Measures Implementation

The Respondents shall implement the accelerated corrective measures in accordance with the approved Accelerated Corrective Measures Work Plan. Within 90 days of completion of the accelerated corrective measures, the Respondents shall submit to the Department for approval a Remedy Completion Report in a format approved by the Department in accordance with Section XI.A of this Consent Order. If upon review, the Department identifies any deficiencies in the Remedy Completion Report, the Department will notify the Respondents in writing.

VII.F.3 Accelerated Corrective Action Work Plan

The Respondents shall submit an Accelerated Corrective Action Work Plan a minimum of 30 days in advance of the commencement of field work. The Respondents shall prepare the Work Plan in accordance with the requirements of Section XI.B of this Consent Order. The Respondents may implement the Accelerated Corrective Action Work Plan, at their risk, without prior approval from the Department; however, if the Department disapproves the Accelerated Corrective Action Work Plan, the Department will notify the Respondents in writing of the Plan's deficiencies and specify a due date for submission of a revised Accelerated Corrective Action Work Plan. The Respondents shall include a remedy implementation and reporting schedule in the revised Accelerated Corrective Action Work Plan.

VII.F.4 Accelerated Corrective Action Implementation

If the Department has approved the Accelerated Corrective Action Work Plan, the Respondents shall implement the accelerated corrective action in accordance with the approved Plan. Within 90 days of completion of the accelerated corrective action, the Respondents shall prepare and submit to the Department for approval a Remedy Completion Report in a format approved by the Department in accordance with Section XI.A of this Consent Order. If the Department identifies any deficiencies in the Remedy Completion Report, the Department will notify the Respondents in writing.

VIII. CLEANUP AND SCREENING LEVELS

The Department and the WQCC have separately specified certain cleanup goals and methods of calculating cleanup levels. The Department has also specified certain reporting requirements for sites where corrective action is required in response to the release of Contaminants to the environment. The WQCC's and the Department's cleanup levels for protection of human health are based on excess lifetime cancer risk levels and hazard index levels that are consistent with the EPA's National Oil and Hazardous Substance Pollution Contingency Plan, 40 C.F.R. § 300.430(e)(2)(i)(A)(*2*). The EPA recommends a range of 10^{-4} to 10^{-6} lifetime excess cancer risk and a hazard index (HI) of one as acceptable. In general, the Department has selected a human health target risk level of 10^{-5} or an HI of one as cleanup goals for establishing site-specific cleanup levels for one or more Contaminants for which toxicological data are published. Unless otherwise specifically provided in this Consent Order, the Respondents shall follow the cleanup and screening levels described in this section (VIII) in implementing the corrective action requirements of this Consent Order. In addition, cleanup levels for the protection of the environment shall address ecological risk consistent with the Department's risk assessment guidance. In addition to the above-noted clean-up goals, the Department and the EPA have established certain soil screening levels and MCLs, and the WQCC has adopted groundwater and surface water standards that are described below.

The Department has neither established, nor adopted pursuant to applicable law, a cleanup level for perchlorate in soil, surface water, or groundwater. To the extent any future regulatory requirements (e.g., WQCC standards, MCLs or other standards that are applicable) are adopted by the Environmental Improvement Board (EIB), WQCC, or EPA for perchlorate, Respondents shall comply with those requirements. The Parties have agreed to a screening level for monitoring perchlorate in groundwater. Section VIII.A.1.a identifies that screening level and describes the procedures Respondents shall follow if Respondents obtain detections above that level.

VIII.A GROUNDWATER

Groundwater cleanup levels for human health should typically be developed using existing standards (e.g., drinking water standards) when they are available and when using them is protective of current and reasonably expected exposures. The parties shall refer to EPA guidance, *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action* (Sept. 2002 and as it may be amended), in developing and applying groundwater cleanup levels. As provided in that guidance, States may take a more stringent approach than what EPA would otherwise use for making groundwater use and cleanup decisions.

VIII.A.1 Groundwater Cleanup Levels

The WQCC groundwater standards, including alternative abatement standards (20.6.2.4103 NMAC), and the drinking water maximum contaminant levels (MCLs) adopted by EPA under the federal Safe Drinking Water Act (42 U.S.C. §§ 300f to 300j-26) or the EIB (20.7.10 NMAC)

are cleanup levels for groundwater. If both a WQCC standard and an MCL have been established for an individual substance, then the lower of the two levels will be considered the cleanup level for that substance.

The Department uses the most recent version of the EPA Region VI Human Health Medium-Specific Screening Level (HHMSSL) for tap water as the screening level if either a WQCC standard or an MCL has not been established for a specific substance. If no WQCC groundwater standard or MCL has been established for a Contaminant for which toxicological information is published, the Respondents shall use a target excess cancer risk level of 10^{-5} and/or HI of one (1.0) as the basis for proposing a cleanup level for the Contaminant. If the naturally occurring (background) concentration of a Contaminant exceeds the standard then the cleanup goal defaults to the background concentration for that specific Contaminant.

VIII.A.1.a Groundwater Perchlorate Screening Levels

There currently is no WQCC groundwater standard or MCL for perchlorate; however, Respondents shall determine the nature and extent of the perchlorate contamination at the Facility and, if necessary, down gradient of the Facility. If either the WQCC adopts a groundwater standard for perchlorate, or EPA or the EIB adopts an MCL for perchlorate, such standard shall be followed in accordance with Section VIII.A.1.

If perchlorate is detected, Respondents shall evaluate the nature and extent of the perchlorate contamination in accordance with the appropriate schedule established by the Department under this Consent Order. If perchlorate is detected at concentrations at or greater than 4 µg/L and no groundwater standard or MCL has been adopted by the EIB, WQCC or EPA for perchlorate, then the Respondents shall use the cleanup goal of a HI of one (1.0) to develop the proposed cleanup level for use in their site investigation or corrective measure evaluation.

VIII.B SOIL

VIII.B.1 Soil Cleanup Levels

The Department has specified soil-screening levels that are based on a target total excess cancer risk of 10^{-5} and for noncarcinogenic Contaminants a target HI of one (1.0) for residential and industrial land use. The target residential and industrial soil screening levels for selected substances are listed in the Department's *Technical Background Document for Development of Soil Screening Levels* (as updated). The Department uses the most recent version of the EPA Region VI Human Health Medium Specific Screening Level (HHMSSL) for residential and industrial soil as the target screening level for compounds designated as "n" (noncarcinogen effects), "max" (maximum concentration), and "sat" (soil saturation concentration), or ten times the EPA Region VI HHMSSL for compounds designated "c" (carcinogen effects), if a Department soil screening level has not been established for a Contaminant for which toxicological information is published. The Respondents shall use the most recent version of this document for determining soil screening levels.

The Respondents shall use soil screening levels pursuant to the previous paragraph as cleanup levels for purposes of this Consent Order unless one of the following two circumstances applies: 1) cleanup to the specified levels is determined to be impracticable in accordance with Section VIII.E; or 2) the current and reasonably foreseeable future land use is one for which NMED has not established soil screening levels. If either of the foregoing circumstances applies, then the Respondents may propose cleanup levels to the Department based on a risk assessment and a target excess cancer risk level of 10^{-5} or for noncarcinogenic Contaminants an HI of one (1.0), for current and reasonably foreseeable future land use (e.g., residential, recreational, or industrial). The proposed cleanup level will be subject to the Department's review and approval.

VIII.B.1.a Soil Polychlorinated Biphenyls Cleanup Levels

PCBs are hazardous constituents (20.4.1.200 NMAC incorporating 40 C.F.R. § 261, Appendix VIII). Soil cleanup levels for PCBs are discussed in the Department's Position Paper *Risk-based Remediation of Polychlorinated Biphenyls at RCRA Corrective Action Sites* (March 2000). The soil cleanup level for PCBs is either a default concentration of 1 milligram per kilogram (mg/kg) or a risk-based PCB concentration level established through performing a health risk assessment in accordance with the Department's Position Paper referenced above.

VIII.B.1.b Soil Perchlorate Cleanup Levels

The Department has not yet established a soil cleanup level for perchlorate. The Respondents shall investigate for the presence of perchlorate in soil and shall address perchlorate in the same manner as other Contaminants in soil with respect to investigation and evaluation of potential corrective action.

VIII.C SURFACE WATER

VIII.C.1 Surface Water Cleanup Levels

The Respondents shall comply with the surface water quality standards outlined in the Clean Water Act (33 U.S.C. §§ 1251 to 1387), the New Mexico WQCC Regulations (20.6.2 NMAC), the State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC) and the procedures for alternative abatement standards (20.6.2.4103 NMAC).

VIII.D ECOLOGICAL RISK EVALUATION

Screening for ecological risk shall be conducted using the LANL Ecological Screening Levels (ESLs) which are included in LANL's *"Screening Level Ecological Risk Assessment Methods"*, (LA-UR-99-1405). In the absence of ESLs, the Respondents may use U.S. EPA's ECO-SSLs with Department approval. If the LANL ESLs database does not contain a screening value for the receptor or Contaminant, the Respondents shall derive a screening level using the methodology in the Department's *"Guidance for Assessing Ecological Risks Posed by Chemicals: Screening –Level Ecological Risk Assessment"* or in LANL's *"Screening Level Ecological Risk Assessment Methods"*, (LA-UR-99-1405). Ecological risk at each site shall be evaluated in a manner consistent with the Department's *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment* (March 2000).

VIII.E REQUESTS FOR VARIANCE FROM CLEANUP GOAL OR CLEANUP LEVEL

Respondents may seek to vary from a particular cleanup goal or cleanup level. The nature of that request will differ depending on whether a WQCC standard is involved. If a WQCC standard is involved, Respondents may seek an alternative abatement standard in accordance with the process specified in the WQCC Regulations, 20.6.2.4103.E and F NMAC. Those regulations require Respondents to make a request to the WQCC. The WQCC will then determine whether an alternative abatement standard is appropriate, and if it is, will establish such standard consistent with the WQCC regulations.

For all other instances in which Respondents seek to vary from a cleanup goal or level identified above, Respondents shall submit a demonstration to the Department that achievement of the cleanup goal or level is impracticable. In making such demonstration, Respondents may consider such things as technical or physical impracticability of the project, the effectiveness of proposed solutions, the cost of the project, hazards to workers or to the public, and any other basis that may support a finding of impracticability at a particular SWMU, AOC, or aggregate. Respondents may also refer to all applicable guidance concerning impracticability, including, for example, the criteria set forth in EPA's Interim Final Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration (September 1993) and EPA's Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action (September 2002 as updated). In addition to demonstrating the basis for their impracticability request, Respondents' written submission shall propose the action to be taken by Respondents if the Department approves the impracticability demonstration. Such action shall include, but is not limited to, completion of a site-specific risk assessment and identification of alternate clean-up goals or levels.

The Department will review the Respondents' written submission concerning impracticability and determine whether the demonstration is approvable. The Department may consider such things as technical or physical feasibility of the project, the effectiveness of proposed solutions, the cost of the project, hazards to workers or to the public, and any other basis that may support or refute a finding of impracticability at a particular SWMU, AOC, or aggregate.

If the Department approves Respondents' impracticability demonstration, it will notify the Respondents in writing, and such notice will describe the specific action to be taken by Respondents.

IX. INVESTIGATION AND SAMPLING METHODS AND PROCEDURES

The Respondents shall submit to the Department, for review and written approval, site-specific work plans for each site prior to the commencement of field activities where environmental investigation, corrective action, sampling or monitoring is being conducted or proposed. The site-specific work plans shall include the methods to be used to conduct all activities at each site or unit and shall be prepared in accordance with the format described in Section XI of this Consent Order. The Respondents shall provide notification to the Department of corrective action field activities a minimum of 15 days prior to commencing the activity.

The methods used to conduct investigation, remediation, and monitoring activities shall be sufficient to fulfill the requirements of this Consent Order and provide accurate data for the evaluation of site conditions, the nature and extent of contamination and contaminant migration, and for remedy selection and implementation, where necessary. The methods presented in Section IX.B of this Consent Order are minimum requirements for environmental investigation and sampling, and are not intended to include all methods that may be necessary to fulfill the requirements of this Consent Order. The methods for conducting investigations, corrective actions, and monitoring at the Facility must be determined based on the conditions and contaminants that exist at each site or unit.

IX.A STANDARD OPERATING PROCEDURES

The Respondents shall provide a brief description of investigation, sampling or analytical methods and procedures in documents submitted to the Department that includes sufficient detail to evaluate the quality of the acquired data. The Respondents may reference relevant Standard Operating Procedures as presented on the LANL website. The reference should include the appropriate Internet address.

IX.B INVESTIGATION, SAMPLING, AND ANALYSIS METHODS

IX.B.1 Introduction and Purpose

This section (IX.B) is of the Consent Order provides minimum requirements for field investigations, sample collection, handling and screening procedures, field and laboratory sample analysis, and quality assurance procedures for samples of the medium being investigated or tested at the Facility.

The purpose of this Section (IX.B) is to: 1) provide minimum requirements for drilling and sample collection in exploratory borings and other excavations; 2) provide minimum requirements for sampling of the target media; 3) provide minimum requirements for monitoring of groundwater and vadose zone conditions; and 4) identify minimum required screening, analytical, and quality assurance procedures that shall be implemented during field sampling activities and laboratory analyses.

The quality assurance procedures referenced in the previous paragraph include: 1) the Facility investigation data quality objectives; 2) the requirements for QA/QC to be followed during field investigations and by the analytical laboratories; and 3) the methodology for the review and evaluation of the field and laboratory QA/QC results and documentation.

IX.B.2 Field Exploration Activities

Exploratory borings shall be advanced at locations specified in this Consent Order or as approved by the Department in site-specific work plans. The Department may require additional exploratory borings to fulfill the requirements of this Consent Order. Any additional boring locations, if required, will be determined or approved by the Department. The depths and locations of all exploratory and monitoring well borings shall be specified in the canyon- or site-specific work plans submitted to the Department for approval prior to the start of the respective field activities. The Department must approve proposed unit aggregates grouped for the purpose of site investigation, remediation, and/or monitoring activities.

IX.B.2.a Subsurface Features/Utility Geophysical Surveys

The Respondents shall conduct surveys to locate underground utilities, pipelines structures, drums, debris, and other buried features, including buried waste, in the shallow subsurface prior to the start of field exploration activities. The methods used to conduct the surveys, such as magnetometer, ground penetrating radar, resistivity, or other methods, shall be selected based on the characteristics of the site and the possible or suspected underground structures. The results of the surveys shall be included in the investigation reports submitted to the Department.

IX.B.2.b Drilling and Soil, Rock, and Sediment Sampling

IX.B.2.b.i Drilling

Exploratory and monitoring well borings shall be drilled using the most effective, proven, and practicable method for recovery of undisturbed samples and potential contaminants. The Department shall approve the drilling methods selected for advancement of each boring prior to the start of field activities. Based on the drilling conditions, the borings shall be advanced using one of the following methods:

- Hollow-stem auger
- Air rotary
- Mud rotary
- Percussion hammer
- Sonic
- Dual wall air rotary
- Direct Push Technology (DPT)
- Cryogenic

- Cable tool

Hollow-stem auger or DPT drilling methods are preferred if vapor-phase or VOC contamination is known or suspected to be present. Air rotary drilling is preferred for borings intersecting the regional aquifer. The type of drilling fluid used, if necessary, shall be approved by the Department prior to the start of drilling activities or prior to use at any unit or unit aggregate.

All drilling equipment shall be in good working condition and capable of performing the assigned task. Drilling rigs and equipment shall be operated by properly trained, experienced, and responsible crews. The Respondents are responsible for ensuring that contaminants from another site or facility are not introduced into the site under investigation due to malfunctioning equipment or poor site maintenance. The drilling equipment shall be properly decontaminated before drilling each boring.

Exploratory borings shall be advanced to unit- and location-specific depths specified or approved by the Department. The Respondents shall propose drilling depths in the site-specific work plans submitted for each subject area. Unless otherwise specified in this Consent Order, the borings shall be advanced to the following minimum depths:

1. In all borings, 25 ft below the deepest detected contamination based on field screening, laboratory analyses, and/or previous investigations at the site.
2. Twenty ft below the base of disposal units if contamination is not detected.
3. Five ft below the base of shallow structures such as piping or building sumps, or other building structures.
4. Five ft below the contact between canyon alluvium and bedrock.
5. One hundred ft below the deepest known intermediate perched groundwater zone.
6. One hundred ft below the top of the regional aquifer.
7. Depths specified by the Department based on regional or unit specific data needs.

The Respondents shall notify the Department as early as practicable if conditions arise or are encountered that do not allow the advancement of borings to the depths specified by the Department or proposed in an approved work plan so that alternative actions may be discussed. Precautions shall be taken to prevent the migration of contaminants between geologic, hydrologic, or other identifiable zones during drilling and well installation activities. Contaminant zones shall be isolated from other zones encountered in the borings.

The drilling and sampling shall be accomplished under the direction of a qualified engineer or geologist who shall maintain a detailed log of the materials and conditions encountered in each boring. Both sample information and visual observations of the cuttings and core samples shall be recorded on the boring log. Known site features and/or site survey grid markers shall be used as references to locate each boring prior to surveying the location as described in Section IX.B.2.f of this Consent Order. The boring locations shall be measured to the nearest foot, and locations shall be recorded on a scaled site map upon completion of each boring.

Trenching and other exploratory excavation methods shall follow the applicable general procedures outlined in this Consent Order. The particular methods proposed for use by the Respondents for exploratory excavation and sampling at any specific unit shall be included in the site-specific investigation work plan submitted to the Department. The Department will include any changes or additional requirements for conducting exploratory excavation and sampling activities at the subject unit in its response to the Respondents after review of the investigation work plan.

IX.B.2.b.ii Soil and Rock Sampling

Relatively undisturbed discrete soil and rock samples shall be obtained, where possible, during the advancement of each boring for the purpose of logging, field screening, and analytical testing. Generally, the samples shall be collected at the following intervals and depths:

1. At five-ft intervals, ten-ft intervals, continuously, or as approved by the Department.
2. At the depth immediately below the base of the disposal unit or facility structure.
3. At the maximum depth of each boring.
4. At the depths of contacts or first encounter, observed during drilling, with geologic units of different lithology, structural or textural characteristics, or of relatively higher or lower permeability.
5. Of soil or rock types relatively more likely to sorb or retain contaminants than surrounding lithology.
6. At the depth of the first encounter, during drilling, with shallow or intermediate saturated zones.
7. At intervals suspected of being source or contaminated zones.
8. At the top of the regional aquifer.
9. At other intervals approved or required by the Department.

The sampling interval for the borings may be modified, or samples may be obtained from a specific depth, based on field observations. A decontaminated split-barrel sampler lined with brass sleeves, a coring device, or other method approved by the Department shall be used to obtain samples during the drilling of each boring.

A split barrel sampler lined with brass sleeves or a coring device is the preferred sampling method for borehole soil, rock, and sediment sampling. The following procedures should be followed if a split barrel sampler is used. Upon recovery of the sample, one or more brass sleeves shall be removed from the split barrel sampler and the open ends of the sleeves covered with Teflon tape or foil and sealed with plastic caps fastened to the sleeves with tape for shipment to the analytical laboratory. If brass sleeves are not used, a portion of the sample shall be placed in pre-cleaned, laboratory-prepared sample containers for laboratory chemical analysis. The remaining portions of the sample shall be used for logging and field screening, as described in Sections IX.B.2.c and IX.B.2.d of this Consent Order, respectively.

Discrete samples shall be collected for field screening and laboratory analyses. Homogenization of discrete samples collected for analyses other than for VOC and SVOC analyses shall be performed by the analytical laboratory, if necessary. The Respondents may submit site-specific, alternative methods for homogenization of samples in the field to the Department for review and written approval.

Samples to be submitted for laboratory analyses shall be selected based on: 1) the results of the field screening or mobile laboratory analyses; 2) the position of the sample relative to groundwater, suspected releases, or site structures; 3) the sample location relative to former or altered site features or structures; 4) the stratigraphy encountered in the boring; and 5) the specific objectives and requirements of this Consent Order. The proposed number of samples and analytical parameters shall be included as part of the site-specific work plan submitted to the Department for approval prior to the start of field investigation activities at each unit. The work plans shall allow for flexibility in modifying the project-specific tasks based on information obtained during the course of the investigation. Modifications to site-specific work plan tasks must be pre-approved in writing by the Department.

IX.B.2.b.iii Sediment Sampling

Sediment samples shall be collected in the same manner as described in Section IX.B.2.b.ii for soil and rock sampling where borings are drilled to explore alluvial subsurface conditions. The sampling device shall be a decontaminated, hand-held stainless steel coring device, shelby tube, thin-wall sampler, or other device approved by the Department where sediment sampling is conducted without the use of the drilling methods described in Section IX.B.2.b.i of this Consent Order. The samples shall be transferred to pre-cleaned laboratory prepared containers for submittal to the laboratory. Samples obtained for volatiles analysis shall be collected using shelby tubes, thin-wall samplers, or other device approved by the Department. The ends of the samplers shall be lined with Teflon tape or aluminum foil and sealed with plastic caps fastened to the sleeves with tape for shipment to the analytical laboratory.

The physical characteristics of the sediment (such as mineralogy, ASTM soil classification, AGI [American Geological Institute] rock classification, moisture content, texture, color, presence of stains or odors, and/or field screening results), depth where each sample was obtained, method of sample collection, and other observations shall be recorded in the field log.

IX.B.2.b.iv Drill Cuttings (Investigation Derived Waste)

Drill cuttings, excess sample material and decontamination fluids, and all other investigation derived waste (IDW) shall be contained and characterized using methods based on the boring location, boring depth, drilling method, and type of contaminants suspected or encountered. Proposed IDW management shall be included with the unit-specific investigation work plan submitted to the Department for approval prior to the start of field investigations. The Department shall approve the method of containment for drill cuttings prior to the start of drilling activities. Borings not completed as groundwater or vapor monitoring wells shall be properly abandoned in accordance with the methods listed in Section X.D of this Consent Order. Borings completed as

groundwater monitoring wells shall be constructed in accordance with the requirements described in Section X.C of this Consent Order.

IX.B.2.c Logging of Soil/Rock and Sediment Samples

Samples obtained from all exploratory borings and excavations shall be visually inspected and the soil or rock type classified in general accordance with ASTM D2487 (Unified Soil Classification System) and D2488, or AGI Methods for soil and rock classification. Detailed logs of each boring shall be completed in the field by a qualified engineer or geologist. Additional information, such as the presence of water-bearing zones and any unusual or noticeable conditions encountered during drilling shall be recorded on the logs. Field boring logs, test pit logs, and field well construction diagrams shall be converted to the format acceptable for use in final reports submitted to the Department. If requested, draft boring logs, test pit logs, and well construction diagrams shall be submitted to the Department for review within thirty (30) days after the completion of each boring or monitoring well.

IX.B.2.d Soil, Rock, and Sediment Sample Field Screening

Samples obtained from borings shall be screened in the field for evidence of the potential presence of contaminants. Field screening results shall be recorded on the exploratory boring and excavation logs. Field screening results are used as a general guideline to determine the nature and extent of possible contamination. In addition, screening results shall be used to aid in the selection of soil, rock, sediment, and vapor-phase samples for laboratory analysis. The Department recognizes that field screening alone will not detect the possible presence or full nature and extent of all contaminants that may be encountered at the site.

The primary screening methods to be used shall include: 1) visual examination; 2) headspace vapor screening for VOCs; and 3) metals screening using X-ray fluorescence (XRF). Additional screening for site- or release-specific characteristics such as pH, HE, or for other specific compounds using field test kits shall be conducted where appropriate.

Headspace vapor screening shall target VOCs and shall be conducted by placing a soil or rock sample in a plastic sample bag or a foil-sealed container allowing space for ambient air. The container shall be sealed and then shaken gently to expose the soil or rock to the air trapped in the container. The sealed container shall be allowed to rest for a minimum of five minutes while vapors equilibrate. Vapors present within the sample bag headspace will then be measured by inserting the probe of the instrument in a small opening in the bag or through the foil. The maximum value and the ambient air temperature shall be recorded on the field boring or test pit log for each sample. The monitoring instruments shall be calibrated each day to the manufacturers standard for instrument operation. A photo-ionization detector (PID) equipped with a 10.6 or higher electron volt (eV) lamp, combustible gas indicator, or other instrument approved by the Department shall be used for VOC field screening. The limitations, precision, and calibration procedures of the instrument to be used for VOC field screening shall be included in the site-specific investigation work plan prepared for each unit.

XRF may be used to screen soil, rock, or sediment samples for the presence of metals. XRF screening requires proper sample preparation and proper instrument calibration. Sample preparation and instrument calibration procedures shall be documented in the field logs. The methods and procedures for sample preparation and instrument calibration shall be approved by the Department prior to the start of field activities. Field XRF screening results for selected metals may be used in lieu of laboratory analyses upon written approval by the Department; however, the results shall, at a minimum, be confirmed by laboratory analyses at a frequency of 20 percent (one sample per every five analyzed by XRF analysis).

Field screening results are site- and boring-specific and the results vary with instrument type, media screened, weather conditions, moisture content, soil or rock type, and type of contaminant. The Respondents shall record on the field logs all conditions capable of influencing the results of field screening. The Respondents shall submit to the Department conditions potentially influencing field screening results as part of the site-specific investigation, remediation, or monitoring reports.

At a minimum, the Respondents shall submit the samples with the greatest apparent degree of contamination, based on field observations and field screening, for laboratory analysis. The Respondents shall also use the location of the sample relative to groundwater, stratigraphic units or contacts, and the proximity to significant site or subsurface features or structures as a guideline for sample selection. In addition, the Respondents shall submit the samples with no or little apparent contamination, based on field screening, for laboratory analysis if the intention is to confirm that the base (or other depth interval) of a boring or other sample location is not contaminated.

IX.B.2.e Soil, Rock, and Sediment Sample Types

The Respondents shall collect soil, rock, and sediment samples at the frequencies outlined in the site-specific investigation, corrective action, or monitoring work plans for each SWMU, AOC, or other site submitted by the Respondents for review and written approval by the Department. The samples collected shall be representative of the media and site conditions being investigated or monitored. The Respondents shall collect QA/QC samples to monitor the validity of the soil, rock, and sediment sample collection procedures. Field duplicates will be collected at a rate of ten percent. The Respondents shall collect equipment blanks from all sampling apparatus at a frequency of ten percent for chemical analysis. Equipment blanks shall be collected at a frequency of one per day if disposable sampling equipment is used. The Respondents shall collect field blanks at a frequency of one per day for each medium (with the exception of air samples) at each SWMU, AOC, or other site. Reagent blanks shall be used if chemical analytical procedures requiring reagents are employed in the field as part of the investigation or monitoring program. The resulting data will provide information on the variability associated with sample collection, handling, and laboratory analysis operations. The blanks and duplicates shall be submitted for laboratory analyses associated with the project-specific contaminants, data quality concerns, and media being sampled.

IX.B.2.f Sample Point and Structure Location Surveying

The horizontal and vertical coordinates of the top of each monitoring well casing and the ground surface at each monitoring well location shall be determined by a registered New Mexico professional land surveyor in accordance with the State Plane Coordinate System (NMSA 1978 47-1-49-56 (Repl. Pamp. 1993)). The surveys shall be conducted in accordance with Sections 500.1 through 500.12 of the Regulations and Rules of the Board of Registration for Professional Engineers and Surveyors Minimum Standards for Surveying in New Mexico. Horizontal positions shall be measured to the nearest 0.1-ft, and vertical elevations shall be measured to the nearest 0.01-ft. The Respondents shall prepare site map(s), certified by a registered New Mexico professional land surveyor, presenting all surveyed locations and elevations including relevant site features and structures for submittal with all associated reports to the Department.

Site attributes (e.g., soil sample locations, sediment sample locations, springs, outfalls, pertinent structures, monitoring stations, as well as staked out sampling grids), shall be located by using the global positioning system (GPS), the electronic total station with prism reflectors, or a combination of both surveying systems, or by using a registered New Mexico Registered Land Surveyor using the methods described in the paragraph above. Horizontal locations shall be measured to the nearest 0.5 ft. Respondents shall provide the Department a statement of accuracy for survey data upon request.

IX.B.2.g Subsurface Vapor-phase Monitoring and Sampling

Samples of subsurface vapors shall be collected from vapor monitoring points from both discrete zones, selected based on investigation and field screening results, and as total well subsurface vapor samples where required by the Department.

The Respondents shall, at a minimum, collect vapor samples for field measurement of the following:

- Percent oxygen;
- Organic vapors (using a photo-ionization detector with an 11.7 eV (electron volt) lamp, a combustible vapor indicator or other method approved by the Department);
- Percent carbon dioxide;
- Static subsurface pressure; and
- Other parameters (such as carbon monoxide and hydrogen sulfide) as required by the Department.

The Respondents also shall collect vapor samples for laboratory analysis of the following as required:

- Percent moisture;
- VOCs; and
- Other analytes required by the Department.

Vapor samples analyzed by the laboratory for percent moisture and VOCs shall be collected using SUMMA canisters or other sample collection method approved by the Department. The samples shall be analyzed for VOC concentrations by EPA Method TO-15, as it may be updated, or equivalent VOC analytical method.

Field vapor measurements, the date and time of each measurement, and the instrument used shall be recorded on a vapor monitoring data sheet. The instruments used for field measurements shall be calibrated daily in accordance with the manufacturers specifications and as described in Section IX.B.4. The methods used to obtain vapor-phase field measurements and samples shall be approved by the Department in writing prior to the start of air monitoring at each Facility site where vapor-phase monitoring is conducted.

IX.B.2.h Groundwater Monitoring

IX.B.2.h.i Groundwater Levels

Groundwater level measurements shall be obtained at intervals required by the Department. Groundwater levels also shall be obtained prior to purging in preparation for a sampling event. Measurement data and the date and time of each measurement shall be recorded on a site monitoring data sheet. The depth to groundwater shall be measured to the nearest 0.01 ft. The depth to groundwater shall be recorded relative to the surveyed well casing rim or other surveyed datum.

Groundwater levels shall be measured in all wells in a given watershed or at the subject site (or the number of wells otherwise specified in a Department approved groundwater monitoring work plan) within 24 hours. Facility-wide regional aquifer and intermediate perched zone groundwater level measurements shall be obtained at all well locations (or the number of wells otherwise specified in a Department approved groundwater monitoring work plan) within 14 days of the commencement of the specified measuring event. The Respondents shall conduct periodic measuring events, the schedule for which shall be provided in the groundwater monitoring work plans. In addition, groundwater levels shall be measured in alluvial wells in conjunction with the collection of surface water measurements in each watershed.

IX.B.2.h.ii Surface Water Measurements

Stream flow rates within each watershed shall be measured in conjunction with sampling events.

IX.B.2.i Groundwater Sampling

Groundwater samples shall initially be obtained from newly installed alluvial monitoring wells between ten (10) and thirty (30) days after completion of well development. Groundwater samples shall initially be obtained from newly installed intermediate zone and regional aquifer monitoring wells between ten (10) and sixty (60) days after completion of well development. Groundwater monitoring and sampling shall be conducted at an interval approved by the Department after the initial sampling event. All monitoring wells within a watershed or at each specific site or sites or the number of wells otherwise specified in a Department approved groundwater monitoring work plan shall be sampled within twenty one (21) days of the start of the groundwater sampling event.

The Respondents shall sample all saturated zones screened to allow entry of groundwater into each monitoring well during each sampling event (or as otherwise specified in a Department approved groundwater monitoring work plan). All requests for variances from the groundwater sampling schedule shall be submitted to the Department, in writing, thirty (30) days prior to the start of scheduled monitoring and sampling events. Groundwater samples shall be collected from all saturated zones, where possible, within exploratory borings not intended to be completed as monitoring wells prior to abandonment of the borings.

Water samples shall be analyzed in accordance with approved work plans for one or more of the following general chemistry parameters as required by the Department:

nitrate/nitrite	sulfate	chloride	sodium
dissolved CO_2	alkalinity	carbonate/bicarbonate	boron
fluoride	manganese	calcium	silicon
ferric/ferrous iron	ammonia	potassium	phosphorus/phosphate
strontium	lithium	magnesium	molybdenum
TKN	total organic carbon	suspended sediment concentration*	
total dissolved solids	bromide	stable isotopes (as required by the Department)	
* ASTM Method D3977-97 standard test for determining sediment concentration in water samples.			

IX.B.2.i.i

IX.B.2.i.ii Well Purging

All zones in each monitoring well shall be purged by removing groundwater prior to sampling and in order to ensure that formation water is being sampled. Purge volumes shall be determined by monitoring, at a minimum, groundwater pH, specific conductance, dissolved oxygen concentrations, turbidity, redox potential, and temperature during purging of volumes and at measurement intervals approved by the Department in writing. The groundwater quality parameters shall be measured using a flow-through cell and instruments approved by the Department in writing. The volume of groundwater purged, the instruments used, and the readings obtained at each interval shall be recorded on the field monitoring log. Water samples may be obtained from the well after the measured parameters of the purge water have stabilized to within ten percent for three consecutive measurements. Well purging may also be conducted in accordance with the Department's Position Paper "Use of Low-Flow and other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring" (October 30, 2001). The Respondents may submit, to the Department for approval, a written request for a variance from the described methods of well purging for individual wells no later than ninety (90) days prior to

scheduled sampling activities. The Department will respond to the request, in writing, within sixty (60) days of receipt of the variance request.

IX.B.2.i.iii Groundwater Sample Collection

Groundwater samples shall be obtained from each well after a sufficient amount of water has been removed from the well casing to ensure that the sample is representative of formation water. Groundwater samples shall be obtained using methods approved by the Department within eight hours of the completion of well purging. Sample collection methods shall be documented in the field monitoring reports. The samples shall be transferred to the appropriate, clean, laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody procedures are described in Section IX.B.2.j of this Consent Order. Decontamination procedures shall be established for reusable water sampling equipment as described in Section IX.B.3 of this Consent Order.

All purged groundwater and decontamination water shall be temporarily stored at satellite accumulation areas or transfer stations in labeled 55-gallon drums, less-than-90-day storage areas or other containers approved by the Department until proper characterization and disposal can be arranged. The methods for disposal of purge/decontamination water shall be approved by the Department prior to removal from the temporary storage area. Disposable materials shall be handled as described in Section IX.B.5 of this Consent Order.

Groundwater samples intended for metals analysis shall be submitted to the laboratory as total metals samples. If required by the Department, the Respondents shall obtain groundwater samples for dissolved metals analysis to be filtered using disposable in-line filters with a 0.45 micron or other mesh size approved by the Department.

IX.B.2.i.iv Surface Water Sample Collection

Surface water samples shall be collected using methods approved by the Department. Samples shall be collected in clean laboratory-prepared sampling containers. The methods and instruments used to measure field parameters shall be approved by the Department prior to conducting surface water sampling. The sampling and monitoring techniques used and the measurements obtained shall be recorded in the field monitoring reports.

IX.B.2.i.v Groundwater and Surface Water Sample Types

Groundwater samples shall be collected from each monitoring well and surface water samples shall be collected at predetermined locations. Field duplicates, field blanks, equipment rinseate blanks, reagent blanks, if necessary, and trip blanks shall be obtained for quality assurance during groundwater and surface water sampling activities. The samples shall be handled as described in Section IX.B.2.j of this Consent Order.

Field duplicate surface water and groundwater samples shall be obtained at a frequency of ten percent. At a minimum, one duplicate sample per sampling event shall always be obtained.

Field blanks shall be obtained at a frequency of no less than one per day per site or unit. Field blanks shall be generated by filling sample containers in the field with deionized water and submitting the samples, along with the groundwater or surface water samples, to the analytical laboratory for the appropriate analyses.

Equipment rinsate blanks shall be obtained for chemical analysis at the rate of five percent but no fewer than one rinseate blank per sampling day. Equipment rinsate blanks shall be collected at a rate of one per sampling day if disposable sampling apparatus is used. Rinsate samples shall be generated by rinsing deionized water through unused or decontaminated sampling equipment. The rinsate sample then shall be placed in the appropriate sample container and submitted with the groundwater or surface water samples to the analytical laboratory for the appropriate analyses.

Reagent blanks shall be obtained at a frequency of ten percent but no fewer than one per day per unit if chemical analyses requiring the use of chemical reagents are conducted in the field during water sampling activities.

Trip blanks shall accompany laboratory sample bottles and shipping and storage containers intended for VOC analyses. Trip blanks shall consist of a sample of analyte-free deionized water prepared by the laboratory and placed in an appropriate sample container. The trip blank shall be prepared by the analytical laboratory prior to the sampling event and shall be kept with the shipping containers and placed with other water samples obtained from the site each day. Trip blanks shall be analyzed at a frequency of one for each shipping container of samples.

IX.B.2.j Sample Handling

At a minimum, the following procedures shall be used at all times when collecting samples during investigation, corrective action, and monitoring activities:

1. Neoprene, nitrile, or other protective gloves shall be worn when collecting samples. New disposable gloves shall be used to collect each sample.

2. All samples collected of each medium for chemical analysis shall be transferred into clean sample containers supplied by the project analytical laboratory with the exception of soil, rock, and sediment samples obtained in brass sleeves or in Encore™ samplers. Upon recovery of the sample collected using split barrel samplers with brass sleeves, the brass sleeves shall be removed from the split barrel sampler and the open ends of the sleeves shall be lined with Teflon tape or foil and sealed with plastic caps. The caps shall be fastened to the sleeve with tape for storage and shipment to the analytical laboratory. The sample depth and the top of the sample shall be clearly marked. Sample container volumes and preservation methods shall be in accordance with EPA SW-846 and established industry practices for use by accredited analytical laboratories. Sufficient sample volume shall be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis.

3. Sample labels and documentation shall be completed for each sample following procedures included in the site-specific work plans approved by the Department. Immediately after the samples are collected, they shall be stored in a cooler with ice or

other appropriate storage method until they are delivered to the analytical laboratory. Standard chain-of-custody procedures, as described in Section IX.B.6.b of this Consent Order, shall be followed for all samples collected. All samples shall be submitted to the laboratory soon enough to allow the laboratory to conduct the analyses within the method holding times. At a minimum, all samples shall be submitted to the laboratory within 48 hours after their collection.

Shipment procedures shall include the following:

1. Individual sample containers shall be packed to prevent breakage and transported in a sealed cooler with ice or other suitable coolant or other EPA or industry-wide accepted method. The drainage hole at the bottom of the cooler shall be sealed and secured in case of sample container leakage. Temperature blanks shall be included with each shipping container.
2. Each cooler or other container shall be delivered directly to the analytical laboratory.
3. Glass bottles shall be separated in the shipping container by cushioning material to prevent breakage.
4. Plastic containers shall be protected from possible puncture during shipping using cushioning material.
5. The chain-of-custody form and sample request form shall be shipped inside the sealed storage container to be delivered to the laboratory.
6. Chain-of-custody seals shall be used to seal the sample-shipping container in conformance with EPA protocol.
7. Signed and dated chain-of-custody seals shall be applied to each cooler prior to transport of samples from the site.

IX.B.2.k In-situ Testing

In-situ permeability tests, remediation system pilot tests, stream flow tests, and other tests conducted to evaluate site and subsurface conditions shall be designed to accommodate specific site conditions and to achieve the test objectives. The testing methods shall be approved, in writing, by the Department prior to implementation. The tests shall be conducted in order to appropriately represent site conditions and in accordance with USGS, ASTM or other methods generally accepted by the industry. Detailed logs of all relevant site conditions and measurements shall be maintained during the testing events. If requested, a summary of the general test results, including unexpected or unusual test results and equipment failures or testing limitations shall be reported to the Department within thirty (30) days of completion of the test. The summary shall be presented in a format acceptable to the Department and in general accordance with the report formats outlined in Section XI of this Consent Order. A report summarizing the results of each test shall be submitted to the Department within one hundred and twenty (120) days of completion of each test.

IX.B.3 Decontamination Procedures

The objective of the decontamination procedures is to minimize the potential for cross-contamination. A designated decontamination area shall be established for decontamination of drilling equipment, reusable sampling equipment and well materials. The drilling rig shall be decontaminated prior to entering the site or unit. Drilling equipment or other exploration equipment that may come in contact with the borehole shall be decontaminated by steam cleaning, by hot-water pressure washing, or by other method approved by the Department prior to drilling each new boring.

Sampling or measurement equipment, including but not limited to, stainless steel sampling tools, split-barrel or core samplers, well developing or purging equipment, groundwater quality measurement instruments, and water level measurement instruments, shall be decontaminated in accordance with the following procedures or other methods approved by the Department before each sampling attempt or measurement:

1. Brush equipment with a wire or other suitable brush, if necessary or practicable, to remove large particulate matter.
2. Rinse with potable tap water.
3. Wash with nonphosphate detergent or other detergent approved by the Department (examples include Fantastik™, Liqui-Nox®) followed by a tap water rinse.
4. Rinse with 0.1 M nitric acid (to remove trace metals, if necessary) followed by a tap water rinse.
5. Rinse with methanol (to remove organic compounds, if necessary) followed by a tap water rinse.
6. Rinse with potable tap water.
7. Double rinse with deionized water.

All decontamination solutions shall be collected and stored temporarily as described in Section IX.B.5 of this Consent Order. Decontamination procedures and the cleaning agents used shall be documented in the daily field log.

IX.B.4 Field Equipment Calibration Procedures

Field equipment requiring calibration shall be calibrated to known standards, in accordance with the manufacturers' recommended schedules and procedures. At a minimum, calibration checks shall be conducted daily, or at other intervals approved by the Department, and the instruments shall be recalibrated, if necessary. Calibration measurements shall be recorded in the daily field logs. If field equipment becomes inoperable, its use shall be discontinued until the necessary repairs are made. In the interim, a properly calibrated replacement instrument shall be used.

IX.B.5 Collection and Management of Investigation Derived Waste

Investigation derived waste (IDW) includes general refuse, drill cuttings, excess sample material, water (decontamination, development and purge), and disposable equipment generated during the course of investigation, corrective action, or monitoring activities. All IDW shall be properly characterized and disposed of in accordance with all Federal, State, and local rules and regulations for storage, labeling, handling, transport, and disposal of waste. The Respondents shall include a description of anticipated management of IDW as part of the applicable work plan submitted to the Department for approval prior to disposal of any IDW produced during investigation, corrective action, or monitoring activities. The Respondents may submit a request to the Department to dispose of IDW on a case-by-case basis prior to submittal of the applicable work plan.

All water generated during sampling and decontamination activities shall be temporarily stored at satellite accumulation areas or transfer stations in labeled 55-gallon drums or other containers approved by the Department until proper characterization and disposal can be arranged. The IDW may be characterized for disposal based on the known or suspected contaminants potentially present in the waste. The methods for waste characterization and disposal of IDW shall be approved by the Department prior to removal from the temporary storage area.

IX.B.6 Documentation of Field Activities

IX.B.6.a General

Daily field activities, including observations and field procedures, shall be recorded on appropriate forms. The original field forms shall be maintained at the Facility. Copies of the completed forms shall be maintained in a bound and sequentially numbered field file for reference during field activities. Indelible ink shall be used to record all field activities. Photographic documentation of field activities shall be performed, as appropriate. The daily record of field activities shall include the following:

- Site or unit designation;
- Date;
- Time of arrival and departure;
- Field investigation team members including subcontractors and visitors;
- Weather conditions;
- Daily activities and times conducted;
- Observations;
- Record of samples collected with sample designations and locations specified;
- Photographic log;
- Field monitoring data, including health and safety monitoring if conditions arise that require modification of required work;

- Equipment used and calibration records, if appropriate;
- List of additional data sheets and maps completed;
- An inventory of the waste generated and the method of storage or disposal; and
- Signature of personnel completing the field record.

IX.B.6.b Sample Custody

All samples collected for analysis shall be recorded in the field report or data sheets. Chain-of-custody forms shall be completed at the end of each sampling day, prior to the transfer of samples off site, and shall accompany the samples during shipment to the laboratory. A signed and dated custody seal shall be affixed to the lid of the shipping container. Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody form shall be signed as received by the laboratory, and the conditions of the samples shall be recorded on the form. The original chain-of-custody form shall remain with the laboratory and copies shall be returned to the relinquishing party. The Respondents shall maintain copies of all chain-of-custody forms generated as part of sampling activities. Copies of the chain-of-custody records (either paper copies or electronically scanned in PDF format) shall be included with all draft and final laboratory reports submitted to the Department.

IX.C CHEMICAL ANALYSES

The Respondents shall submit all samples for laboratory analysis to accredited contract laboratories. The laboratories shall use the most recent EPA and industry-accepted extraction and analytical methods for chemical analyses for target analytes as the testing methods for each medium sampled.

The Respondents shall submit a list of analytes and analytical methods to the Department, for review and written approval as part of each site-specific investigation, corrective action, or monitoring work plan. The detection limits for each method shall be less than applicable background, screening, and regulatory cleanup levels. The preferred method detection limits are a maximum of 20 percent of the cleanup, screening, or background levels. Analyses conducted with detection limits that are greater than applicable background, screening, and regulatory cleanup levels shall be considered data quality exceptions and the reasons for the elevated detection limits shall be reported to the Department. These data cannot be used for statistical analyses. All analytical data (non-detects, estimated blanks, and detects) shall be included in the electronic copy of the investigation report in Microsoft™ Excel format with qualifiers as attached from the analytical laboratory. The summary tables shall include only detects of the data based on the corresponding qualifiers. The Respondents shall not censor the data based on detection limits, quantitation limits, or measurement uncertainty.

IX.C.1 Laboratory QA/QC Requirements

The following requirements for laboratory QA/QC procedures shall be considered the minimum QA/QC standards for the laboratories employed by the Respondents that provide analytical services for environmental investigation, corrective action, and monitoring activities conducted at

the Facility. The Respondents shall provide the names of the contract analytical laboratories and copies of the laboratory quality assurance manuals to the Department within forty-five (45) days of awarding a contract for analytical services to any contract laboratory.

IX.C.1.a Quality Assurance Procedures

Contract analytical laboratories shall maintain internal quality assurance programs in accordance with EPA and industry-wide accepted practices and procedures. At a minimum, the laboratories shall use a combination of standards, blanks, surrogates, duplicates, matrix spike/matrix spike duplicates (MS/MSD), blank spike/blank spike duplicates (BS/BSD), and laboratory control samples to demonstrate analytical QA/QC. The laboratories shall establish control limits for individual chemicals or groups of chemicals based on the long-term performance of the test methods. In addition, the laboratories shall establish internal QA/QC that meets EPA's laboratory certification requirements. The specific procedures to be completed are identified in the following sections.

IX.C.1.b Equipment Calibration Procedures and Frequency

The laboratories' equipment calibration procedures, calibration frequency, and calibration standards shall be in accordance with the EPA test methodology requirements and documented in the laboratories' quality assurance and SOP manuals. All instruments and equipment used by the laboratory shall be operated, calibrated, and maintained according to manufacturers' guidelines and recommendations. Operation, calibration, and maintenance shall be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance shall be kept on file at the laboratory.

IX.C.1.c Laboratory QA/QC Samples

Analytical procedures shall be evaluated by analyzing reagent or method blanks, surrogates, MS/MSDs, BS/BSDs, and laboratory duplicates, as appropriate for each method. The laboratory QA/QC samples and frequency of analysis to be completed shall be documented in the cited EPA or DOE test methodologies. At a minimum, the laboratory shall analyze laboratory blanks, MS/MSDs, BS/BSDs, and laboratory duplicates at a frequency of one in twenty for all batch runs requiring EPA test methods and at a frequency of one in ten for non-EPA test methods. Laboratory batch QA/QC samples shall be specific to the project.

IX.C.1.d Laboratory Deliverables

The laboratory analytical data package shall be prepared in accordance with EPA-established Level III or IV analytical support protocol. The following shall be provided in the analytical laboratory reports submitted to the Respondents either electronically or in hard (paper) copy for this project:

1. Transmittal letter, including information about the receipt of samples, the testing methodology performed, any deviations from the required procedures, any problems encountered in the analysis of the samples, any data quality exceptions, and any corrective actions taken by the laboratory relative to the quality of the data contained in the report.

2. Sample analytical results, including sampling date; date of sample extraction or preparation; date of sample analysis; dilution factors and test method identification; soil, rock, or sediment sample results in consistent units (mg/kg) or micrograms per kilogram in dry-weight basis; water sample results in consistent units (milligrams per liter or micrograms per liter (µg/L)); vapor sample results in consistent units (ppm or $\mu g/m^3$); and detection limits for undetected analytes. Results shall be reported for all field samples, including field duplicates and blanks, submitted for analysis.
3. Method blank results, including detection limits for undetected analytes.
4. Surrogate recovery results and corresponding control limits for samples and method blanks (organic analyses only).
5. MS/MSD and/or BS/BSD spike concentrations, percent recoveries, relative percent differences (RPDs), and corresponding control limits.
6. Laboratory duplicate results for inorganic analyses, including relative percent differences and corresponding control limits.
7. Sample chain-of-custody documentation.
8. Holding times and conditions.
9. Conformance with required analytical protocol(s).
10. Instrument calibration.
11. Blanks.
12. Detection/quantitation limits.
13. Recoveries of surrogates.
14. Variability for duplicate analyses.
15. Completeness.
16. Data report formats.
17. The following data deliverables for organic compounds shall be required from the laboratory:
    - A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications, including signature from authority representative certifying to the quality and authenticity of data as reported;
    - Report of sample collection, extraction, and analysis dates, including sample holding conditions;
    - Tabulated results for samples in units as specified, including data qualification in conformance with EPA protocol, and definition of data descriptor codes;
    - Reconstructed ion chromatograms for gas chromatograph/mass spectrometry (GC/MS) analyses for each sample and standard calibration;

- Selected ion chromatograms and mass spectra of detected target analytes (GC/MS) for each sample and calibration with associated library/reference spectra;
- Gas chromatograph/electron capture device (GC/ECD) and/or gas chromatograph/flame ionization detector (GC/FID) chromatograms for each sample and standard calibration;
- Raw data quantification reports for each sample and calibrations, including areas and retention times for analytes, surrogates, and internal standards;
- A calibration data summary reporting calibration range used and a measure of linearity [include decafluorotriphenylphosphine (DFTPP) and p-bromofluorobenzene (BFB) spectra and compliance with tuning criteria for GC/MS];
- Final extract volumes (and dilutions required), sample size, wet-to-dry weight ratios, and instrument practical detection/quantitation limit for each analyte;
- Analyte concentrations with reporting units identified, including data qualification in conformance with the CLP Statement of Work (SOW) (include definition of data descriptor codes);
- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample;
- Recovery assessments and a replicate sample summary, including all surrogate spike recovery data with spike levels/concentrations for each sample and all MS/MSD results (recoveries and spike amounts); and
- Report of tentatively identified compounds with comparison of mass spectra to library/reference spectra.

18. The following data deliverables for inorganic compounds shall be required from the laboratory:

- A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications; including signature from authority representative certifying to the quality and authenticity of data as reported;
- Report of sample collection, digestion, and analysis dates, with sample holding conditions;
- Tabulated results for samples in units as specified, including data qualification in conformance with the CLP SOW (including definition of data descriptor codes);
- Results of all method QA/QC checks, including inductively coupled plasma (ICP) Interference Check Sample and ICP serial dilution results;
- Tabulation of instrument and method practical detection/quantitation limits;
- Raw data quantification report for each sample;
- A calibration data summary reporting calibration range used and a measure of linearity, where appropriate;
- Final digestate volumes (and dilutions required), sample size, and wet-to-dry weight ratios;

- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample; and
- Recovery assessments and a replicate sample summary, including post-digestate spike analysis; all MS data (including spike concentrations) for each sample, if accomplished; all MS results (recoveries and spike amounts); and laboratory control sample analytical results).

The Respondents shall present summary tables of these data and Level II QA/QC results to the Department in the formats described in Section XI of this Order. The raw analytical data, including calibration curves, instrument calibration data, data calculation work sheets, and other laboratory support data for samples from this project, shall be compiled and kept on file at the Facility for reference. The Respondents shall make the data available to the Department upon request.

IX.C.2 Review of Field and Laboratory QA/QC Data

The Respondents shall evaluate the sample data, field, and laboratory QA/QC results for acceptability with respect to the data quality objectives (DQOs). Each group of samples shall be compared with the DQOs and evaluated using data validation guidelines contained in EPA guidance documents, the latest version of SW-846, and industry-accepted QA/QC methods and procedures.

The Respondents shall require the laboratory to notify the Facility project manager of data quality exceptions within one working day of discovery in order to allow for sample re-analysis, if possible. The Facility project manager shall contact the Department within one working day of receipt of laboratory notification of data quality exceptions that may affect the ability to meet the objectives of the investigation or compliance activity in order to discuss the implications and determine whether the data will still be considered acceptable or if sample re-analysis or resampling is necessary. The Facility project manager shall summarize the results of the discussion with the Department project leader regarding the data quality exceptions in a memorandum. The Respondents shall submit the memorandum to the Department by fax or electronic mail within three working days of the conclusion of the data quality discussion.

IX.C.3 Blanks, Field Duplicates, Reporting Limits and Holding Times

IX.C.3.a Blanks

The analytical results of field blanks and field rinseate blanks shall be reviewed to evaluate the adequacy of the equipment decontamination procedures and the possibility of cross-contamination caused by decontamination of sampling equipment. The analytical results of trip blanks shall be reviewed to evaluate the possibility for contamination resulting from the laboratory-prepared sample containers or the sample transport containers. The analytical results of laboratory blanks shall be reviewed to evaluate the possibility of contamination caused by the analytical procedures. If contaminants are detected in field or laboratory blanks, the sample data shall be qualified, as appropriate.

IX.C.3.b Field Duplicates

Field duplicates shall consist of two samples either split from the same sample device or collected sequentially. Field duplicate samples shall be collected at a minimum frequency of ten percent of the total number of samples submitted for analysis. RPDs for field duplicates shall be calculated. A precision of no more than 20 percent for duplicates shall be considered acceptable for soil, rock, and sediment sampling conducted at the Facility. The analytical DQO for precision shall be used for water duplicates.

IX.C.3.c Method Reporting Limits

Method reporting limits for sample analyses for each medium shall be established at the lowest level practicable for the method and analyte concentrations and shall not exceed soil, groundwater, surface water, or vapor emissions background levels, cleanup standards, and screening levels. The preferred method detection limits are a maximum of 20 percent of the background, screening, or cleanup levels. Detection limits that exceed established soil, groundwater, surface water, or air emissions cleanup standards, screening levels, or background levels and are reported as "not detected" shall be considered data quality exceptions and an explanation for the exceedance and its acceptability for use shall be provided.

IX.C.3.d Holding Times

The Respondents shall review the sampling, extraction, and analysis dates to confirm that extraction and analyses were completed within the recommended holding times, as specified by EPA protocol. Appropriate data qualifiers shall be noted if holding times were exceeded.

IX.C.4 Representativeness and Comparability

IX.C.4.a Representativeness

Representativeness is a qualitative parameter related to the degree to which the sample data represent the relevant specific characteristics of the media sampled. The Respondents shall implement procedures to assure representative samples are collected and analyzed, such as repeated measurements of the same parameter at the same location over several distinct sampling events. The Respondents shall note any procedures or variations that may affect the collection or analysis of representative samples and shall qualify the data.

IX.C.4.b Comparability

Comparability is a qualitative parameter related to whether similar sample data can be compared. To assure comparability, the Respondents shall report analytical results in appropriate units for comparison with other data (past studies, comparable sites, screening levels, and cleanup standards), and shall implement standard collection and analytical procedures. Any procedure or variation that may affect comparability shall be noted and the data shall be qualified.

IX.C.5 Laboratory Reporting, Documentation, Data Reduction, and Corrective Action

Upon receipt of each laboratory data package, data shall be evaluated against the criteria outlined in the previous sections. Any deviation from the established criteria shall be noted and the data will be qualified. A full review and discussion of analytical data QA/QC and all data qualifiers shall be submitted as appendices or attachments to investigation and monitoring reports prepared in accordance with Section XI of this Consent Order. Data validation procedures for all samples shall include checking the following, when appropriate:

1. Holding times;
2. Detection limits;
3. Field equipment rinseate blanks;
4. Field blanks;
5. Field duplicates;
6. Trip blanks;
7. Reagent blanks;
8. Laboratory duplicates;
9. Laboratory blanks;
10. Laboratory matrix spikes;
11. Laboratory matrix spike duplicates;
12. Laboratory blank spikes;
13. Laboratory blank spike duplicates; and
14. Surrogate recoveries.

If significant quality assurance problems are encountered, appropriate corrective action shall be implemented. All corrective action shall be defensible and the corrected data shall be qualified.

X. MONITORING WELL CONSTRUCTION REQUIREMENTS

X.A TYPES OF MONITORING WELLS

Three types of groundwater monitoring wells are required at the Facility: alluvial, intermediate, and regional wells. Alluvial wells are shallow wells which monitor groundwater in the alluvium located in the canyon bottoms. Intermediate wells monitor perched groundwater beneath the Facility and generally extend from depths of approximately 100 to 700 ft below ground surface. Regional wells monitor the deep regional aquifer beneath the Facility and generally are deeper than 700 ft below ground surface.

The well construction, installation, and completion procedures for these wells differ because each well monitors a different stratigraphic horizon and at different depths. General drilling procedures are presented in Section X.B and monitoring well construction requirements are presented in Section X.C of this Consent Order.

X.B DRILLING METHODS

Groundwater monitoring wells and piezometers must be designed and constructed in a manner which will yield high quality samples, ensure that the well will last the duration of the project, and ensure that the well will not serve as a conduit for contaminants to migrate between different stratigraphic units or aquifers. The design and construction of groundwater monitoring wells shall comply with the guidelines established in various EPA RCRA guidance, including, but not limited to:

- U.S. EPA, *RCRA Groundwater Monitoring: Draft Technical Guidance*, EPA/530-R-93-001, November, 1992;
- U.S. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, September, 1986; and
- Aller, L., Bennett, T.W., Hackett, G., Petty, R.J., Lehr, J.H., Sedoris, H., Nielsen, D.M., and Denne, J.E., *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*, EPA 600/4-89/034, 1989.

A variety of methods are available for drilling monitoring wells. While the selection of the drilling procedure is usually based on the site-specific geologic conditions, the following issues shall also be considered:

- Drilling shall be performed in a manner that minimizes impacts to the natural properties of the subsurface materials.
- Contamination and cross-contamination of groundwater and aquifer materials during drilling shall be avoided.
- The drilling method shall allow for the collection of representative samples of rock, unconsolidated materials, and soil.

- The drilling method shall allow the Respondents to determine when the appropriate location for the screened interval(s) has been encountered.
- The drilling method shall allow for the proper placement of the filter pack and annular sealants. The borehole diameter shall be at least four inches larger in diameter than the nominal diameter of the well casing and screen to allow adequate space for placement of the filter pack and annular sealants.

The drilling method shall allow for the collection of representative groundwater samples. Drilling fluids (which includes air) shall be used only when minimal impact to the surrounding formation and groundwater can be ensured.

A brief description of the different drilling methods that may be appropriate for the construction of monitoring wells at the Facility follows. Many of these methods may be used alone, or in combination, to install monitoring wells at the Facility. While the selection of the specific drilling procedure will usually depend on the site-specific geologic conditions, justification for the method selected must be provided to the Department.

X.B.1 Hollow-Stem Auger

The hollow-stem continuous flight auger consists of a hollow, steel shaft with a continuous, spiraled steel flight welded onto the exterior site of the stem. The stem is connected to an auger bit and, when rotated, transports cuttings to the surface. The hollow stem of the auger allows drill rods, split-spoon core barrels, Shelby tubes, and other samplers to be inserted through the center of the auger so that samples may be retrieved during the drilling operations. The hollow stem also acts to temporarily case the borehole, so that the well screen and casing (riser) may be inserted down through the center of the augers once the desired depth is reached, minimizing the risk of possible collapse of the borehole. A bottom plug or pilot bit can be fastened onto the bottom of the augers to keep out most of the soils and/or water that have a tendency to clog the bottom of the augers during drilling. Drilling without a center plug is acceptable provided that the soil plug, formed in the bottom of the auger, is removed before sampling or installing well casings. The soil plug can be removed by washing out the plug using a side discharge rotary bit, or augering out the plug with a solid-stem auger bit sized to fit inside the hollow-stem auger. In situations where heaving sands are a problem, potable water may be poured into the augers to equalize the pressure so that the inflow of formation materials and water shall be held to a minimum when the bottom plug is removed. The hollow-stem auger method is best suited for drilling shallow overburden wells.

X.B.2 Air Rotary/Air Down-The-Hole Hammer/ODEX

The air rotary method consists of a drill pipe or drill stem coupled to a drill bit that rotates and cuts through soils and rock. The cuttings produced from the rotation of the drilling bit are transported to the surface by compressed air, which is forced down the borehole through the drill pipe and returns to the surface through the annular space (between the drill pipe and the borehole wall). The circulation of the compressed air not only removes the cuttings from the borehole but also helps to cool the drill bit. The use of air rotary drilling is best suited for hard-rock formations. In soft unconsolidated formations, casing is driven to keep the formation from caving. When using air rotary, the air compressor shall have an in-line filter system to filter the

air coming from the compressor. The filter system shall be inspected regularly to insure that the system is functioning properly. In addition, a cyclone velocity dissipator or similar air containment/dust-suppression system shall be used to funnel the cuttings to one location instead of allowing the cuttings to discharge uncontrolled from the borehole. Air rotary that employs the dual-tube (reverse circulation) drilling system is acceptable because the cuttings are contained within the drill stem and are discharged through a cyclone velocity dissipator to the ground surface.

The injection of air into the borehole during air rotary drilling has the potential to alter the natural properties of the subsurface. This can occur through air-stripping of the VOCs in both soil and groundwater in the vicinity of the borehole, altering the groundwater geochemical parameters (e.g., pH and redox potential), and potentially increasing biodegradation of organic compounds in the aquifer near the borehole. These factors may prevent the well from yielding groundwater samples that are representative of in-situ conditions.

In hard, abrasive, consolidated rock, a down-the-hole hammer may be more appropriate than the air rotary method. In this method, compressed air is used to actuate and operate a pneumatic hammer as well as lift the cuttings to the surface and cool the hammer bit. One drawback of the down-the-hole hammer is that oil is required in the air stream to lubricate the hammer-actuating device, and this oil could potentially contaminate the soil in the vicinity of the borehole and the aquifer.

The ODEX method is a variation of the air rotary method in which a casing-driving technique is used in combination with air rotary drilling. With the ODEX system, the drill bit extends outward and reams a pilot hole large enough for a casing assembly to slide down behind the drill bit assembly. As a result, casing is advanced simultaneously while drilling the hole.

X.B.3 Water Rotary and Mud Rotary

The water and mud rotary drilling methods consist of rotary drilling techniques where water or drilling mud is used as the circulating fluid. In both methods, the circulating fluid is pumped down through the drill pipe and is returned back up the borehole through the annular space. The circulating fluid stabilizes the borehole, cools the drill bit, and carries the drill cuttings up to the surface. While the water and mud rotary drilling techniques are rapid and effective drilling methods, the recognition of water-bearing zones is hampered by the addition of water into the system.

Mud rotary drilling is similar to water rotary drilling with the exception that mud additives are added to the water to change the properties (e.g., density, viscosity, yield point, gel strength, fluid-loss-control effectiveness, and lubricity) of the circulating fluid. Drilling muds provide greater borehole stabilization than water alone. There are several types of mud presently available, including bentonite, barium sulfate, organic polymers, cellulose polymers, and polyacrylamides. While drilling muds enhance the stability of the borehole and allow for drilling in formations not appropriate to other methods, they can adversely affect the hydrologic properties and geochemistry of the aquifer. For example, drilling fluid invasion and the buildup of borehole filter cake may reduce the effective porosity of the aquifer in the vicinity of the borehole. In addition, bentonite drilling muds may affect the pH of groundwater and organic polymer drilling muds have been observed to facilitate bacterial growth, which reduces the

reliability of sampling results. If polymer emulsions are to be used in the drilling program at the Facility, polymer dispersion agents shall be used at the completion of the drilling program to remove the polymers from the boreholes. For example, if EZ Mud® is used as a drilling additive, a dispersant (e.g., BARAFOS® or five percent sodium hypochlorite) shall be used to disperse and chemically breakdown the polymer prior to developing and sampling the well.

X.B.4 Dual-Wall Reverse Circulation

The dual-wall reverse circulation drilling method utilizes a double-wall drill pipe and has the reverse circulation of other conventional rotary drilling methods. The circulating fluid (water or air) is pumped down the borehole between the outer and inner drill pipe, and returns up the inner drill pipe. Cuttings are lifted to the surface through the inner drill pipe. The inner drill pipe rotates the bit, and the outer drill pipe acts as a casing and stabilizes the borehole. Typically, a tri-cone bit is used when drilling through unconsolidated formations and a down-the-hole hammer is used in hard rock.

The dual-wall reverse circulation rotary method is one of the better methods available for obtaining representative and continuous formation samples while drilling. If a roller cone bit is used, the formation that is being drilled is located only a few inches ahead of the double-wall pipe. As a result, the cuttings observed at the surface represent no more than one foot of the formation at any point in time.

When drilling with air, an in-line filter shall be used to remove oil or other impurities from the airstream. However, if a down-the-hole hammer is used, it must be used with caution since it requires oil in the airstream to lubricate the hammer. This could possibly introduce contaminants to the borehole and aquifer.

X.B.5 Resonant Sonic

Resonant sonic drilling is a method that uses a sonic drill head to produce high-frequency, high-force vibrations in a steel drill pipe. The vibrations in the pipe create a cutting action at the bit face, which allows a continuous core of the formation to move into a core barrel. The method requires no drilling fluid, drills very fast (up to one ft/sec in certain formations), drills at any angle through all formations (rock, clay, sand, boulders, permafrost, glacial till), and yields virtually no cuttings in the drilling process. While there are numerous advantages to this process, the primary disadvantage is the cost of the method. This drilling method has been tested by the DOE and used at various DOE facilities.

X.B.6 Cryogenic

Cryogenic drilling is a technique that uses standard air rotary drilling methods, but employs cold nitrogen gas as the circulating fluid instead of compressed air. The use of nitrogen gas as the circulation fluid freezes the borehole wall while drilling, which stabilizes unconsolidated sediments and prevents potential cross-contamination of different water-bearing zones. In addition, the method produces fewer cuttings than liquid based drilling methods, requires minimal equipment modifications to existing drill rigs, and does not add contaminants to the borehole during the drilling process due to the benign nature of nitrogen gas. The method is especially applicable for drilling through alternating hard (competent) and soft (unconsolidated)

formations. This drilling method has been tested by the DOE and proposed for future use at various DOE facilities.

X.C WELL CONSTRUCTION/COMPLETION METHODS

X.C.1 Well Construction Materials

Well construction materials shall be selected based on the goals and objectives of the proposed monitoring program and the geologic conditions at the site. When selecting well construction materials, the primary concern shall be selecting materials that will not contribute foreign constituents or remove contaminants from the groundwater. Other factors to be considered include the tensile strength, compressive strength, and collapse strength of the materials; length of time the monitoring well will be in service; and the material's resistance to chemical and microbiological corrosion. Generally, if the monitoring program requires the analysis of organic constituents, stainless steel or fluoropolymer materials should be used. However, if the monitoring program requires only inorganic constituent analyses, polyvinyl chloride (PVC) materials may be used. PVC should not be used for monitoring wells where organic constituents will be analyzed due to its potential for sorption and leaching of contaminants.

Well screen and casing materials acceptable for the construction of RCRA monitoring wells include stainless steel (304 or 316), rigid PVC (meeting American National Standards Institute/National Sanitation Foundation Standard 14), and fluoropolymer materials (polytetrafluoroethylene, fluorinated ethylene propylene, and polyvinylidene). In addition, there are other materials available for the construction of monitoring wells including acrylonitrile butadiene styrene (ABS), fiberglass-reinforced plastic (FRP), black iron, carbon steel, and galvanized steel, but these materials are not recommended for use in long term monitoring wells due to their low resistance to chemical attack and potential contribution of contamination to the groundwater. However, these materials may be used in the construction of monitoring wells where they will not be in contact with the groundwater that will be sampled (e.g., carbon steel pipe used as surface casing).

X.C.2 Well Construction Techniques

X.C.2.a Single-Cased Wells

The borehole shall be bored, drilled, or augered as close to vertical as possible, and checked with a plumb bob, level, or appropriate downhole logging tool. Slanted boreholes shall not be acceptable unless specified in the design. The borehole shall be of sufficient diameter so that well construction can proceed without major difficulties. To assure an adequate size, a minimum two-inch annular space is required between the casing and the borehole wall (or the hollow-stem auger wall). The two-inch annular space around the casing will allow the filter pack, bentonite seal, and annular grout to be placed at an acceptable thickness. Also, the two-inch annular space will allow up to a 1.5-inch outer diameter tremie pipe to be used for placing the filter pack, bentonite seal, and grout at the specified intervals.

It may be necessary to overdrill the borehole so that any soils that have not been removed (or that have fallen into the borehole during augering or drill stem retrieval) will fall to the bottom of the borehole below the depth where the filter pack and well screen are to be placed. Normally, three

to five ft is sufficient for overdrilling shallow wells. Deep wells may require deeper overdrilling. The borehole can also be overdrilled to allow for an extra space for a well sump to be installed. If the borehole is overdrilled deeper than desired, it can be backfilled to the designated depth with bentonite pellets or the filter pack.

The well casings (riser assembly) should be secured to the well screen by flush-jointed threads or other appropriate connections and placed into the borehole and plumbed by the use of centralizers, a plumb bob, or a level. No petroleum-based lubricating oils or grease shall be used on casing threads. Teflon tape can be used to wrap the threads to insure a tight fit and minimize leakage. No glue of any type shall be used to secure casing joints. Teflon "O" rings can also be used to ensure a tight fit and minimize leakage. "O" rings made of materials other than Teflon are not acceptable if the well will be sampled for organic compound analyses. Before the well screen and casings are placed at the bottom of the borehole, at least six inches of filter material shall be placed at the bottom to serve as a firm footing. The string of well screen and casing should then be placed into the borehole and plumbed. If centralizers are used, they shall be placed below the well screens and above the bentonite annular seals so that the placement of the filter pack, overlying bentonite seal, and annular grout will not be hindered. Centralizers placed in the wrong locations can cause bridging during material placement. If installing the well screen and casings through hollow-stem augers, the augers shall be slowly extracted as the filter pack, bentonite seal, and grout are tremied or poured into place. The gradual extraction of the augers will allow the materials being placed in the augers to flow out of the bottom of the augers into the borehole. If the augers are not gradually extracted, the materials will accumulate at the bottom of the augers causing potential bridging problems. After the string of well screen and casing is plumb, the filter material shall be placed around the well screen (preferably by the tremie pipe method) up to the designated depth. After the filter pack has been installed, the bentonite seal shall be placed directly on top of the filter pack up to the designated depth or a minimum of two ft above the filter pack, whichever is greater. After the bentonite seal has hydrated for the specified time, the annular grout shall be pumped by the tremie method into the annular space around the casings (riser assembly) up to within two ft of the ground surface or below the frost line, whichever is greater. The grout shall be allowed to cure for a minimum of 24 hours before the surface pad and protective casing are installed. After the surface pad and protective casing are installed, bumper guards (guideposts) shall be installed (if necessary).

X.C.2.b Double-Cased Wells

Double-cased wells should be constructed when there is reason to believe that interconnection of two aquifers by well construction may cause cross contamination, or when flowing sands make it impossible to install a monitoring well using conventional methods. A pilot borehole should be advanced through the overburden and the contaminated zone into a clay, confining layer, or bedrock. An outer casing (surface or pilot casing) shall be placed into the borehole and sealed with grout. The borehole and outer casing should extend into tight clay a minimum of two ft or into competent bedrock a minimum of one foot. The total depth into the clay or bedrock will vary depending upon the plasticity of the clay and the extent of weathering and fracturing of the bedrock. The size of the outer casing shall be of sufficient inside diameter to contain the inner casing and the two-inch annular space. In addition, the borehole shall be of sufficient size to contain the outer casing and the two-inch minimum outer annular space, if applicable.

The outer casing shall be grouted by the tremie method from the bottom of the borehole to within two ft of the ground surface. The grout shall be pumped into the annular space between the outer casing and the borehole wall. This can be accomplished by either placing the tremie pipe in the annular space and pumping the grout from the bottom of the borehole to the surface, or placing a grout shoe or plug inside the casing at the bottom of the borehole and pumping the grout through the bottom grout plug and up the annular space on the outside of the casing. The grout shall consist of a Type I Portland cement and bentonite or other approved grout to provide a rigid seal. A minimum of 24 hours shall be allowed for the grout plug (seal) to cure before attempting to drill through it. When drilling through the seal, care shall be taken to avoid cracking, shattering, and washing out of the seal. If caving conditions exist so that the outer casing cannot be sufficiently sealed by grouting, the outer casing shall be driven into place and a grout seal placed in the bottom of the casing.

X.C.2.c Bedrock Wells

The installation of monitoring wells into bedrock can be accomplished in two ways. The first method is to drill or bore a pilot borehole through the soil overburden into the bedrock. An outer casing is installed into the borehole by setting it into the bedrock, and grouting it into place. After the grout has set, the borehole can be advanced through the grout seal into the bedrock. The preferred method of advancing the borehole into the bedrock is rock coring. Rock coring makes a smooth, round hole through the seal and into the bedrock without cracking or shattering the seal. Roller cone bits are used in soft bedrock, but extreme caution should be taken when using a roller cone bit to advance through the grout seal in the bottom of the borehole because excessive water and bit pressure can cause cracking, eroding (washing), and/or shattering of the seal. Low volume air hammers may be used to advance the borehole, but they have a tendency to shatter the seal because of the hammering action. If the structural integrity of the grout seal is in question, a pressure test can be utilized to check for leaks. If the seal leaks, the seal is not acceptable. When the drilling is complete, the finished well will consist of an open borehole from the ground surface to the bottom of the well. The major limitation of open borehole bedrock wells is that the entire bedrock interval serves as the monitoring zone.

The second method is to install the outer surface casing and drill the borehole into bedrock, and then install an inner casing and well screen with the filter pack, bentonite seal, and annular grout. The well is completed with a surface protective casing and concrete pad. This well installation method gives the flexibility of isolating the monitoring zone(s) and minimizing inter-aquifer flow. In addition, it gives structural integrity to the well, especially in unstable areas (e.g., steeply dipping shales) where the bedrock has a tendency to shift or move when disturbed.

X.C.3 Well Screen and Filter Pack Design

Well screens and filter packs shall be designed to accurately sample the aquifer zone that the well is intended to sample, minimize the passage of formation materials (turbidity) into the well, and ensure sufficient structural integrity to prevent the collapse of the intake structure. The selection of the well screen length depends upon the objective of the well. Piezometers and wells where only a discrete flow path is monitored are generally completed with short screens (two ft or less). While monitoring wells are usually constructed with longer screens (usually five to ten ft), they shall be kept to the minimum length appropriate for intercepting a contaminant

plume. The screen slot size shall be selected to retain from 90 to 100 percent of the filter pack material in artificially filter packed wells, and from 50 to 100 percent of the formation material in naturally packed wells. All well screens shall be factory wire-wrapped or machine slotted.

A filter pack shall be used when: 1) the natural formation is poorly sorted; 2) a long screen interval is required or the screen spans highly stratified geologic materials of widely varying grain sizes; 3) the natural formation is uniform fine sand, silt, or clay, 4) the natural formation is thin-bedded; 5) the natural formation is poorly cemented sandstone; 6) the natural formation is highly fractured or characterized by relatively large solution channels; 7) the natural formation is shale or coal that will act as a constant source of turbidity to groundwater samples; or 8) the diameter of the borehole is significantly greater than the diameter of the screen. The use of natural formation material as a filter pack is only recommended when the natural formation materials are relatively coarse-grained, permeable, and uniform in grain size.

Filter pack materials shall consist of clean, rounded to well-rounded, hard, insoluble particles of siliceous composition (industrial grade quartz sand or glass beads). The required grain-size distribution or particle sizes of the filter pack materials shall be selected based upon a sieve analysis of the aquifer materials or the formation to be monitored, or the characteristics of the aquifer materials using information acquired during previous investigations.

Where sieve analyses are used to select the appropriate filter pack particle size, the results of a sieve analysis of the formation materials are plotted on a grain-size distribution graph, and a grain-size distribution curve is generated. The 70 percent retained grain size value should be multiplied by a factor between four and six (four for fine, uniform formations and six for coarse, non-uniform formations). A second grain-size distribution curve is then drawn on the graph for this new value, ensuring that the uniformity coefficient does not exceed 2.5. The filter pack that shall be used will fall within the area defined by these two curves.

Once the filter pack size is determined, the screen slot size shall be selected to retain at least 90 percent of the filter pack material. The Respondents may propose the use of a pre-determined well screen slot size and filter pack for monitoring wells in the site-specific work plans submitted to the Department.

The filter pack shall be installed in a manner that prevents bridging and particle-size segregation. Filter packs placed below the water table shall be installed by the tremie pipe method. Filter pack materials shall not be poured into the annular space unless the well is shallow (e.g., less than 30 ft deep) and the filter pack material can be poured continuously into the well without stopping. At least two inches of filter pack material shall be installed between the well screen and the borehole wall, and two ft of material shall extend above the top of the well screen. A minimum of six-inches of filter pack material shall also be placed under the bottom of the well screen to provide a firm footing and an unrestricted flow under the screened area. In deep wells (e.g., greater than 200 ft deep), the filter pack may not compress when initially installed. As a result, filter packs may need to be installed as high as five ft above the screened interval in these situations. The precise volume of filter pack material required shall be calculated and recorded before placement, and the actual volume used shall be determined and recorded during well construction. Any significant discrepancy between the calculated and actual volume shall be explained. Prior to installing the filter pack annular seal, a one to two-ft layer of chemically inert

fine sand shall be placed over the filter pack to prevent the intrusion of annular sealants into the filter pack.

Several pre-fabricated groundwater sampling systems that can be installed in open boreholes are available on the market. These include multi-level borehole completion systems (e.g., Westbay MP System®) and pneumatically deployed inverting PVC membranes (e.g., SEAMIST). If these types of borehole completions are to be used in the Facility wells, they shall be installed under the supervision of personnel from the authorized vendor.

X.C.4 Annular Sealant

The annular space between the well casing and the borehole must be properly sealed to prevent cross-contamination of samples and the groundwater. The materials used for annular sealants shall be chemically inert with respect to the highest anticipated concentration of chemical constituents expected in the groundwater at the Facility. In general, the permeability of the sealing material shall be one to two orders of magnitude lower than the least permeable parts of the formation in contact with the well. The precise volume of annular sealants required shall be calculated and recorded before placement, and the actual volume shall be determined and recorded during well construction. Any significant discrepancy between the calculated volume and the actual volume shall be explained.

During well construction, an annular seal shall be placed on top of the filter pack. This seal shall consist of a high solids (10-30 percent) bentonite material in the form of bentonite pellets, granular bentonite, or bentonite chips. The bentonite seal shall be placed in the annulus through a tremie pipe if the well is deep (greater than 30 ft), or by pouring directly down the annulus in shallow wells (less than 30 ft). If the bentonite materials are poured directly down the annulus (which is an acceptable method only in wells less than 30 feet deep), a tamping device shall be used to ensure that the seal is emplaced at the proper depth and the bentonite has not bridged higher in the well casing. The bentonite seal shall be placed above the filter pack a minimum of two ft vertical thickness. The bentonite seal shall be allowed to completely hydrate in conformance with the manufacturer's specifications prior to installing the overlying annular grout seal. The time required for the bentonite seal to completely hydrate will differ with the materials used and the specific conditions encountered, but is generally a minimum of four to 24 hours.

A grout seal shall be installed on top of the filter pack annular seal. The grout seal may consist of a high solids (30 percent) bentonite grout, a neat cement grout, or a cement/bentonite grout. The grout shall be pumped under pressure (not gravity fed) into the annular space by the tremie pipe method, from the top of the filter pack annular seal to within a few ft of the ground surface. The tremie pipe shall be equipped with a side discharge port (or bottom discharge for grouting at depths greater than 100 feet) to minimize damage to the filter pack or filter pack annular bentonite seal during grout placement. The grout seal shall be allowed to cure for a minimum of 24 hours before the concrete surface pad is installed. All grouts shall be prepared in accordance with the manufacturer's specifications. High solids (30 percent) bentonite grouts shall have a minimum density of ten pounds per gallon (as measured by a mud balance) to ensure proper setup. Cement grouts shall be mixed using six and one-half to seven gallons of water per 94-pound bag of Type I Portand cement. Bentonite (five to ten percent) may be added to delay the setting time and reduce the shrinkage of the grout.

X.C.5 Well Development

All monitoring wells shall be developed to create an effective filter pack around the well screen, correct damage to the formation caused by drilling, remove fine particles from the formation near the borehole, and assist in restoring the natural water quality of the aquifer in the vicinity of the well. Development stresses the formation around the screen, as well as the filter pack, so that mobile fines, silts, and clays are pulled into the well and removed. Development is also used to remove any foreign materials (e.g., water, drilling mud) that may have been introduced into the borehole during the drilling and well installation activities, and to aid in the equilibration that will occur between the filter pack, well casing, and the formation water. The development of a well is extremely important to ensuring the collection of representative groundwater samples.

Newly installed monitoring wells shall not be developed for at least 48 hours after the surface pad and outer protective casing are installed. This will allow sufficient time for the well materials to cure before the development procedures are initiated. A new monitoring well shall be developed until the column of water in the well is free of visible sediment, and the pH, temperature, turbidity, and specific conductivity have stabilized. In most cases, the above requirements can be satisfied. However, in some cases, the pH, temperature, and specific conductivity may stabilize but the water remains turbid. In this case, the well may still contain well construction materials, such as drilling mud in the form of a mud cake or formation soils that have not been washed out of the borehole. Thick drilling mud cannot be flushed out of a borehole with one or two well volumes of flushing. Instead, continuous flushing over a period of several days may be necessary to complete the well development. If the well is pumped dry, the water level shall be allowed to sufficiently recover before the next development period is initiated. The common methods used for developing wells include:

- Pumping and overpumping;
- Backwashing;
- Surging (with a surge block);
- Bailing;
- Jetting; and
- Airlift pumping.

These development procedures can be used, either individually or in combination, to achieve the most effective well development. However, the most favorable well development methods include pumping, overpumping, bailing, surging, or a combination of these methods. Well development methods and equipment that alter the chemical composition of the groundwater shall not be used. Development methods that involve adding water or other fluids to the well or borehole, or that use air to accomplish well development should be avoided, if possible. Approval shall be obtained from the Department prior to introducing air, water, or other fluids into the well for the purpose of well development. If water is introduced to a borehole during well drilling and completion, then the same or greater volume of water shall be removed from the well during development. In addition, the volume of water withdrawn from a well during development shall be recorded.

X.C.6 Surface Completion

Monitoring wells may be completed either as flush-mounted wells, or as above-ground completions. A surface seal shall be installed over the grout seal and extended vertically up the well annulus to the land surface. The lower end of the surface seal shall extend a minimum of one foot below the frost line to prevent damage from frost heaving. The composition of the surface seal shall be neat cement or concrete. In above-ground completions, a three-feet wide, four-inch thick concrete surface pad shall be installed around the well at the same time the protective casing is installed. The surface pad shall be sloped so that drainage will flow away from the protective casing and off the pad. In addition, a minimum of one inch of the finished pad shall be below grade or ground elevation to prevent washing and undermining by soil erosion.

A locking protective casing shall be installed around the well casing (riser) to prevent damage or unauthorized entry. The protective casing shall be anchored in the concrete surface pad below the frost line and extend several inches above the well riser stickup. A weep hole shall be drilled into the protective casing just above the top of the concrete surface pad to prevent water from accumulating and freezing inside the protective casing around the well riser. A cap shall be placed on the well riser to prevent tampering or the entry of foreign materials, and a lock shall be installed on the protective casing to provide security. If the wells are located in an area that receives traffic, a minimum of three bumper guards consisting of steel pipes three to four inches in diameter and a minimum of five-feet length should be installed. The bumper guards should be installed to a minimum depth of two feet below the ground surface in a concrete footing and extend a minimum of three feet above ground surface. The pipes should be filled with concrete to provide additional strength. The pipes should be painted a bright color to reduce the possibility of vehicular damage.

If flush-mounted completions are required (e.g., in active roadway areas), a protective structure such as a utility vault or meter box should be installed around the well casing. In addition, measures should be taken to prevent the accumulation of surface water in the protective structure and around the well intake. These measures should include outfitting the protective structure with a steel lid or manhole cover that has a rubber seal or gasket, and ensuring that the bond between the cement surface seal and the protective structure is watertight.

X.D WELL ABANDONMENT

Wells are usually abandoned when they are no longer required in the monitoring network or when they are damaged beyond repair. The goal of well abandonment is to seal the borehole in such a manner that the well cannot act as a conduit for migration of contaminants from the ground surface to the aquifer or between aquifers. To properly abandon a well, the preferred method is to completely remove the well casing and screen from the borehole, clean out the borehole, and backfill with a cement or bentonite grout, neat cement, or concrete. The well abandonment procedure must also comply with current EPA well abandonment guidance.

For wells with small diameter casing, abandonment shall be accomplished by overdrilling the well with a large diameter hollow-stem auger. After the well has been overdrilled, the well casing and grout can be lifted out of the ground with a drill rig, and the remaining filter pack can be drilled out. The open borehole can then be pressure grouted (via the tremie pipe method)

from the bottom of the borehole to the ground surface. After the grout has cured, the top two ft of the borehole shall be filled with concrete to insure a secure surface seal.

Several other well abandonment procedures are available for wells with larger diameter screens and casings. One method is to force a drill stem with a tapered wedge assembly or a solid-stem auger into the well casing and pull the casing out of the ground. However, if the casing breaks or the well cannot be pulled from the ground, the well will have to be grouted in place. To abandon a well in place, a tremie pipe shall be placed at the lowest point in the well (at the bottom of the screen or in the well sump). The entire well is then pressure grouted from the bottom of the well upward. The pressurized grout will be forced out through the well screen into the filter pack and up the inside of the well casing sealing off all breaks and holes in the casing. Once the well is grouted, the casing is cut off even with the ground surface and covered with concrete.

If a PVC well cannot be abandoned due to internal casing damage (e.g., the tremie pipe cannot be extended to the bottom of the screen), it may be necessary to drill out the casing with a roller cone or drag bit using the wet rotary drilling method, or grind out the casing using a solid-stem auger equipped with a carbide tooth bit. Once the casing is removed, the open borehole can be cleaned out and pressure grouted from the bottom of the borehole upward.

X.E DOCUMENTATION

All information on the design, construction, and development of each monitoring well shall be recorded and presented on a boring log, a well construction log, and well construction diagram. The well construction log and well construction diagram shall include the following information:

- Well name/number;
- Date/time of well construction;
- Borehole diameter and well casing diameter;
- Well depth;
- Casing length;
- Casing materials;
- Casing and screen joint type;
- Screened interval(s);
- Screen materials;
- Screen slot size and design;
- Filter pack material and size;
- Filter pack volume (calculated and actual);
- Filter pack placement method;
- Filter pack interval(s);
- Annular sealant composition;

- Annular sealant placement method;
- Annular sealant volume (calculated and actual);
- Annular sealant interval(s);
- Surface sealant composition;
- Surface seal placement method;
- Surface sealant volume (calculated and actual);
- Surface sealant interval;
- Surface seal and well apron design and construction;
- Well development procedure and turbidity measurements;
- Well development purge volume(s) and stabilization parameter measurements;
- Type and design and construction of protective casing;
- Well cap and lock;
- Ground surface elevation;
- Survey reference point elevation on well casing;
- Top of monitoring well casing elevation; and
- Top of protective steel casing elevation.

XI. REPORTING REQUIREMENTS

XI.A GENERAL

The purpose of this section (XI) is to provide the reporting requirements and report formats for corrective action activities at all SWMUs, AOCs, canyons, and watershed aggregates required under this Consent Order. This section (XI) is not intended to provide reporting requirements for every potential corrective action conducted at the Facility; therefore, the formats for all types of reports are not presented below. The described formats include the general reporting requirements and formats for site-specific investigation work plans, investigation reports, periodic monitoring reports, risk assessment reports, and corrective measures evaluations. The Respondents shall generally consider the reports to be the equivalents of RFI work plans, RFI reports, periodic monitoring reports, risk assessments, CMS plans, and CMS reports, for the purposes of RCRA compliance and the Department's fee assessments. The Respondents shall include detailed, site-specific requirements in all SWMU, AOC, canyon, and watershed aggregate investigation work plans, investigation reports, monitoring reports, and corrective measures evaluations. All plans and reports shall be prepared with technical and regulatory input from the Department. All work plans and reports shall be submitted to the Department in the form of one electronic copy and two paper copies.

The reporting requirements listed in this section (XI) do not include all sections that may be necessary to complete each type of report listed. The Respondents or the Department may determine that additional sections may be needed to address additional site-specific issues or information collected during corrective action or monitoring activities not listed below. However, the Respondents must submit variations of the general report format and the formats for reports not listed in this section (XI) in outline form to the Department for approval prior to submittal of the reports. The Department will approve or disapprove, in writing, the proposed report outline within sixty (60) days of receipt of the outline. If the Department disapproves the report outline, the Department will notify the Respondents, in writing, of the outline's deficiencies and will specify a date for submittal of a revised report outline. All reports submitted by the Respondents shall follow the general approach and limitations for data presentation described in this section (XI).

XI.B INVESTIGATION WORK PLAN

The Respondents shall prepare work plans for site investigations or corrective action activities at the Facility using the general outline below. The minimum requirements for describing proposed activities within each section are included. All research, locations, depths and methods of exploration, field procedures, analytical results, data collection methods, and schedules shall be included in each work plan. In general, interpretation of data acquired during previous investigations shall be presented only in the background sections of the work plans. The other text sections of the work plans shall be reserved for presentation of anticipated site-specific activities and procedures relevant to the project. The general work plan outline is described below.

XI.B.1 Title Page

The title page shall include the type of document; Facility name; TA designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible DOE and University of California (or other co-operator) representative shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 C.F.R. 270.11(d)(1).

XI.B.2 Executive Summary (Abstract)

The executive summary or abstract shall provide a brief summary of the purpose and scope of the investigation to be conducted at the subject site. The Facility, SWMU or AOC name, site name, any other unit name, location, and TA designation shall be included in the executive summary.

XI.B.3 Table of Contents

The table of contents shall list all text sections, tables, figures, and appendices or attachments included in the work plan. The corresponding page numbers for the titles of each section of the work plan shall be included in the table of contents.

XI.B.4 Introduction

The introduction shall include the Facility name, TA designation, unit location, and unit status (e.g., closed, corrective action). General information on the current site usage and status shall be included in this section. A brief description of the purpose of the investigation and the type of site investigation to be conducted shall be provided in this section.

XI.B.5 Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity since 1940, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features. The locations of pertinent subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in the background summary and labeled on the figure, unless none exist.

This section shall identify potential receptors, including groundwater, and include a brief summary of the type and characteristics of all waste and all contaminants managed or released at the site, the known and possible sources of contamination, the history of releases or discharges of contamination, and the known extent of contamination. This section shall include brief summaries of results of previous investigations including references to pertinent figures, data summary tables, and text in previous reports. At a minimum, detections of contaminants encountered during previous investigations shall be presented in table format, with an accompanying figure showing sample locations. References to previous reports shall include page, table, and figure numbers for referenced information. Summary data tables and site plans

showing relevant investigation locations shall be included in the Tables and Figures sections of the document, respectively.

XI.B.6 Site Conditions

XI.B.6.a Surface Conditions

A section on surface conditions shall provide a detailed description of current site topography, features and structures including a description of topographic drainages, man-made drainages, vegetation, erosional features, and basins. It shall also include a detailed description of current site usage and any current operations at the site. In addition, descriptions of features located in surrounding sites that may have an impact on the subject site regarding sediment transport, surface water runoff, or contaminant fate and transport shall be included in this section.

XI.B.6.b Subsurface Conditions

A section on subsurface conditions shall provide a brief, detailed description of the site conditions observed during previous subsurface investigations, including relevant soil horizons, stratigraphy, presence of groundwater, and other relevant information. A site plan showing the locations of all borings and excavations advanced during previous investigations shall be included in the Figures section of the work plan. A brief description of the anticipated stratigraphic units that may be encountered during the investigation may be included in this subsection if no previous investigations have been conducted at the site.

XI.B.7 Scope of Activities

A section on the scope of activities shall briefly describe a list of all anticipated activities to be performed during the investigation including background information research, health and safety requirements that may affect or limit the completion of tasks, drilling, test pit or other excavations, well construction, field data collection, survey data collection, chemical analytical testing, aquifer testing, remediation system pilot tests, and IDW storage and disposal.

XI.B.8 Investigation Methods

A section on investigation methods shall provide a description of all anticipated locations and methods for conducting the activities to be performed during the investigation. This section shall include research methods, health and safety practices that may affect the completion of tasks, drilling methods, test pit or other excavation methods, sampling intervals and methods, well construction methods, field data collection methods, geophysical and land survey methods, field screening methods, chemical analytical testing, materials testing, aquifer testing, pilot tests, and other proposed investigation and testing methods. This information may also be summarized in table format, if appropriate.

XI.B.9 Monitoring And Sampling Program

A section on monitoring and sampling shall provide a description of the groundwater, ambient air, subsurface vapor, remediation system, engineering controls, and other monitoring and sampling programs currently being implemented at the site.

XI.B.10 Schedule

A section shall set forth the anticipated schedule for completion of field investigation, pilot testing, and monitoring and sampling activities. In addition, this section shall set forth a schedule for submittal of reports and data to the Department including a schedule for submitting all status reports and preliminary data.

XI.B.11 Tables

The following summary tables may be included in the investigation work plans, if previous investigations have been conducted at the site. Data presented in the tables shall include information on dates of data collection, analytical methods, detection limits, and significant data quality exceptions. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. Summaries of regulatory criteria, background, and applicable cleanup levels (may be included in the analytical data tables instead of as separate tables).
2. Summaries of historical field survey location data.
3. Summaries of historical field screening and field parameter measurements of soil, rock, sediments, groundwater, surface water, and air quality data.
4. Summaries of historical soil, rock, or sediment laboratory analytical data shall include the analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.
5. Summaries of historical groundwater elevation and depth to groundwater data. The table shall include the monitoring well depths, the screened intervals in each well, and the dates and times measurements were taken.
6. Summaries of historical groundwater laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.
7. Summary of historical surface water laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.
8. Summary of historical air sample screening and chemical analytical data. The data tables shall include the screening instruments used, laboratory analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.

9. Summary of historical pilot or other test data, if applicable, including units of measurement and types of instruments used to obtain measurements.

XI.B.12 Figures

The following figures shall be included with each investigation work plan for each site, including presentation of data where previous investigations have been conducted. All figures must include an accurate bar scale and a north arrow. An explanation shall be included on each figure for all abbreviations, symbols, acronyms, and qualifiers. All maps shall contain a date of preparation.

1. A vicinity map showing topography and the general location of the site relative to surrounding features and properties.
2. A site plan that presents pertinent site features and structures, underground utilities, well locations, and remediation system locations and details. Off-site well locations and other relevant features shall be included on the site plan, if appropriate. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.
3. Figures showing historical and proposed soil boring or excavation locations and sampling locations.
4. Figures presenting historical soil sample field screening and laboratory analytical data.
5. Figures presenting the locations of all existing and proposed borings and vapor monitoring well locations.
6. Figures showing all existing and proposed wells and piezometers, presenting historical groundwater elevation data, and indicating groundwater flow directions.
7. Figures presenting historical groundwater laboratory analytical data, if applicable. The chemical analytical data corresponding to each sampling location can be presented in tabular form on the figure or as an isoconcentration map.
8. Figures presenting historical and proposed surface water sample locations and field measurement data, if applicable.
9. Figures presenting historical surface water laboratory analytical data, if applicable.
10. Figures showing historical and proposed air or vapor sampling locations and presenting historical air quality data.
11. Figures presenting historical pilot and other testing locations and data, where applicable, including site plans and graphic data presentation.
12. Figures presenting geologic cross-sections, based on outcrop and borehole data acquired during previous investigations.

XI.B.13 Appendices

A description of IDW management shall be included as an appendix to the investigation work plan. The results of historical investigations required in this Consent Order shall be submitted

with the investigation work plan as a separate document. Additional appendices may be necessary to present additional data or documentation not listed above.

XI.C INVESTIGATION REPORT

The Respondents shall prepare investigation reports at the Facility using the general outline below. The Investigation Report shall be the reporting mechanism for presenting the results of completed Investigation Work Plans. This section (XI.C) describes the minimum requirements for reporting on site investigations. All data collected during each site investigation event in the reporting period shall be included in the reports. In general, interpretation of data shall be presented only in the background, conclusions and recommendations sections of the reports. The other text sections of the reports shall be reserved for presentation of facts and data without interpretation or qualifications. The general report outline is provided below.

XI.C.1 Title Page

The title page shall include the type of document; Facility name; TA designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible DOE and University of California (or co-operator) representative shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 C.F.R. 270.11(d)(1).

XI.C.2 Executive Summary (Abstract)

The executive summary or abstract shall provide a brief summary of the purpose, scope, and results of the investigation; site names; location; and TA designation. In addition, this section shall include a brief summary of conclusions based on the investigation data collected and recommendations for future investigation, monitoring, remedial action or site closure.

XI.C.3 Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the report. The corresponding page numbers for the titles of each section of the report shall be included in the table of contents.

XI.C.4 Introduction

The introduction section shall include the Facility name, TA designation, unit location, and unit status (e.g., closed, corrective action). General information on the site usage and status shall be included in this section. A brief description of the purpose of the investigation, the type of site investigation conducted, and the type of results presented in the report also shall be provided in this section.

XI.C.5 Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity since the

1940s, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features. The locations of any subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in the background summary and labeled on the figure, as appropriate. In addition, this section shall include a brief summary of the possible sources of contamination, the history of releases or discharges of contamination, the known extent of contamination, and the results of previous investigations including references to previous reports. The references to previous reports shall include page, table, and figure numbers for referenced information. A site plan, showing relevant investigation locations, and summary data tables shall be included in the Figures and Tables sections of the document, respectively.

XI.C.6 Scope of Activities

A section on the scope of activities shall briefly describe all activities performed during the investigation event including background information research, implemented health and safety measures that affected or limited the completion of tasks, drilling, test pit or other excavation methods, well construction methods, field data collection, survey data collection, chemical analytical testing, aquifer testing, remediation system pilot tests, and IDW storage or disposal.

XI.C.7 Field Investigation Results

A section shall provide a summary of the procedures used and the results of all field investigation activities conducted at the site including the dates that investigation activities were conducted, the type and purpose of field investigation activities performed, field screening measurements, logging and sampling results, pilot test results, construction details, and conditions observed. Field observations or conditions that altered the planned work or may have influenced the results of sampling, testing, and logging shall be reported in this section. The following sections shall be included.

XI.C.7.a Surface Conditions

A section on surface conditions shall describe current site topography, features, and structures including topographic drainages, man-made drainages, vegetation, and erosional features. It shall also include a description of current site uses and any operations at the site. In addition, descriptions of features located in surrounding sites that may have an impact on the subject site regarding sediment transport, surface water runoff, or contaminant transport shall be included in this subsection.

XI.C.7.b Exploratory Drilling or Excavation Investigations

A section shall describe the locations, methods, and depths of subsurface explorations. The description shall include the types of equipment used, the logging procedures, the soil or rock classification system used to describe the observed materials, exploration equipment decontamination procedures, and conditions encountered that may have affected or limited the investigation.

A description of the site conditions observed during subsurface investigation activities shall be included in this section, including soil horizon and stratigraphic information. Site plans showing the locations of all borings and excavations shall be included in the Figures section of the report. Boring and test pit logs for all exploratory borings and test pits shall be presented in an appendix or attachment to the report.

XI.C.7.c Exploratory and Monitoring Well Boring Geophysical Logging

A section shall describe the methods, dates of measurement, depth intervals measured, and the results of geophysical logging. The relative merits and limitations of each geophysical logging method employed shall be discussed, along with any field conditions or instrument malfunctions that occurred that may have affected the results of the geophysical logging.

XI.C.7.d Subsurface Conditions

A section on subsurface conditions shall describe known subsurface lithology and structures, based on observations made during the current and previous subsurface investigations, including interpretation of geophysical logs and as-built drawings of man-made structures. A description of any known locations of pipelines and utility lines and observed geologic structures shall also be included in this section. A site plan showing boring and excavation locations and the locations of the site's above- and below-ground structures shall be included in the Figures section of the report. In addition, cross-sections shall be constructed, if appropriate, to provide additional visual presentation of site or regional subsurface conditions.

XI.C.7.e Monitoring Well Construction and Boring or Excavation Abandonment

A section shall describe the methods and details of monitoring well construction and the methods used to abandon or backfill exploratory borings and excavations. The description shall include the dates of well construction, boring abandonment, or excavation backfilling. In addition, well construction diagrams shall be included in an appendix or attachment with the associated boring logs for monitoring well borings. The Respondents may submit well abandonment reports as an appendix to the investigation report.

XI.C.7.f Groundwater Conditions

A section shall describe groundwater conditions observed beneath the subject site and relate local groundwater conditions to regional groundwater conditions. A description of the depths to water, aquifer thickness, and groundwater flow directions shall be included in this section for alluvial groundwater, shallow perched groundwater, intermediate perched groundwater, and regional groundwater, as appropriate to the investigation. Figures showing well locations, surrounding area, and groundwater elevations and flow directions for each hydrologic zone shall be included in the Figures section of the report.

XI.C.7.g Surface Water Conditions

A section shall describe surface water conditions and include a description of surface water runoff, drainage, surface water sediment transport, and contaminant transport in surface water as suspended load and as a dissolved phase in surface water via natural and man-made drainages, if applicable. A description of contaminant fate and transport shall be included, if appropriate.

XI.C.7.h Surface Air and Subsurface Vapor Conditions

A section shall describe surface air and subsurface vapor monitoring and sampling methods used during the site investigation. It shall also describe observations made during the site investigation regarding subsurface flow pathways and the subsurface air-flow regime.

XI.C.7.i Materials Testing Results

A section shall discuss the materials testing results, such as core permeability testing, grain size analysis, or other materials testing results. Sample collection methods, locations, and depths shall also be included. Corresponding summary tables shall be included in the Tables section of the report.

XI.C.7.j Pilot Testing Results

A section shall discuss the results of any pilot tests. Pilot tests are typically conducted after initial subsurface investigations are completed and the need for additional investigation or remediation has been evaluated. Pilot tests, including aquifer tests and remediation system pilot tests, shall be addressed through separate work plans and pilot test reports. The format for pilot test work plans and reports shall be approved by the Department prior to submittal.

XI.C.8 Regulatory Criteria

A section shall set forth the cleanup standards, risk-based screening levels, and risk-based cleanup goals for each pertinent medium at the subject site. The appropriate cleanup levels for each site shall be included if site-specific levels have been established at separate Facility sites or units. A table summarizing the applicable cleanup standards or levels or inclusion of applicable cleanup standards or levels in the data tables shall be included as part of the document. The risk assessment, if conducted, shall be presented in a separate document or in an appendix to this report. If cleanup or screening levels calculated in a Department-approved risk evaluation are employed, the risk evaluation document shall be referenced and shall include pertinent page numbers for referenced information.

XI.C.9 Site Contamination

A section shall provide a description of sampling intervals and methods for detection of surface and subsurface contamination in soils, rock, sediments, groundwater, and surface water, and as vapor-phase contamination. Only factual information shall be included in this section. Interpretation of the data shall be reserved for the summary and conclusions sections of the report. Tables summarizing all sampling, testing, and screening results for detected

contaminants shall be prepared in a format approved by the Department. The tables shall be presented in the Tables section of the report.

XI.C.9.a Soil, Rock, and Sediment Sampling

A section shall describe the sampling of soil, rock, and sediment. It shall include the dates, locations and methods of sample collection; sampling intervals; sample logging methods; screening sample selection methods; and laboratory sample selection methods including the collection depths for samples submitted for laboratory analyses. A site plan showing the sample locations shall be included in the Figures section of the report.

XI.C.9.b Soil, Rock, and Sediment Sample Field Screening Results

A section shall describe the field screening methods used during the investigation and the field screening results. Field screening results also shall be presented in summary tables in the Tables section of the document. The limitations of field screening instrumentation and any conditions that influenced the results of field screening shall be discussed in this subsection.

XI.C.9.c Soil, Rock, and Sediment Sampling Analytical Results

A section shall summarize the results of laboratory analysis for soil, rock, and sediment samples. It shall also describe the analytical methods used and provide a comparison of the analytical results to background levels, cleanup standards, or established cleanup levels for the site. The laboratory results also shall be presented in summary tables in the Tables section of the document. Field conditions and sample collection methods that could potentially affect the analytical results shall be described in this section. If appropriate, soil analytical data shall be presented with sample locations on a site plan and included in the Figures section of the report.

XI.C.9.d Groundwater Sampling

A section on groundwater sampling shall describe the dates, locations, depths, and methods of sample collection; methods for sample logging; and methods for screening and laboratory sample selection. A map showing all site and surrounding area well locations shall be included in the Figures section of the report.

XI.C.9.e Groundwater General Chemistry

A section on the general groundwater chemistry shall describe the results of measurement of field purging parameters and field analytical measurements. Field parameter measurements and field analytical results also shall be presented in summary tables in the Tables section of the document. The limitations of field measurement instrumentation and any conditions that may have influenced the results of field screening shall be discussed in this section. As determined by the Respondents and the Department, relevant water chemistry concentrations shall be presented as data tables or as isoconcentration contours on a map included in the Figures section of the report.

XI.C.9.f Groundwater Chemical Analytical Results

A section shall summarize the results of groundwater chemical analyses. It shall describe the groundwater chemical analytical methods and analytical results. It shall also provide a comparison of the data to cleanup standards or established cleanup levels for the site. The rationale or purpose for altering or modifying the groundwater sampling program outlined in the site investigation work plan shall also be provided in this section. Field conditions shall be described in this section that may have affected the analytical results during sample collection. Tables summarizing the groundwater laboratory, field, and field sample QA/QC chemical analytical data; applicable cleanup levels; and modifications to the groundwater sampling program shall be provided in the Tables section of the report. Relevant contaminant concentrations shall be presented as individual analyte concentrations, data tables, or as isoconcentration contours on a map included in the Figures section of the report.

XI.C.9.g Surface Water Sampling

A section shall describe the surface water sampling and shall include the dates, times, locations, depths, and methods of sample collection. It shall also describe methods for sample logging, sample-screening methods, and laboratory sample selection methods. A map showing all surface-water sampling locations shall be included in the Figures section of the report.

XI.C.9.h Surface Water General Chemistry

A section on the surface water general chemistry shall describe the results of measurement of field parameters and field analytical measurements. Field parameter measurements and field analytical results also shall be presented in summary tables in the Tables section of the document. The limitations of field measurement instrumentation and any conditions that influenced the results of field screening shall be discussed in this section. Relevant water chemistry concentrations shall be presented as data tables on a map included in the Figures section of the report.

XI.C.9.i Surface Water Chemical Analytical Results

A section shall summarize the results of surface water chemical analyses. It shall describe the analytical methods and analytical results, and provide a comparison of the data to the cleanup standards or established background or cleanup levels for the site. The rationale or purpose for altering or modifying the surface-water sampling program outlined in the site investigation work plan also shall be provided in this section. Field conditions that may have affected the analytical results during sample collection shall be described in this section. Tables summarizing the surface water laboratory, field, and analytical field sample QA/QC analytical data; applicable cleanup levels; and modifications to the surface-water sampling program shall be provided in the Tables section of the report. Relevant contaminant concentrations shall be presented as individual analyte concentrations or as data tables on a map included in the Figures section of the report.

XI.C.9.j Air and Subsurface Vapor Sampling

A section shall describe the air and subsurface vapor sampling. It shall describe the dates, locations, depths or elevations above ground surface, methods of sample collection, methods for sample logging, and methods for laboratory sample selection. A map showing all air sampling locations shall be provided in the Figures section of the report.

XI.C.9.k Air and Subsurface Vapor Field Screening Results

A section shall describe the air and subsurface vapor field screening results. It shall describe the field screening methods used for ambient air and subsurface vapors during the investigation and the field screening results. Field screening results shall also be presented in summary tables in the Tables section of the report. The locations of ambient air and subsurface vapor screening sample collection shall be presented on a site plan included in the Figures section of the report. The limitations of field screening instrumentation and any conditions that influenced the results of field screening shall be discussed in this section.

XI.C.9.l Air and Subsurface Vapor Laboratory Analytical Results

A section shall describe the results of air and subsurface vapor laboratory analysis. It shall describe the air sampling laboratory analytical methods and analytical results, and provide a comparison of the data to emissions standards or established cleanup or emissions levels for the site. The rationale or purpose for altering or modifying the air monitoring or sampling program outlined in the site investigation work plan also shall be provided in this section. Field conditions that may have affected the analytical results during sample collection shall be described in this section. Tables summarizing the air sample laboratory, field, and analytical field sample QA/QC data; applicable cleanup levels or emissions standards; and modifications to the air sampling program shall be provided in the Tables section of the report. Relevant contaminant concentrations shall be presented as individual analyte concentrations, data tables, or as isoconcentration contours on a map included in the Figures section of the report.

XI.C.10 Conclusions

A section shall provide a brief summary of the investigation activities and a discussion of the conclusions of the investigation conducted at the site. In addition, this section shall provide a comparison of the results to applicable cleanup or screening levels, and to relevant historical investigation results and analytical data. Potential receptors, including groundwater, shall be identified and discussed. An explanation shall be provided with regard to data gaps. A risk assessment may be included as an appendix to the investigation report; however, the risk assessment shall be presented in the Risk Assessment format described in Section XI.E of this document. References to the risk assessment shall be presented only in the summary and conclusions sections of the Investigation Report.

XI.C.11 Recommendations

A section shall discuss the need for further investigation, corrective measures, risk assessment and monitoring, or recommendations for corrective action completed, based on the conclusions

provided in the Conclusions section. It shall include explanations regarding additional sampling, monitoring, and site closure. A corresponding schedule for further action regarding the site shall also be provided. No action recommendations shall include the anticipated schedule for submittal of a petition for a permit modification.

XI.C.12 Tables

A section shall provide the following summary tables. With prior approval from the Department, the Respondents may combine one or more of the tables. Data presented in the tables shall include the current data, dates of data collection, analytical methods, detection limits, and significant data quality exceptions. The summary analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. Tables summarizing regulatory criteria, background levels, and applicable cleanup levels (this information may be included in the analytical data tables instead of as separate tables).
2. Tables summarizing field survey location data. Separate tables shall be prepared for well locations and individual medium sampling locations except where the locations are the same for more than one medium.
3. Tables summarizing field screening and field parameter measurements of soil, rock, sediments, groundwater, surface water, and air quality data.
4. A table summarizing soil, rock, and/or sediment laboratory analytical data. It shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
5. A table summarizing the groundwater elevations and depths to groundwater. The table shall include the monitoring well depths and the screened intervals in each well.
6. A table summarizing the groundwater laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
7. A table summarizing the surface water laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
8. A table summarizing the air sample screening and laboratory analytical data. The data tables shall include the screening instruments used, laboratory analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
9. Tables summarizing the pilot test data, if applicable, including units of measurement and types of instruments used to obtain measurements.
10. A table summarizing any materials test data.

XI.C.13 Figures

A section shall provide the following figures. All figures shall include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers. All maps shall have a date.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features and properties.
2. A site plan that presents any pertinent site features and structures, underground utilities, well locations, and remediation system location(s) and details. Off-site well locations and other relevant features shall be included on the site plan. Additional site plans may be required to present the locations of relevant off-site well locations, structures and features.
3. Figures showing boring or excavation locations and sampling locations.
4. Figures presenting soil sample field screening and laboratory analytical data.
5. Figures displaying the locations of all newly installed and existing wells and borings.
6. Figures presenting monitoring well and piezometer locations, groundwater elevation data, and groundwater flow directions.
7. Figures presenting groundwater laboratory analytical data, including any past data requested by the Department. The laboratory analytical data corresponding to each sampling location may be presented in table form on the figure or as an isoconcentration map.
8. Figures presenting surface water sample locations and field measurement data including any past data requested by the Department.
9. Figures presenting surface water laboratory analytical data including any past data requested by the Department. The laboratory analytical data corresponding to each sampling location may be presented in table form on the figure.
10. Figures showing air sampling locations and presenting air quality. The field screening or laboratory analytical data corresponding to each sampling location may be presented in table form on the figure or as an isoconcentration map.
11. Figures presenting geologic cross-sections based on outcrop and borehole data.
12. Figures presenting pilot test locations and data, where applicable, including site plans or graphic data presentation.

XI.C.14 Appendices

Each investigation report shall include the following appendices. Additional appendices may be necessary to present data or documentation not listed below.

XI.C.14.a Field Methods

An appendix shall provide detailed descriptions of the methods used to acquire field measurements of each medium that was surveyed or tested during the investigation. This appendix shall include exploratory drilling or excavation methods, the methods and types of instruments used to obtain field screening, field analytical or field parameter measurements, instrument calibration procedures, sampling methods for each medium investigated, decontamination procedures, sample handling procedures, documentation procedures, and a description of field conditions that affected procedural or sample testing results. Methods of measuring and sampling during pilot tests shall be reported in this appendix, if applicable. Geophysical logging methods shall be discussed in a separate section of this appendix. IDW storage and disposal methods shall also be discussed in this appendix. Copies of IDW disposal documentation shall be provided in a separate appendix.

XI.C.14.b Boring/Test Pit Logs and Well Construction Diagrams

An appendix shall provide boring logs, test pit logs, or other excavation logs, and well construction details. In addition, a key to symbols and a soil or rock classification system shall be included in this appendix. Geophysical logs shall be provided in a separate section of this appendix.

XI.C.14.c Analytical Program

An appendix shall discuss the analytical methods, a summary of data quality objectives, and the data quality review procedures. A summary of data quality exceptions and their effect on the acceptability of the field and laboratory analytical data with regard to the investigation and the site status shall be included in this appendix along with references to the case narratives provided in the laboratory reports.

XI.C.14.d Analytical Reports

An appendix shall provide the contract laboratory final analytical data reports generated for the investigation. The reports shall include all chain-of-custody records and Level II QA/QC results provided by the laboratory. The final laboratory reports and data tables shall be provided electronically in a format approved by the Department. Paper copies (or electronically scanned in PDF format) of all chain-of-custody records shall be provided with the reports.

XI.C.14.e Other Appendices

Other appendices containing additional information shall be included as required by the Department or as otherwise appropriate.

XI.D PERIODIC MONITORING REPORT

The Respondents shall use the following guidance for preparing periodic monitoring reports. The reports shall present the reporting of periodic groundwater, surface water, vapor, and remediation system monitoring at the Facility. The following sections provide a general outline

for monitoring reports, and also provide the minimum requirements for reporting for specific Facility sites, watersheds, and regional monitoring. All data collected during each monitoring and sampling event in the reporting period shall be included in the reports. In general, interpretation of data shall be presented only in the background, conclusions, and recommendations sections of the reports. The other text sections of the reports shall be reserved for presentation of facts and data without interpretation or qualifications.

XI.D.1 Title Page

The title page shall include the type of document; Facility name; TA designation; SWMU or AOC name, site, watershed, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible DOE and University of California (or co-operator) representative shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 C.F.R. 270.11(d)(1).

XI.D.2 Executive Summary (Abstract)

The executive summary or abstract shall provide a brief summary of the purpose, scope, and results of the monitoring conducted at the subject site(s) during the reporting period. The watershed, specific sites or areas , SWMU, AOC and site name, location, and TA designation shall be included in the executive summary. In addition, this section shall include a brief summary of conclusions based on the monitoring data collected.

XI.D.3 Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the report. The corresponding page numbers for the titles of each section of the report shall be included in the table of contents.

XI.D.4 Introduction

The introduction section shall include the Facility name, TA designation, unit location, and unit status (e.g. closed, corrective action). General information on the site usage and status shall be included in this section. A brief description of the purpose of the monitoring, type of monitoring conducted, and the type of results presented in the report also shall be provided in this section.

XI.D.5 Scope of Activities

A section on the scope of activities shall briefly describe all activities performed during the monitoring event or reporting period including field data collection, analytical testing, remediation system monitoring, if applicable, and purge/decontamination water storage and disposal.

XI.D.6 Regulatory Criteria

A section on regulatory criteria shall provide information regarding applicable cleanup standards, risk-based screening levels and risk-based cleanup goals for the subject site. A separate table

summarizing the applicable screening levels or standards or inclusion of the applicable cleanup standards or screening levels in the data tables can be substituted for this section. The appropriate cleanup or screening levels for each site shall be included, if site-specific levels have been established at separate sites. Risk-based evaluation procedures, if used to calculate cleanup or screening levels, must either be included as an attachment or referenced. The specific document and page numbers must be included for all referenced materials.

XI.D.7 Monitoring Results

A section shall provide a summary of the results of monitoring conducted at the site. This section shall include the dates and times that monitoring was conducted, the measured depths to groundwater, directions of groundwater flow, field air and water quality measurements, contaminant surveys, static pressures, field measurements, and a comparison to previous monitoring results. Field observations or conditions that may influence the results of monitoring shall be reported in this section. Tables summarizing vapor-monitoring parameters, groundwater elevations, depths to groundwater measurements, and other field measurements can be substituted for this section. The tables shall include all information required in Section XI.D.11 below.

XI.D.8 Analytical Data Results

A section shall discuss the results of the chemical analyses. It shall provide the dates of sampling, the analytical methods, and the analytical results. It shall also provide a comparison of the data to previous results and to background levels, cleanup standards, or established cleanup levels for the site. The rationale or purpose for altering or modifying the monitoring and sampling program shall be provided in this section. A table summarizing the laboratory analytical data, QA/QC data, applicable cleanup levels, and modifications to the sampling program can be substituted for this section. The tables shall include all information required in Section XI.D.11 below.

XI.D.9 Remediation System Monitoring

A section shall discuss the remediation system monitoring. It shall summarize the remediation system's capabilities and performance. It shall also provide monitoring data, treatment system discharge sampling requirements, and system influent and effluent sample analytical results. The dates of operation, system failures, and modifications made to the remediation system during the reporting period shall also be included in this section. A summary table may be substituted for this section. The tables shall include all information required in Section XI.D.11 below.

XI.D.10 Summary

A summary section shall provide a discussion and conclusions of the monitoring conducted at the site. In addition, this section shall provide a comparison of the results to applicable cleanup levels, and to relevant historical monitoring and laboratory analytical data. An explanation shall be provided with regard to data gaps. A discussion of remediation system performance, monitoring results, modifications, if applicable, and compliance with discharge requirements

shall be provided in this section. Recommendations and explanations regarding future monitoring, remedial actions, or site closure, if applicable, shall also be included in this section.

XI.D.11 Tables

A section shall provide the following summary tables for the media sampled. With prior approval from the Department, the Respondents may combine one or more of the tables. Data presented in the tables shall include the current sampling and monitoring data plus data from the three previous monitoring events or, if data from less than three monitoring events is available, data acquired during previous investigations. Remediation system monitoring data also shall be presented. The dates of data collection shall be included in the tables. Summary tables may be substituted for portions of the text. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. A table summarizing the regulatory criteria (a Regulatory Criteria text section may be substituted for this table or the applicable cleanup levels may be included in the analytical data tables).
2. A table summarizing groundwater elevations and depths to groundwater data. The table shall include the monitoring well depths, the screened intervals in each well, and the dates and times of measurements.
3. A table summarizing field measurements of surface water quality data.
4. A table summarizing field measurements of vapor monitoring data (must include historical vapor monitoring data as described above).
5. A table summarizing field measurements of groundwater quality data (must include historical water quality data as described above).
6. A table summarizing vapor sample analytical data (must include historical vapor sample analytical data as described above).
7. A table summarizing surface water analytical data (must include historical surface water analytical data as described above).
8. A table summarizing groundwater analytical data (must include historical groundwater analytical data as described above).
9. A table summarizing remediation system monitoring data, if applicable (must include historical remediation system monitoring data as described above).

XI.D.12 Figures

The section shall include the following figures. All figures shall include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers. All figures shall have a date.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features or properties.

2. A site plan that presents pertinent site features and structures, well and piezometer locations, and remediation system location(s) and features. Off-site well locations and pertinent features shall be included on the site plan, if practical. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.
3. Figures presenting the locations of piezometer, monitoring and other well locations, groundwater elevation data, and groundwater flow directions.
4. Figures presenting groundwater analytical data for the current monitoring event. The analytical data corresponding to each sampling location may be presented as individual concentrations or in table form on the figure or as an isoconcentration map.
5. Figures presenting surface water sampling locations and analytical data for the current monitoring period.
6. Figures presenting vapor sampling locations and analytical data for the current monitoring event. The analytical data corresponding to each sampling location may be presented as individual concentrations or in table form on the figure or as an isoconcentration map.
7. Figures presenting geologic cross-sections based on outcrop and borehole data, if applicable.

XI.D.13 Appendices

Each monitoring report shall include the following appendices. Additional appendices may be necessary to present data or documentation not listed below.

XI.D.13.a Field Methods

An appendix shall include the methods used to acquire field measurements of groundwater elevations, vapor and water quality data, and vapor, surface water and groundwater samples. It shall include the methods and types of instruments used to measure depths to water, air or headspace parameters, flow measurements, and water quality parameters. In addition, decontamination, well purging techniques, well sampling techniques, and sample handling procedures shall be provided in this appendix. Methods of measuring and sampling remediation systems shall be reported in this section, if applicable. Purge and decontamination water storage and disposal methods shall also be presented in this appendix. Copies of purge and decontamination water disposal documentation shall be provided in a separate appendix.

XI.D.13.b Analytical Program

An appendix shall discuss the analytical program. It shall include the analytical methods, a summary of data quality objectives, and data quality review procedures. A summary of data quality exceptions and their effect on the acceptability of the analytical data with regard to the monitoring event and the site status shall be included in this appendix along with references to case narratives provided in the laboratory reports.

XI.D.13.c Analytical Reports

An appendix shall provide the analytical reports and shall include the contract laboratory final chemical analytical data reports generated during this reporting period. The reports must include all chain-of-custody records and Level II QA/QC results provided by the laboratory. The laboratory final reports and data tables shall be provided electronically in a format approved by the Department. Paper copies (or electronically scanned in PDF format) of all chain-of-custody records shall be provided with the reports.

XI.E RISK ASSESSMENT REPORT

The Respondents shall prepare risk assessment reports for sites requiring corrective action at the Facility using the format listed below. This section (XI.E) provides a general outline for risk assessments and also lists the minimum requirements for describing risk assessment elements. In general, interpretation of data shall be presented only in the Background, Conceptual Site Model, and Conclusions and Recommendations sections of the reports. The other text sections of the Risk Assessment report shall be reserved for presentation of sampling results from all investigations, conceptual and mathematical elements of the risk assessment, and presentations of toxicity information and screening values used in the risk assessment. Section XI.E.8 and subsequent sections should be presented in separate sections for the human health and ecological risk assessments, but the general risk assessment outline applicable to both sections is provided below.

XI.E.1 Title Page

The title page shall include the type of document; Facility name; TA designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible DOE and University of California (or co-operator) representative shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 C.F.R. 270.11(d)(1).

XI.E.2 Executive Summary (Abstract)

The executive summary or abstract section shall provide a brief summary of the purpose and scope of the risk assessment of the subject site. The Executive Summary shall also briefly summarize the conclusions of the risk assessment. The Facility, SWMU, AOC, and site names; location; and TA designation shall be included in the executive summary.

XI.E.3 Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the risk assessment. The corresponding page numbers for the titles of each unit of the report shall be included in the table of contents.

XI.E.4 Introduction

The introduction section shall include the Facility name, TA designation, unit location, and unit status (e.g., closed, corrective action). General information on the current site usage and status shall be included in this section.

XI.E.5 Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity since 1940, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features.

XI.E.5.a Site Description

A section shall describe current site topography, features and structures including topographic drainages, man-made drainages, erosional features, current site uses, and other data relevant to assessing risk at the site. Depth to groundwater and direction of groundwater flow shall be included in this section. The presence and location of surface water bodies such as springs or wetlands shall be noted in this section. Photographs of the site may be incorporated into this section. Ecological features of the site shall be described here, including type and amount of vegetative cover, observed and expected wildlife receptors, and level of disturbance of the site. The LANL ecological checklist for the site may be included as an appendix or attachment to the document and its inclusion may meet the requirement to describe the ecological features of the site. A topographical map of the site and vicinity of the site showing habitat types, boundaries of each habitat, and any surface water features shall be included in the Figures section of the document.

XI.E.5.b Sampling Results

A section shall discuss the results of the sampling at the site. It shall include a description of the history of releases of contaminants, the known and possible sources of contamination, and the vertical and lateral extent of contamination present in each medium. This section shall include summaries of sampling results of all investigations including site plans (included in the Figures section of the report) showing locations of detected contaminants. This section shall reference pertinent figures, data summary tables, and references in previous reports. References to previous reports shall include page, table, and figure numbers for referenced information. Summaries of sampling data shall include for each constituent: the maximum value detected, the detection limit, the 95 percent upper confidence level (UCL) of the mean value detected (if applicable to the data set), and whether the 95 percent UCL of the mean was calculated based on a normal or lognormal distribution. Background values used for comparison to inorganic constituents at the site shall be presented here. The table of background values should appear in the Tables section of the document and include actual values used as well as the origin of the values (e.g. Facility-wide, UCL, upper tolerance level (UTL)). This section shall also include a discussion of how “non-detect” sample results were handled in the averaging of data.

XI.E.6 Conceptual Site Model

A section shall present the conceptual site model. It shall include information on the expected fate and transport of contaminants detected at the site. This section shall provide a list of all sources of contamination at the site. Sources that are no longer considered to be ongoing but represent the point of origination for contaminants transported to other locations shall be included. The discussion of fate and transport shall address potential migration of each contaminant in each medium, potential breakdown products and their migration, and anticipated pathways of exposure for human or ecological receptors. Diagrammatic representations of the conceptual site model shall appear in the Figures section of the document.

For human health risk assessments, the conceptual site model shall include the current and reasonably foreseeable land use and residential land use for all risk assessments. All values for exposure parameters and the source of those values shall be included in table format and presented in the Tables section of the document.

Conceptual site models presented for ecological risk assessments shall identify assessment endpoints and measurement receptors for the site. The discussion of the model shall explain how the measurement receptors for the site are protective of the wildlife receptors identified by the Respondents in the Site Description section (see Section XI.E.5.a).

XI.E.7 Risk Screening Levels

A section shall present the actual screening values used for each contaminant for comparison to all human health and ecological risk screening levels. The Department's SSLs for residential and industrial soil shall be used to screen soil for human health using EPA's *Risk Assessment Guidance for Superfund (RAGS), Volume I, Part A, 1989*. For those contaminants not appearing on the Department's SSL table, the EPA Region 6 soil screening value adjusted to meet the Department's risk goal of 10^{-5} for total risk for carcinogens shall be used to screen the site for human health risks. Screening for ecological risk shall be conducted using the LANL Ecological Screening Levels (ESLs) if the LANL ESLs have received written approval from the Department. If the ESLs have not been approved by the Department or the LANL ESLs database does not contain a screening value for the receptor or contaminant of concern, the Respondents shall use U.S. EPA's ECO-SSLs, or derive a screening level using the methodology in the Department's "*Guidance for Assessing Ecological Risks Posed by Chemicals: Screening – Level Ecological Risk Assessment"* or in LANL's *"Screening Level Ecological Risk Assessment Methods"* (LA-UR99-1405). If no valid toxicological studies exist for a particular receptor or contaminant, the contaminant/receptor combination shall be addressed using qualitative methods. If a Department approved site-specific risk scenario is used for the human health risk assessment, this section shall include all toxicity information and exposure assessment equations used for the site-specific scenario as well as the sources for that information. Other regulatory levels applicable to screening the site, such as drinking water MCLs, shall also be included in this section.

XI.E.8 Risk Assessment Results

A section shall present all risk values, hazard quotients (HQ), and HIs for human health based on current and reasonably foreseeable future land use. Where the current or reasonably foreseeable future land use is not residential, risk values, HQs, and HIs for a residential land use scenario shall also be calculated and reported. The residential scenario shall be used for comparison purposes only, unless the land use becomes residential. This section shall also present the HQ and HI for each contaminant for each ecological receptor.

XI.E.8.a Uncertainty Analysis

A section shall include discussion of qualitative, semi-quantitative, and quantitative uncertainty in the risk assessment and estimate the potential impact of the various uncertainties.

XI.E.9 Conclusions and Recommendations

A section shall include the interpretation of the results of the risk assessment and any recommendations for future disposition of the site. This section may include additional information and considerations that the Respondents believe are relevant to the analysis of the site.

XI.E.10 Tables

A section shall provide the following summary tables, as appropriate. With prior approval from the Department, the Respondents may combine one or more of the tables. Data presented in the summary tables shall include information on detection limits and significant data quality exceptions. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. A table presenting background values used for comparison to inorganic constituents at the site. The table shall include actual values used as well as the origin of the values (Facility-wide, UCL, UTL, or maximum).
2. A table summarizing sampling data shall include, for each constituent, all detected values above background, the maximum value detected, the 95 percent UCL of the mean value detected (if applicable to the data set), and whether that 95 percent UCL of the mean was calculated based on a normal or lognormal distribution.
3. A table of all screening values used and the sources of those values.
4. A table presenting all risk values, HQs, and HIs under current and reasonably foreseeable future land use for human health.
5. If residential use is not a current or reasonably foreseeable future land use, a table presenting all risk values, HQs, and HIs under a residential land use scenario for human health shall be included for comparison purposes.
6. A table presenting the HQ and HI for each contaminant for each ecological receptor.
7. A table presenting values for exposure parameters and the source of the values.

XI.E.11 Figures

A section shall present the following figures for each site, as appropriate. With prior approval from the Department, the Respondents may combine one or more of the figures. All figures shall include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features or properties.
2. For human health risk assessments, a site plan that presents pertinent site features and structures, underground utilities, well locations, and remediation system location(s) and its details. Off-site well locations and other relevant features shall be included on the site plan if practical. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.
3. For ecological risk assessments, a topographical map of the site and vicinity of the site showing habitat types, boundaries of each habitat, and any surface water features.
4. Conceptual site model diagrams for both human health and ecological risk assessments.

XI.E.12 Appendices

Each risk assessment report shall include appendices containing supporting data. Appendices may include the results of statistical analyses of data sets and comparisons of data, LANL ecological checklists for the site, full sets of results of all sampling investigations at the site, or other data as appropriate.

XI.F CORRECTIVE MEASURES EVALUATION REPORT

The Respondents shall prepare corrective measures evaluations for sites requiring corrective measures using the format listed below. This section (XI.F) provides a general outline for corrective measures evaluations and also lists the minimum requirements for describing corrective measures when preparing these documents. All investigation summaries, site condition descriptions, corrective action goals, corrective action options, remedial options selection criteria, and schedules shall be included in the corrective measures evaluations. In general, interpretation of historical investigation data and discussions of prior interim activities shall be presented only in the background sections of the corrective measures evaluations. At a minimum, detections of contaminants encountered during previous site investigations shall be presented in the corrective measures evaluations in table format with an accompanying site plan showing sample locations. The other text sections of the corrective measures evaluations shall be reserved for presentation of corrective action-related information regarding anticipated or potential site-specific corrective action options and methods relevant to the project. The general corrective measures evaluation outline is provided below.

XI.F.1 Title Page

The title page shall include the type of document; Facility name; TA designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible DOE and University of California (or co-operator) representative shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 C.F.R. 270.11(d)(1).

XI.F.2 Executive Summary (Abstract)

This executive summary or abstract shall provide a brief summary of the purpose and scope of the corrective measures evaluation to be conducted at the subject site. The executive summary or abstract shall also briefly summarize the conclusions of the evaluation. The SWMU, AOC, and site names, location, and TA designation shall be included in the executive summary.

XI.F.3 Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the corrective measures evaluation. The corresponding page numbers for the titles of each section of the report shall be included in the table of contents.

XI.F.4 Introduction

The Introduction section shall include the Facility name, TA designation, site location, and site status (e.g. closed, corrective action). General information on the current site usage and status shall be included in this section. A brief description of the purpose of the corrective measures evaluation and the corrective action objectives for the project also shall be provided in this section.

XI.F.5 Background

The Background section shall describe the relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity since the 1940s, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features. The locations of any subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in this section and labeled on the site plan, as appropriate.

This section shall include contaminant and waste characteristics, a brief summary of the history of contaminant releases, known and possible sources of contamination, and the vertical and lateral extent of contamination present in each medium. This section shall include brief summaries of results of previous investigations, including references to pertinent figures, data summary tables, and text in previous reports. References to previous reports shall include page, table, and figure numbers for referenced information. Summary tables and site plans showing relevant investigation locations shall be referenced and included in the Tables and Figures sections of the document, respectively.

XI.F.6 Site Conditions

XI.F.6.a Surface Conditions

A section on surface conditions shall describe current and historic site topography, features, and structures, including a description of topographic drainages, man-made drainages, vegetation, and erosional features. It shall also include a description of current uses of the site and any current operations at the site. This section shall also include a description of those features that could potentially influence corrective action option selection or implementation such as archeological sites, wetlands, or other features that may affect remedial activities. In addition, descriptions of features located in surrounding sites that may have an effect on the subject site regarding sediment transport, surface water runoff or contaminant transport shall be included in this section. A site plan displaying the locations of all pertinent surface features and structures shall be included in the Figures section of the corrective measures evaluation.

XI.F.6.b Subsurface Conditions

A section on subsurface conditions shall describe the site conditions observed during previous subsurface investigations. It shall include relevant soil horizon and stratigraphic information, groundwater conditions, fracture data, and subsurface vapor information. A site plan displaying the locations of all borings and excavations advanced during previous investigations shall be included in the Figures section of the corrective measures evaluation. A brief description of the stratigraphic units anticipated to be present beneath the site may be included in this section if stratigraphic information is not available from previous investigations conducted at the site.

XI.F.7 Potential Receptors

XI.F.7.a Sources

A section shall provide a list of all sources of contamination at the subject site where corrective measures are to be considered or required. Sources that are no longer considered to be releasing contaminants at the site, but may be the point of origination for contaminants transported to other locations, shall be included in this section.

XI.F.7.b Pathways

A section shall describe potential migration pathways that could result in either acute or chronic exposures to contaminants. It shall include such pathways as utility trenches, paleochannels, surface exposures, surface drainages, stratigraphic units, fractures, structures, and other features. The migration pathways for each contaminant and each relevant medium should be tied to the potential receptors for each pathway. A discussion of contaminant characteristics relating to fate and transport of contaminants through each pathway shall also be included in this section.

XI.F.7.c Receptors

A section shall provide a listing and description of all anticipated potential receptors that could possibly be affected by the contamination present at the site. Potential receptors shall include

human and ecological receptors, groundwater, and other features such as pathways that could divert or accelerate the transport of contamination to human receptors, ecological receptors, and groundwater.

XI.F.8 Regulatory Criteria

A section shall set forth the applicable cleanup standards, risk-based screening levels, and risk-based cleanup goals for each pertinent medium at the subject site. The appropriate cleanup levels for each site shall be included, if site-specific levels have been established at separate sites or units. A table summarizing the applicable cleanup standards or levels, or inclusion of applicable cleanup standards or levels in the summary data tables shall be included in the Tables section of the document. The risk assessment shall be presented in a separate document or in an appendix to this report. If cleanup or screening levels calculated in a risk evaluation are employed, the risk evaluation document shall be referenced including pertinent page numbers for referenced information.

XI.F.9 Identification of Corrective Measures Options

A section shall identify and describe potential corrective measures for source, pathway, and receptor controls. Corrective measures options shall include the range of available options including, but not limited to, a no action alternative, institutional controls, engineering controls, in-situ and on-site remediation alternatives, complete removal, and any combination of alternatives that would potentially achieve cleanup goals.

XI.F.10 Evaluation of Corrective Measures Options

A section shall provide an evaluation of the corrective measures options identified in Section XI.F.9 above. The evaluation shall be based on the applicability, technical feasibility, effectiveness, implementability, impacts to human health and the environment, and cost of each option. A table summarizing the corrective measures alternatives and the criteria listed below shall be included in the Tables section of this document. The general basis for evaluation of corrective measures options is defined below.

XI.F.10.a Applicability

Applicability addresses the overall suitability for the corrective action option for containment or remediation of the contaminants in the subject medium for protection of human health and the environment.

XI.F.10.b Technical Practicability

Technical practicability describes the uncertainty in designing, constructing, and operating a specific remedial alternative. The description shall include an evaluation of historical applications of the remedial alternative including performance, reliability, and minimization of hazards.

XI.F.10.c Effectiveness

Effectiveness assesses the ability of the corrective measure to mitigate the measured or potential impact of contamination in a medium under the current and projected site conditions. The assessment also shall include the anticipated duration for the technology to attain regulatory compliance. In general, all corrective measures described above will have the ability to mitigate the impacts of contamination at the site, but not all remedial options will be equally effective at achieving the desired cleanup goals to the degree and within the same time frame as other options. Each remedy shall be evaluated for both short-term and long-term effectiveness.

XI.F.10.d Implementability

Implementability characterizes the degree of difficulty involved during the installation, construction, and operation of the corrective measure. Operation and maintenance of the alternative shall be addressed in this section.

XI.F.10.e Human Health and Ecological Protectiveness

This category evaluates the short-term (remedy installation-related) and long-term (remedy operation-related) hazards to human health and the environment of implementing the corrective measure. The assessment shall include whether the technology will create a hazard or increase existing hazards and the possible methods of hazard reduction.

XI.F.10.f Cost

This section shall discuss the anticipated cost of implementing the corrective measure. The costs shall be divided into: 1) capital costs associated with construction, installation, pilot testing, evaluation, permitting, and reporting of the effectiveness of the alternative; and 2) continuing costs associated with operating, maintaining, monitoring, testing, and reporting on the use and effectiveness of the technology.

XI.F.11 Selection of Preferred Corrective Measure

The Respondents shall propose the preferred corrective measure(s) at the site and provide a justification for the selection in this section. The proposal shall be based upon the ability of the remedial alternative to: 1) achieve cleanup objectives in a timely manner; 2) protect human and ecological receptors; 3) control or eliminate the sources of contamination; 4) control migration of released contaminants; and 5) manage remediation waste in accordance with State and Federal regulations. The justification shall include the supporting rationale for the remedy selection, based on the factors listed in Section XI.F.10 and a discussion of short- and long-term objectives for the site. The benefits and possible hazards of each potential corrective measure alternative shall be included in this section.

XI.F.12 Design Criteria To Meet Cleanup Objectives

The Respondents shall present descriptions of the preliminary design for the selected corrective measures in this section. The description shall include appropriate preliminary plans and

specifications to effectively illustrate the technology and the anticipated implementation of the remedial option at the subject area. The preliminary design shall include a discussion of the design life of the alternative and provide engineering calculations for proposed remediation systems.

XI.F.13 Schedule

A section shall set forth a proposed schedule for completion of remedy-related activities such as bench tests, pilot tests, construction, installation, remedial excavation, cap construction, installation of monitoring points, and other remedial actions. The anticipated duration of corrective action operations and the schedule for conducting monitoring and sampling activities shall also be presented. In addition, this section shall provide a schedule for submittal of reports and data to the Department, including a schedule for submitting all status reports and preliminary data.

XI.F.14 Tables

A section shall present the following summary tables, as appropriate. With prior approval of the Department, the Respondents may combine one or more of the tables. Data presented in the summary tables shall include information on dates of sample collection, analytical methods, detection limits, and significant data quality exceptions. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. A table summarizing regulatory criteria, background, and/or the applicable cleanup standards.
2. A table summarizing historical field survey location data.
3. Tables summarizing historical field screening and field parameter measurements of soil, rock, sediments, groundwater, surface water, and air quality data.
4. Tables summarizing historical soil, rock, or sediment laboratory analytical data. The summary tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
5. A table summarizing historical groundwater elevation and depth to groundwater data. The table shall include the monitoring well depths and the screened intervals in each well.
6. Tables summarizing historical groundwater laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
7. Tables summarizing historical surface water laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
8. Tables summarizing historical air sample screening and analytical data. The data tables shall include the screening instruments used, laboratory analytical methods, detection

limits, and significant data quality exceptions that would influence interpretation of the data.

9. Tables summarizing historical pilot or other test data, if applicable, including units of measurement and types of instruments used to obtain measurements.

10. A table summarizing the corrective measures alternatives and evaluation criteria.

11. A table presenting the schedule for installation, construction, implementation, and reporting of selected corrective measures.

XI.F.15 Figures

A section shall present the following figures for each site, as appropriate. All figures must include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers. All figures shall have a date.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features or properties.

2. A unit site plan that presents pertinent site features and structures, underground utilities, well locations, and remediation system locations and details. Off-site well locations and other relevant features shall be included on the site plan if practical. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.

3. Figures showing historical soil boring or excavation locations and sampling locations.

4. Figures presenting historical soil sample field screening and laboratory analytical data, if appropriate.

5. Figures showing all existing wells including vapor monitoring wells and piezometers. The figures shall present historical groundwater elevation data and indicate groundwater flow directions.

6. Figures presenting historical groundwater laboratory analytical data including past data, if applicable. The analytical data corresponding to each sampling location may be presented as individual concentrations, in table form on the figure or as an isoconcentration map.

7. Figures presenting historical surface water sample locations and analytical data including past data, if applicable. The laboratory analytical data corresponding to each sampling location may be presented as individual concentrations or in table form on the figure.

8. Figures presenting historical air sampling locations and presenting air quality data. The field screening or laboratory analytical data corresponding to each sampling location may be presented as individual concentrations, in table form on the figure or as an isoconcentration map.

9. Figures presenting historical pilot or other test locations and data, where applicable, including site plans or graphic data presentation.

10. Figures presenting geologic cross-sections based on outcrop and borehole data, if applicable.
11. Figures presenting the locations of existing and proposed remediation systems.
12. Figures presenting existing remedial system design and construction details.
13. Figures presenting preliminary design and construction details for preferred corrective measures.

XI.F.16 Appendices

Each corrective measures evaluation shall include, as appropriate, as an appendix, the management plan for waste, including investigation derived waste, generated as a result of construction, installation, or operation of remedial systems or activities conducted. Each corrective measures evaluation shall include additional appendices presenting relevant additional data, such as pilot or other test or investigation data, remediation system design specifications, system performance data, or cost analyses as necessary.

XII. COMPLIANCE SCHEDULE TABLES

The Respondents shall follow the specified compliance schedules for all of the SWMUs, AOCs, canyons, and watershed aggregates included in this Order. Table XII-1 is the closure milestone schedule by watershed. Tables XII-2 and XII-3 are the compliance schedules of deliverables. Table XII-4 is the compliance schedule for the general requirements included in this Order. Table XII-5 is the sampling and monitoring schedule for alluvial, intermediate, and regional groundwater monitoring wells and springs. The details of the compliance activities and deliverables can be found in Sections IV, V, and VI of this Consent Order. Specific remedies for SWMUs, AOCs, canyons, or watershed aggregates are not presumed under this Consent Order.

Table XII-1

Closure Milestone Schedule

SITE	DELIVERABLE	DUE DATE
Los Alamos/Pueblo Watershed		
Los Alamos/Pueblo Canyon	Appropriate Report*	Submitted
MDA T	Appropriate Report*	9/30/05
	Remedy Completion Report	12/31/09
MDA B	Appropriate Report*	1/31/06
	Remedy Completion Report	4/30/11
MDA U	Appropriate Report*	1/31/06
	Remedy Completion Report	10/31/11
MDA V	Appropriate Report*	4/30/06
	Remedy Completion Report	11/30/10
MDA A	Appropriate Report*	8/31/06
	Remedy Completion Report	12/31/10
North Canyons (Guaje/Barrancas/Rendija/Bayo)	Appropriate Report*	6/30/09
Los Alamos/Pueblo Canyon Aggregate Areas	Remedy Completion Reports	8/31/11
Mortandad Watershed		
MDA C	Appropriate Report*	3/31/05
	Remedy Completion Report	9/5/2010
TA-35 (Middle Mortandad/Ten Site Aggregate Area)	Appropriate Report*	9/30/05
Mortandad Canyon	Appropriate Report*	6/30/06
Cañada del Buey	Appropriate Report*	8/31/09
Mortandad Canyon Aggregate Areas	Remedy Completion Reports	11/30/12
Water Canyon/Cañon de Valle Watershed		

SITE	DELIVERABLE	DUE DATE
Water Canyon/Cañon de Valle	Appropriate Report*	12/31/10
Potrillo/Fence Canyons	Appropriate Report*	8/31/11
Water Canyon/Cañon de Valle Aggregate Areas	Remedy Completion Reports	8/31/15
Sandia Watershed		
Sandia Canyon	Appropriate Report*	8/31/09
Sandia Canyon Aggregate Areas	Remedy Completion Reports	1/31/11
Pajarito Watershed		
MDA H	Appropriate Report*	6/30/05
	Remedy Completion Report	9/30/06
MDA G	Appropriate Report*	4/30/07
	Remedy Completion Report	8/31/15
MDA L	Appropriate Report*	1/31/07
	Remedy Completion Report	12/31/10
Pajarito Canyon	Appropriate Report*	2/29/08
Pajarito Canyon Aggregate Areas	Remedy Completion Reports	4/30/15
Ancho/Chaquehui/Frijoles Watersheds		
MDA AB	Appropriate Report*	5/31/10
	Remedy Completion Report	1/31/15
Frijoles Canyon Aggregate Area	Remedy Completion Report	10/31/11
Ancho/Chaquehui/Indio Canyons	Appropriate Report*	2/28/11
Chaquehui Canyon Aggregate Area	Remedy Completion Report	8/31/14
Ancho Canyon Aggregate Areas	Remedy Completion Reports	2/28/15

* Appropriate Report includes one or more of the following: Investigation Report, Corrective Measures Implementation Plan, Corrective Measures Evaluation Report, Remedy Completion Report, or other document as required.

Table XII-2
Schedule of Deliverables by Watershed

DELIVERABLE	DUE DATE	NOTICE DATE[1]	ACTUAL NOTICE DATE
Los Alamos/Pueblo Watershed			
SWMU 21-014 (MDA A)			
Investigation Work Plan	31-Jan-05 Submitted	17-May-05	26-Jul-05
Investigation Report	9-Nov-06 Submitted	9-Mar-07	
Remedy Completion Report	11-Mar-11	9-Jul-11	
SWMU 21-015 (MDA B)			
Investigation Work Plan	30-Jun-04 Submitted	28-Oct-04	21-Dec-04
Investigation/Remediation Work Plan	26-Mar-06 Submitted	31-Jan-07	
Remedy Completion Report	31-Dec-10	30-Jun-11	
SWMUs 21-001, 21-010(a-h), 21-011(a, c-j), 21-016(a-c), 21-028(a), C-21-009, C-21-012 (MDA T)			
Investigation Work Plan	29-Feb-04 Submitted	31-May-04	19-May-05
Investigation Report	18-Sep-06 Submitted	16-Jan-07	
Phase II Investigaton Work Plan	15-Feb-07 Submitted	30-Apr-07	
Phase II Investigation Report	15-Nov-07	15-Mar-08	
Remedy Completion Report	19-Dec-10	18-Apr-11	
SWMUs 21-017(a-c), 21-022(f) (MDA U)			
Investigation Work Plan	30-Nov-04 Submitted	15-Mar-05	21-Mar-05
Investigation Report	6-Feb-06 Submitted	6-Jun-06	28-Sep-06
Remedy Completion Report[3]	6-Nov-11	6-Mar-12	
SWMUs 21-013(b, g), 21-018(a, b) (MDA V)			
Investigation Work Plan	30-Jun-04 Submitted	13-Oct-04	5-Nov-04
Investigation Report	31-Oct-06 Submitted	28-Feb-07	

Revised Investigation Report	16-Jul-07 Submitted	15-Nov-07	
Remedy Completion Report	2-Jun-11	30-Sep-11	
SWMUs 73-001(a-d), 73-004(d) (Airport Landfill)			
Remedy Design Work Plan	30-Apr-04 Submitted	28-Aug-04	2-Sep-04
Remedy Completion Report	15-Apr-07 Submitted	13-Aug-07	
Los Alamos/Pueblo Canyons			
Investigation Report	30-Apr-04 Submitted	27-Oct-04	11-May-05
North Canyons (Guaje/Barrancas/Rendija/Bayo)			
Investigation Report	30-Jun-09	28-Sep-09	
DP Site Aggregate Area			
Investigation Work Plan	31-Aug-04 Submitted	28-Jan-05	13-Apr-05
Investigation Report	7-Nov-07	7-Sep-08	
Pueblo Canyon Aggregate Area			
Investigation Work Plan	31-May-05 Submitted	28-Sep-05	23-Sep-05
Investigation Report	28-Mar-08	25-Aug-08	
SWMU 73-002			
Investigation Work Plan	31-May-05 Submitted	28-Sep-05	30-Sep-05
Investigation Report	12-Sep-06 Not submitted	11-Dec-06	
Bayo Canyon Aggregate Area (includes SWMUs 10-002(a,b), 10-003(a-o), 10-004(b), and 10-007)			
Investigation Work Plan	30-Jul-05 Submitted	26-Dec-05	19-Dec-05
Investigation Report	1-Mar-08	30-May-08	
Upper Los Alamos Canyon Aggregate Area			
Investigation Work Plan[2]	30-Apr-06 Submitted	28-Aug-06	6-Nov-06
Investigation Report	31-May-09	30-Apr-10	
Lower Los Alamos Canyon Aggregate Area			
Investigation Work Plan[2]	31-Oct-07	29-Jan-08	
Middle Los Alamos Canyon Aggregate Area			

Investigation Work Plan[2]	31-Dec-05 Submitted	30-May-06	30-May-06
Investigation Report	19-Jan-08	19-Jul-08	
Guaje/Barrancas/Rendija Canyons Aggregate Area			
Investigation Work Plan[2]	31-Jul-05 Submitted	29-Oct-05	5-Jan-06
Investigation Report	31-Aug-07	29-Dec-07	
Regional Well Rehabilitation and Replacement			
Work Plan Update	13-Jun-07	28-Aug-07	
Mortandad Watershed			
SWMU 50-009 (MDA C)			
Investigation Work Plan	31-Jul-03 Submitted	1-Jun-04	6-Apr-05
Investigation Report	6-Dec-06 Submitted	5-Apr-07	
Remedy Completion Report	5-Sep-10	3-Jan-11	
Mortandad Canyon			
Investigation Report	28-Oct-06 Submitted	25-Feb-07	
Cañada del Buey			
Investigation Report	31-Aug-09	29-Nov-09	
Upper Mortandad Canyon Aggregate Area			
Investigation Work Plan[2]	30-Nov-07	29-Mar-08	
Upper Cañada del Buey Aggregate Area			
Investigation Work Plan[2]	30-Jun-08	28-Oct-08	
Middle Cañada del Buey Aggregate Area			
Investigation Work Plan[2]	31-Oct-07	29-Jan-08	
Lower Mortandad/Cedro Canyon Aggregate Area			
Investigation Work Plan[2]	31-Oct-09	29-Jan-10	
Lower Mortandad/Cañada del Buey Aggregate Area			
Investigation Work Plan[2]	30-Apr-09	29-Jul-09	
Middle Mortandad/Ten Site Canyon Aggregate Area			
Supplemental SAP	31-May-04 Submitted	29-Jun-04	25-Jun-04

Investigation Report	30-Sep-05 Submitted	27-Feb-06	14-Aug-06
Revised Investigation Report	20-Jul-07 Submitted	30-Apr-08	
Chromium Contamination in Regional Well R-28 Groundwater			
Interim Measures Report	30-Nov-06 Submitted	30-Dec-06	27-Dec-06
Phase II Work Plan	30-Jan-07	1-Mar-07	
Water Canyon/Cañon de Valle Watershed			
SWMU 16-003(o)			
Investigation Work Plan	31-Mar-04 Submitted	29-Jun-04	28-Jun-04
Investigation Report	31-Jan-06 Submitted	1-May-06	25-Oct-06
SWMU 16-008(a)			
Investigation Work Plan	31-Mar-05 Submitted	29-Jul-05	19-Aug-05
Investigation Report	21-Jun-07	19-Sep-07	
SWMUs 16-021(c), 16-003(k)			
Phase III RFI Report	30-Sep-03 Submitted	1-Mar-05	21-Jun-04
CMS Report for Surface System/Alluvial Groundwater	Submitted	1-Mar-05	13-Oct-06
CMI Plan for Surface System/Alluvial Groundwater	13-May-07 Submitted	30-Sep-07	
Investigation Report for Intermediate and Regional Groundwater	31-Aug-06 Submitted	29-Nov-06	
CME Report for Intermediate and Regional Groundwater	31-May-07	28-Sep-07	
CMI Plan for Intermediate and Regional Groundwater	30-Nov-07	28-Feb-08	
Water Canyon/Cañon de Valle			
Investigation Work Plan (includes Ancho/Chaquehui/Indio/Fence/Potrillo Canyons)	30-Sep-06 Submitted	29-Mar-07	
Investigation Report (Water Canyon/Cañon de Valle)	31-Dec-10	30-Apr-11	
Potrillo/Fence Canyons			
Investigation Report	31-Aug-11	29-Nov-11	
Cañon de Valle Aggregate Area			

Investigation Work Plan[2]	30-Sep-06 Submitted	12-Feb-07	
S-Site Aggregate Area			
Investigation Work Plan[2]	30-Sep-07	28-Jan-08	
Upper Water Canyon Aggregate Area			
Investigation Work Plan[2]	31-Aug-10	29-Dec-10	
Lower Water/Indio Canyon Aggregate Area			
Investigation Work Plan[2]	30-Sep-12	29-Dec-12	
Potrillo/Fence Canyon Aggregate Area			
Investigation Work Plan[2]	30-Apr-09	13-Aug-09	
Sandia Watershed			
SWMU 53-002 (a,b)			
Investigation Report	30-Jan-04 Submitted	30-May-04	25-Jul-06
Sandia Canyon			
Investigation Report	31-Aug-09	29-Dec-09	
Upper Sandia Canyon Aggregate Area			
Investigation Work Plan[2]	31-Mar-08	13-Aug-08	
Lower Sandia Canyon Aggregate Area			
Investigation Work Plan[2]	30-Apr-09	13-Aug-09	
Pajarito Watershed			
SWMU 54-004 (MDA H)			
CMS Report	31-May-03 Submitted	31-Dec-04	Pending
CMI Plan	Pending	Pending	
Remedy Completion Report	Pending	Pending	
SWMU 54-006 (MDA L)			
Investigation Work Plan	31-Aug-03 Submitted	31-Mar-04	28-Sep-04
Investigation Report	13-Sep-05 Submitted	~~27-Dec-05~~ 31-Jul-07	
CME Report	9-Aug-07	7-Dec-07	
Remedy Completion Report	9-Jul-11	6-Nov-11	
SWMU 3-010(a)			
Investigation Report	31-Aug-05 Submitted	29-Nov-05	
MDA G			

Investigation Work Plan	30-Sep-03 Submitted	31-Jul-04	5-Nov-04
Investigation Report	8-Sep-05 Submitted	21-Jan-06	Pending
CME Work Plan	5-Jun-06	~~31-Oct-06~~ 31-Dec-07	
CME Report[3]	12-Sep-08	31-Jan-09	
Remedy Completion Report	6-Dec-15	4-Apr-16	
Pajarito Canyon			
Investigation Report	29-Feb-08	28-Jun-08	
Threemile Canyon Aggregate Area			
Investigation Work Plan[2]	31-Jul-08	28-Nov-08	
Lower Pajarito Canyon Aggregate Area			
Investigation Work Plan[2]	31-Jul-10	13-Dec-10	
Starmer/Upper Pajarito Canyon Aggregate Area			
Investigation Work Plan[2]	30-Sep-10	12-Feb-11	
Twomile Canyon Aggregate Area			
Investigation Work Plan[2]	31-Jan-10	15-Jun-10	
Ancho Watershed			
SWMUs 49-005(a), 49-006, AOCs C-49-002, C-49-005(b), C-49-008(a, b) (Areas 5, 6, and 10)			
Investigation Work Plan	31-Oct-07	28-Feb-08	
Investigation Report	31-May-10	28-Sep-10	
SWMUs 49-001(a-g), 49-003, AOC C-49-008(d) (MDA AB, Areas 1, 3, 4, 11, and 12)			
Investigation Work Plan	31-Oct-07	28-Feb-08	
Investigation Report	31-May-10	28-Sep-10	
Remedy Completion Report	31-Jan-15	31-May-15	
Ancho/Chaquehui/Indio Canyons			
Investigation Report	28-Feb-11	29-May-11	
North Ancho Canyon Aggregate Area			
Investigation Work Plan[2]	30-Sep-07	13-Jan-08	
South Ancho Canyon Aggregate Area			
Investigation Work Plan[2]	31-Mar-13	29-Jun-13	
Chaquehui Watershed			
Chaquehui Canyon Aggregate Area			
Investigation Work Plan[2]	30-Nov-09	28-Feb-10	
SWMU 33-013			

Remedy Completion Report	3-Mar-06 Submitted	1-Jun-06	30-Aug-06
Frijoles Watershed			
Frijoles Canyon Aggregate Area			
Investigation Work Plan[2]	31-Oct-10	29-Jan-11	
Technical Area 57			
TA-57 Aggregate Area (Fenton Hill)			
Investigation Work Plan[2]	31-Oct-11	29-Jan-12	

Note: All deliverables marked as "Submitted" were submitted to the Department on or before the due date.

1. "Notice Date" is described in Section III.M.2 of the Order on Consent.

2. Investigation Work Plans for the Aggregate Areas shall include a schedule for submitting the Investigation Reports.

3. NMED has issued a Certificate of Completion for the SWMU(s) and AOC(s) covered by this document. Pending a Class 3 permit modification to remove the SWMU(s) from the list of SWMUs requiring corrective action, NMED will no longer require submittal of this document.

Table XII-3
Schedule of Deliverables by Calendar Year

SITE	DELIVERABLE	DUE DATE	NOTICE DATE [1]	ACTUAL NOTICE DATE
		CY03		
SWMU 54-004 (MDA H)	CMS Report	5/31/03 Submitted	12/31/04	Pending
SWMU 50-009 (MDA C)	Investigation Work Plan	7/31/03 Submitted	6/1/04	4/6/05 309 days past due
MDA G	Investigation Work Plan	9/30/03 Submitted	7/31/04	11/5/04 97 days past due
SWMU 54-006 (MDA L)	Investigation Work Plan	8/31/03 Submitted	3/31/04	9/28/04 181 days past due
SWMUs 16-021(c), 16-003(k)	Phase III RFI Report	9/30/03 Submitted	3/1/05	6/21/04
		CY04		
SWMUs 53-002 (a,b)	Investigation Report	1/31/04 Submitted	5/30/04	7/25/06 785 days past due
SWMUs 21-001, 21-010(a-h), 21-011(a,c-j), 21-016(a-c), 21-028(a), C-21-009, C-21-012 (MDA T)	Investigation Work Plan	2/29/04 Submitted	5/31/04	5/19/05 353 days past due
Middle Mortandad/Ten Site Canyon Aggregate Area	Supplemental SAP	3/31/04 Submitted	6/29/04	6/25/04
SWMU 16-003(o)	Investigation Work Plan	3/31/04 Submitted	6/29/04	6/28/04
Los Alamos/Pueblo Canyon	Investigation Report	4/30/04 Submitted	10/27/04	5/11/05 196 days past due
SWMUs 73-001(a-d), 73-004(d) (Airport Landfill – Mesa Top)	Remedy Design Work Plan	4/30/04 Submitted	8/28/04	9/2/04 5 days past due

SITE	DELIVERABLE	DUE DATE	NOTICE DATE [1]	ACTUAL NOTICE DATE
SWMUs 21-013(b, g), 21-018(a, b) (MDA V)	Investigation Work Plan	6/30/04 Submitted	10/13/04	11/5/04 23 days past due
SWMU 21-015(MDA B)	Investigation Work Plan	6/30/04 Submitted	10/28/04	12/21/04 54 days past due
DP Site Aggregate Area	Investigation Work Plan[2]	8/31/04 Submitted	1/28/05	4/13/05 75 days past due
SWMUs 21-017(a-c), 21-022(f) (MDA U)	Investigation Work Plan	11/30/04 Submitted	3/15/05	3/21/05 6 days past due
		CY05		
SWMUs 16-021(c), 16-003(k)	CMS Report for Surface System/Alluvial Groundwater	Submitted	3/1/05	10/13/06 591 days past due
SWMU 21-014 (MDA A)	Investigation Work Plan	1/31/05 Submitted	5/17/05	7/26/05 70 days past due
SWMU 16-008(a)	Investigation Work Plan	3/31/05 Submitted	7/29/05	8/19/05 21 days past due
Pueblo Canyon Aggregate Area	Investigation Work Plan	5/31/05 Submitted	9/28/05	9/23/05
SWMU 73-002	Investigation Work Plan	5/31/05 Submitted	9/28/05	9/30/05 2 days past due
SWMU 54-004 (MDA H)	CMI Plan	Pending	Pending	
Bayo Canyon Aggregate Area (including SWMUs 10-002(a,b), 10-003(a-o), 10-004(b), and 10-007)	Investigation Work Plan	7/30/05 Submitted	12/26/05	12/19/05
Guaje/Barrancas/ Rendija Canyons Aggregate Area	Investigation Work Plan[2]	7/31/05 Submitted	10/29/05	1/5/06 68 days past due

SITE	DELIVERABLE	DUE DATE	NOTICE DATE [1]	ACTUAL NOTICE DATE
SWMU 3-010(a)	Investigation Report	8/31/05 Submitted	11/29/05	5/14/07 531 days past due
MDA G	Investigation Report	9/8/05 Submitted	1/21/06	
SWMU 54-006 (MDA L)	Investigation Report	9/13/05 Submitted	12/27/05 7/31/07	
Middle Mortandad/Ten Site Canyon Aggregate Area	Investigation Report	9/30/05 Submitted	2/27/06	8/14/06 168 days past due
Middle Los Alamos Canyon Aggregate Area[2]	Investigation Work Plan	12/31/05 Submitted	5/30/06	5/30/06
		CY06		
SWMU 16-003(o)	Investigation Report	1/31/06 Submitted	5/1/06	10/25/06 177 days past due
SWMUs 21-017(a-c), 21-022(f) (MDA U)	Investigation Report	2/6/06 Submitted	6/6/06	9/28/06 114 days past due
SWMU 33-013	Remedy Completion Report	3/3/06 Submitted	6/1/06	8/30/06 90 days past due
SWMU 21-015 (MDA B)	Investigation/Remediation Work Plan	3/26/06 Submitted	7/23/06 1/31/07[4]	1/31/07
Upper Los Alamos Canyon Aggregate Area	Investigation Work Plan[2]	4/30/06 Submitted	8/28/06	11/6/06 70 days past due
MDA G	CME Work Plan	6/5/06 Submitted	~~10/31/06~~ 12/31/07	
SWMUs 16-021(c), 16-003(k)	Investigation Report for Intermediate and Regional Groundwater	8/31/06 Submitted	11/29/06	

SITE	DELIVERABLE	DUE DATE	NOTICE DATE [1]	ACTUAL NOTICE DATE
SWMU 73-002	Investigation Report	9/12/06 Not submitted	12/11/06	
SWMU 54-004 (MDA H)	Remedy Completion Report	Pending	Pending	
SWMUs 21-001, 21-010(a-h), 21-011(a, c-j), 21-016(a-c), 21-028(a); AOCs C-21-009, C-21-012 (MDA T)	Investigation Report	9/18/06 Submitted	1/16/07	
Cañon de Valle Aggregate Area	Investigation Work Plan[2]	9/30/06 Submitted	2/12/07	
Water Canyon/Cañon de Valle	Investigation Work Plan (includes Ancho/Chaquehui/Indio/Fence/ Potrillo Canyons)	9/30/06 Submitted	3/29/07	
Mortandad Canyon	Investigation Report	10/28/06 Submitted	2/25/07	
SWMUs 21-013(b, g), 21-018(a, b) (MDA V)	Investigation Report	7/21/06 10/31/06 Submitted	~~11/18/06~~ 2/28/07	
SWMU 21-014 (MDA A)	Investigation Report	11/9/06 Submitted	3/9/07	
Chromium Contamination in Regional Well R-28 Groundwater	Interim Measures Report	11/30/06	12/30/06	
SWMU 50-009 (MDA C)	Investigation Report	12/6/06	4/5/07	
		CY07		
Chromium Contamination in Regional Well R-28 Groundwater	Phase II Work Plan	1/30/07	3/1/07	
SWMUs 73-001(a-d), 73-004(d) (Airport Landfill – Mesa Top)	Remedy Completion Report	4/5/07	8/3/07	
SWMUs 16-021(c), 16-003(k)	CMI Plan for Surface System/Alluvial Groundwater	5/13/07	9/30/07	
Middle Mortandad/Ten Site Canyon Aggregate Area	Revised Investigation Report	5/18/07	1/31/08	

SITE	DELIVERABLE	DUE DATE	NOTICE DATE [1]	ACTUAL NOTICE DATE
SWMUs 16-021(c), 16-003(k)	CME Report for Intermediate and Regional Groundwater	5/31/07	9/28/07	
SWMU 16-008(a)	Investigation Report	6/21/07	9/19/07	
SWMU 54-006 (MDA L)	CME Report	~~8/9/07~~ Pending	~~12/7/07~~ Pending	
MDA G	CME Report	~~8/5/07~~ Pending	~~12/18/07~~ Pending	
Guaje/Barrancas/Rendija Canyons Aggregate Area	Investigation Report	8/31/07	12/29/07	
S-Site Aggregate Area	Investigation Work Plan[2]	9/30/07	1/28/08	
North Ancho Canyon Aggregate Area	Investigation Work Plan[2]	9/30/07	1/13/08	
SWMUs 49-001(a-g), 49-003, AOC C-49-008(d) (MDA AB, Areas 1, 3, 4 ,11, and 12)	Investigation Work Plan	10/31/07	2/28/08	
SWMUs 49-005(a), 49-006, AOCs C-49-002, C-49-005(b), C-49-008(a, b) (Areas 5, 6, and 10)	Investigation Work Plan	10/31/07	2/28/08	
Middle Cañada del Buey Aggregate Area	Investigation Work Plan[2]	10/31/07	1/29/08	
Lower Los Alamos Canyon Aggregate Area	Investigation Work Plan[2]	10/31/07	1/29/08	
DP Site Aggregate Area	Investigation Report	11/7/07	9/7/08	
Upper Mortandad Canyon Aggregate Area	Investigation Work Plan[2]	11/30/07	3/29/08	
SWMUs 16-021(c), 16-003(k)	CMI Plan for Intermediate and Regional Groundwater	11/30/07	2/28/08	
		CY08		
Middle Los Alamos Canyon Aggregate Area	Investigation Report	1/19/08	7/19/08	
Pajarito Canyon	Investigation Report	2/29/08	6/28/08	
Bayo Canyon Aggregate Area (including SWMUs 10-002(a,b), 10-003(a-o), 10-004(b), and 10-007)	Investigation Report	3/1/08	5/30/08	
Pueblo Canyon Aggregate Area	Investigation Report	3/28/08	8/25/08	

SITE	DELIVERABLE	DUE DATE	NOTICE DATE [1]	ACTUAL NOTICE DATE
Upper Sandia Canyon Aggregate Area	Investigation Work Plan[2]	3/31/08	8/13/08	
Upper Cañada del Buey Aggregate Area	Investigation Work Plan[2]	6/30/08	10/28/08	
Threemile Canyon Aggregate Area	Investigation Work Plan[2]	7/31/08	11/28/08	
		CY09		
Lower Sandia Canyon Aggregate Area	Investigation Work Plan[2]	4/30/09	8/13/09	
Lower Mortandad/Cañada del Buey Aggregate Area	Investigation Work Plan[2]	4/30/09	7/29/09	
Potrillo/Fence Canyon Aggregate Area	Investigation Work Plan[2]	4/30/09	8/13/09	
Upper Los Alamos Canyon Aggregate Area	Investigation Report	5/31/09	4/30/10	
North Canyons (Guaje/Barrancas/Rendija/Bayo)	Investigation Report	6/30/09	9/28/09	
Sandia Canyon	Investigation Report	8/31/09	12/29/09	
Cañada del Buey	Investigation Report	8/31/09	11/29/09	
Lower Mortandad/Cedro Canyon Aggregate Area	Investigation Work Plan[2]	10/31/09	1/29/10	
Chaquehui Canyon Aggregate Area	Investigation Work Plan[2]	11/30/09	2/28/10	
		CY10		
Twomile Canyon Aggregate Area	Investigation Work Plan[2]	1/31/10	6/15/10	
SWMUs 49-001(a-g), 49-003, AOC C-49-008(d) (MDA AB, Areas 1, 3, 4, 11, and 12)	Investigation Report	5/31/10	9/28/10	
SWMUs 49-005(a), 49-006, AOCs C-49-002, C-49-005(b), C-49-008(a, b) (Areas 5, 6, and 10)	Investigation Report	5/31/10	9/28/10	
Lower Pajarito Canyon Aggregate Area	Investigation Work Plan[2]	7/31/10	12/13/10	
Upper Water Canyon Aggregate Area	Investigation Work Plan[2]	8/31/10	12/29/10	
SWMU 50-009 (MDA C)	Remedy Completion Report	9/5/10	1/3/11	
Starmer/Upper Pajarito Canyon Aggregate Area	Investigation Work Plan[2]	9/30/10	2/12/11	

SITE	DELIVERABLE	DUE DATE	NOTICE DATE [1]	ACTUAL NOTICE DATE
Frijoles Canyon Aggregate Area	Investigation Work Plan[2]	10/31/10	1/29/11	
SWMUs 21-001, 21-010(a-h), 21-011(a, c-j), 21-016(a-c), and 21-028(a), and AOCs C-21-009 and C-21-012 (MDA T)	Remedy Completion Report	12/19/10	4/18/11	
Water Canyon/Cañon de Valle	Investigation Report	12/31/10	4/30/11	
SWMU 21-015 (MDA B)	Remedy Completion Report	12/31/10	6/30/11	
		CY11		
Ancho/Chaquehui/Indio Canyons	Investigation Report	2/28/11	5/29/11	
SWMU 21-014 (MDA A)	Remedy Completion Report	3/11/11	7/9/11	
SWMUs 21-013(b, g), 21-018(a, b) (MDA V)	Remedy Completion Report	6/2/11	9/30/11	
SWMU 54-006 (MDA L)	Remedy Completion Report	7/9/11	11/6/11	
Potrillo/Fence Canyons	Investigation Report	8/31/11	11/29/11	
TA-57 Aggregate Area (Fenton Hill)	Investigation Work Plan[2]	10/31/11	1/29/12	
SWMUs 21-017(a-c), 21-022(f) (MDA U)	Remedy Completion Report[3]	11/6/11	3/6/12	
		CY12		
Lower Water/Indio Canyon Aggregate Area	Investigation Work Plan[2]	9/30/12	12/29/12	
		CY13		
South Ancho Canyon Aggregate Area	Investigation Work Plan[2]	3/31/13	6/29/13	
		CY15		
SWMUs 49-001(a-g), 49-003, AOC C-49-008(d) (MDA AB, Areas 1, 3, 4, 11, and 12)	Remedy Completion Report	1/31/15	5/31/15	
MDA G	Remedy Completion Report	12/6/15	4/4/16	

Note: All deliverables marked as "Submitted" were submitted to the Department on or before the due date.

1. "Notice Date" is described in Section III.M.2 of the Order on Consent.

2. Investigation Work Plans for the Aggregate Areas shall include a schedule for submitting the Investigation Reports.

3. NMED has issued a Certificate of Completion for the SWMU(s) and AOC(s) covered by this document. Pending a Class 3 permit modification to remove the SWMU(s) from the list of SWMUs requiring corrective action, NMED will no longer require submittal of this document.

Table XII-4

General Requirements

Deliverable/Activity	Due Date	Section
Notification of transfer of ownership of any portion of the Facility	Minimum of 120 days prior to transfer.	III.Y.1.a
Sampling notification and notification of other corrective action activities.	Minimum of 15 days prior to sampling or other corrective action activity.	III.O
Proposed deed restriction language	Minimum of 30 days prior to transfer	III.Y.1.d
Notification prior to transfer of operational control	Minimum of 120 days prior to transfer. As soon as is reasonably practicable if Respondents learn of decision fewer than 120 days.	III.Y.2.a
General Facility Information	30 days after the effective of Consent Order. Annually thereafter on March 31.	IV.A.3
Interim Facility-wide Groundwater Monitoring Plan	Within 90 days after effective date of the Consent Order. Updated annually (90 days after each anniversary of the effective date of the Consent Order)	IV.A.3.b
Watershed-specific Groundwater Monitoring Plans	After completing the installation of all additional monitoring wells.	IV.A.3.b
Groundwater Background Investigation Report	Within 180 days after the effective date of the Consent Order.	IV.A.3.d
Well Completion Summary Fact Sheet (Regional Wells)	Within 30 days after completion of each well.	IV.A.3.e.iv
Well Completion Report (Regional Wells)	150 days after well installation is complete.	IV.A.3.e.iv
Periodic Monitoring Report for groundwater, surface water, and springs	Within 120 days after completion of the monitoring event.	IV.A.3.f and IV.A.6

Deliverable/Activity	Due Date	Section
Revised Active Testing Hazard Zones Map and New Information	Within 30 days of change.	IV.A.5.a
Investigation Work Plan for Firing Site(s)	In accordance with the Aggregate Area IWP or as determined by the Department.	IV.A.5.b
Los Alamos/Pueblo Canyon Long-term Groundwater Monitoring Plan	After completing the installation of all additional monitoring wells.	IV.B.1.b.iv, (See also IV.A.3.b)
Well Abandonment Report for TW-1, TW-1a, TW-2, TW-2a, and TW-3	Within 30 days of completing the activity.	IV.B.1.b.v
Mortandad Canyon Long-term Groundwater Monitoring Plan	After completing the installation of all additional monitoring wells.	IV.B.2.b.iii (See also IV.A.3.b)
Plan to demonstrate validity of R-25 data	Within 90 days of the effective date of Consent Order	IV.B.3.b.iii
Water Canyon/Cañon de Valle Long-term Groundwater Monitoring Plan	After completing the installation of all additional monitoring wells.	IV.B.3.b.v (See also IV.A.3.b)
Pajarito Canyon Long-term Groundwater Monitoring Plan	After completing the installation of all additional monitoring wells.	IV.B.4.b.vi (See also IV.A.3.b)
Sandia Canyon-Long term Groundwater Monitoring Plan	After completing the installation of all additional monitoring wells.	IV.B.5.b.iv (See also IV.A.3.b)
Long-term Groundwater Monitoring Plan for the Other Canyons	After completing the installation of all additional monitoring wells	IV.B.6.b.iv (See also IV.A.3.b)
MDA G Long-term Subsurface Vapor Monitoring and Sampling Work Plan	Prior to implementation of the program.	IV.C.1.c.vi
MDA G Monitoring well design plan for intermediate well	Prior to well construction.	IV.C.1.c.viii
MDA H Long-term Subsurface Vapor Monitoring and Sampling Work Plan	After the MDA H CMS has been approved.	IV.C.1.d.i
MDA L Long-term Subsurface Vapor Monitoring and Sampling Work Plan	Prior to implementation of the program.	IV.C.1.e.vi
MDA L Monitoring well design plan for intermediate well	Prior to construction.	IV.C.1.e.viii

Deliverable/Activity	Due Date	Section
MDA A Long-term Subsurface Vapor Monitoring and Sampling Work Plan	Prior to program implementation.	IV.C.2.c.vi
MDA B Long-term Subsurface Vapor Monitoring and Sampling Work Plan	Prior to program implementation..	IV.C.2.d.vi
MDA T Long-term Subsurface Vapor Monitoring and Sampling Work Plan	Prior to program implementation.	IV.C.2.e.vi
MDA U Long-term Subsurface Vapor Monitoring and Sampling Work Plan	Prior to program implementation..	IV.C.2.f.vi
MDA V Vapor Monitoring and Sampling Work Plan	Prior to program implementation.	IV.C.2.g.vi
MDA C Well design for vapor monitoring well construction	Prior to subsurface exploration.	IV.C.3.c.iii
MDA C Well design to evaluate for intermediate perched groundwater and vapor-phase contamination.	Prior to well completion.	IV.C.3.c.iii
MDA C Investigation Vapor Monitoring and Sampling Work Plan	Prior to subsurface investigation.	IV.C.3.c.v
MDA C Long-term Subsurface Vapor Monitoring and Sampling Work Plan	Prior to program implementation.	IV.C.3.c.v
MDA C Monitoring Well Design Plan for intermediate well(s)	Prior to well construction.	IV.C.3.c.vi
MDA C Long-term Groundwater Monitoring Plan	Prior to program implementation	IV.C.3.c.viii
TA-49 Vapor Monitoring and Sampling Work Plan	Prior to well construction.	IV.C.4.c.v
TA-49 Long-term Groundwater Monitoring Plan	Prior to program implementation	IV.C.4.c.viii
TA-10 Well Installation Work Plan	Prior to well construction	IV.C.5.c.v
Aggregate Areas List; Maps of TAs, SWMUs, and AOCs	Within 180 days of effective date of the Order, updated as needed.	V.B
Notification of newly identified SWMUs/AOCs	Within 15 days of discovery.	V.C
SWMU Assessment report for newly identified SWMUs/AOCs	Within 90 days of notification of new SWMU.	V.C
Notification of previously unknown releases from SWMUs/AOCs	Within 15 days of discovery.	V.D

Deliverable/Activity	**Due Date**	**Section**
Notification of site investigation activity (sampling notification)	Minimum of 15 days prior to the commencement of any field activity	V.E.2
Corrective Measures Evaluation Report	By date specified in written notification	V.F.1
Interim Measures Work Plan	Within 90 days after receiving notification that interim measures are required.	VII.B.2
Emergency Interim Measures Notification	Within 3 business days of discovery.	VII.B.5
Interim Measures Report	Within 90 days after completing the interim measures (or other period specified by the Department).	VII.B.6
Corrective Measures Evaluation Report	Following written notification from the Department.	VII.D.2 (see also V.F.1)
Corrective Measures Implementation Plan	Within 90 days after the Department's selection of remedy or as specified in CME Report.	VII.E.2
Remedy Completion Report	Within 90 days after completion of remedy.	VII.E.6.a
Accelerated Corrective Action Work Plan	At least 30 days in advance of the commencement of field work..	VII.F.3
Remedy Completion Report	Within 90 days after completion of the accelerated corrective action.	VII.F.4 (See also VII.F.2 and VII.E.6.a)
Notification of start of field activities	15 days prior to start of field acitivities.	IX
Draft boring logs, test pit logs, and well construction diagrams (if requested).	Within 30 days after completion of each boring and monitoring well.	IX.B.2.c
Initial groundwater sampling at newly installed alluvial monitoring wells	10-30 days after completion of well development.	IX.B.2.i

Deliverable/Activity	**Due Date**	**Section**
Request for variance from groundwater sampling schedule	30 days prior to start of scheduled monitoring	IX.B.2.i
Initial groundwater sampling at newly installed intermediate and regional wells	10-60 days after well development completion	IX.B.2.i
Variance from well purging methods	At least 90 days prior to scheduled sampling activities.	IX.B.2.i.i
Summary of in-situ test results, if requested.	Within 30 days of test completion.	IX.B.2.k
In-situ Test Results Report	Within 120 days of test completion.	IX.B.2.k
Analytical laboratories contract information	Within 45 days of awarding contract.	IX.C.1
Notification of data quality exceptions	Next working day after receipt of notification from lab.	IX.C.2
Memo summarizing data quality exceptions	Within 3 working days of conclusion of data quality discussion.	IX.C.2
Variations of the general report format	Prior to submittal of report.	XI.A

Table XII-5

Groundwater Monitoring and Sampling Schedule

Canyon Watershed	Sampling Frequency	Alluvial Wells	Intermediate Wells	Regional Wells	Springs
Los Alamos/ Pueblo	Quarterly	Los Alamos: LAO-B LAO-0.3 LAO-0.6 LAO-0.91 LAO-1.6(g) LAO-1.8 LLAO-1b LLAO-3 LLAO-4 LLAO-5 LAO-1.2 LAO-2 LAO-3A LAO-4.5C LAO-5 LAO-6 LAO-6A LAUZ-1 LAUZ-2 Highway Department wells near Totavi: MW-3 MW-5 MW-6 MW-9 Pueblo: All ER wells (including POI-4) ES wells: APCO-1	Los Alamos: LADP-3 R-9i LAOI(a)-1.1 Pueblo: TW-1a TW-2a POI-4	Los Alamos: R-5 R-7 R-9 TW-3 Pueblo: TW-1 TW-2 TW-4	Skate Rink LA 5.19 DP Basalt Los Alamos Otowi Sacred Springs
Mortandad	Quarterly	MCO-2 MCO-3 MCO-4B MCO-5	MCOBT-4.4	R-15 R-22 TW-8	

Canyon Watershed	Sampling Frequency	Alluvial Wells	Intermediate Wells	Regional Wells	Springs
		MCO-6 or 6B MCO-7 MCO-7.5 MT-4 TSWB-6 CDBO-1 through 9			
Water Canyon/ Cañon de Valle	Quarterly	16-2655 16-2656 16-2657 16-2658 16-2659 WCO-1 WCO-2 WCO-3 Beta Hole	CdV-15-3 CdV-37-2	CdV-37-2 CdV-15-3	Water Canyon Gallery Peter Seep SWSC Line Burning Ground Fish Ladder Hollow Martin Springs
Pajarito	Quarterly	BG-1 BG-4 18-MW-5 18-MW-7 18-MW-8 18-MW-9 18-MW-10 18-MW-11 18-MW-12 18-MW-16 18-MW-17 18-MW-18 PCO-1 PCO-2 PCO-3	R-19	R-19 R-22 (top 2 zones quarterly; others limited suite annually)	PC Spring Homestead Starmers Charlie Kieling Bulldog Threemile A & B TA-18
Sandia	Quarterly	SCO-1 SCO-2	R-12	R-12	
Ancho	Quarterly		R-31	DT-5a DT-9 DT-10 R-31	Ancho Spring (monitored annually)
Chaquehui	Annually				DOE
Frijoles	Annually				10

Canyon Watershed	Sampling Frequency	Alluvial Wells	Intermediate Wells	Regional Wells	Springs
White Rock-Rio Grande Springs	Annually				La Mesita 1 2 Sandia 3 3a 5 5a 6 6a 7 8 9 9a 9b
White Rock-Rio Grande Springs	Quarterly				4 4a 4aa 4b 4c

XIII. EFFECTIVE DATE

The undersigned persons executing this Consent Order represent that they have all the requisite authority to bind the Party that they represent to the terms of this Consent Order, and further agree that this representation of authority as to each such Party shall be legally sufficient evidence of actual or apparent authority to bind each of them to all of the terms and conditions of this Consent Order