MDAL HIR
(LANL 2003b)

Appendix B

Historical Investigation Report

CONTENTS

List of Figures

List of Tables

APPENDIX B HISTORICAL INVESTIGATION REPORT

This historical investigation report (HIR) provides a summary of the field investigations and associated environmental data collected to date for Material Disposal Area (MDA) L. The purpose of this HIR is to provides supporting information for the proposed sampling design necessary to complete the MDA L investigation as presented in Section 4 of this investigation work plan (hereafter, the work plan).

B-1.0 MDA L DISPOSAL UNIT INFORMATION (OPERATIONAL HISTORY)

MDA L operated from the early 1960s until 1986 as the designated disposal area for nonradiological liquid chemical wastes, including containerized and uncontainerized liquid wastes; bulk quantities of treated aqueous waste; batch-treated salt solutions and electroplating wastes, including precipitated heavy metals; and small-batch quantities of treated lithium hydride. MDA L consists of an elongated pit (Pit A), three impoundments (Impoundments B, C, and D) and 34 shafts (Shafts 1 through 34 [Figure B-1]). The pit, impoundments, and shafts are unlined. The dimensions, period of operation, and capacity of the pit, impoundments, and shafts are listed in Tables B-1 through B-3. Laboratory drawings AB113 (LANL 1993, 76052) and ENG-C-45259 (DOE 1987, 25606) identify the locations and dimensions of the pit, impoundments, and shafts at MDA L.

Pit A was excavated into native tuff with three near-vertical walls on the west, north, and south sides. A ramp entrance leading down to the flat bottom was excavated on the east side. Pit A was filled with waste to within 3 ft of the surface, and then decommissioned and covered with crushed, consolidated tuff. Impoundments B, C, and D were excavated into native tuff with near-vertical walls on the east and west sides. Ramps leading down to the flat bottom were excavated on the north and south sides, and the waste was covered with crushed, consolidated tuff after the impoundments were decommissioned. Thirty-four disposal shafts were dry-drilled directly into the subsurface tuff at MDA L. The shafts range from 3 ft to 8 ft in diameter and from 15 ft to 65 ft in depth. Three feet of crushed tuff were placed at the bottom of each shaft to fill cracks and joints. When in use, the shafts were covered with a metal cap that could be opened or removed, depending on design, to place the wastes. After it was filled to within approximately 3 ft of the surface, the area below the steel plate was sealed with a 3-ft concrete plug (Rogers 1977, 5707; 5708). When MDA L was decommissioned in 1986, the surface was paved with asphalt to accommodate waste management activities (permitted storage of hazardous and mixed waste). The location and dimensions of the pit, impoundments, and shafts, shown in Figure B-1, were derived from geographic landmarks (i.e., fences, structures, etc.) prior to the installation of asphalt paving. No geodetic data exist for the disposal units at MDA L.

B-1.1 Waste Inventory and Disposal History

Waste disposal records for MDA L are found in un-numbered disposal logbooks used to record information on the type, date, location, and volume of waste placed in MDA L (LANL 2003, 76036). Records prior to 1974 are incomplete, and many logbook entries contain only brief descriptions of wastes disposed at MDA L (i.e., waste types, volumes, and disposal locations are not always provided).

An estimate of the types and quantities of waste disposed of at MDA L was compiled in the operable unit (OU) 1148 data report (LANL 1992, 23247) and in the approved Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan for OU 1148 (LANL 1992, 7669). Two waste inventory databases were developed based on original logbook entries for MDA L. The Source Term Database contains information on untreated waste, and the Batch Waste Source Term Database describes wastes that underwent batch treatment prior to disposal.

B-1.1.1 Source Term Database

The Source Term Database includes the following categories of information for untreated waste disposed at MDA L: date of disposal; waste volume or weight; number of cylinders or waste items disposed of; specific location of disposal (shaft, pit, or impoundment), if known; and a description of the untreated waste. Many of the entries do not include a specific location of disposal within MDA L. An example of potential volume discrepancies in this database occurs within the inventory of beryllium waste. One entry described as "chemicals and beryllium-contaminated wood" lists the volume of waste as five cubic ft. The actual quantity of beryllium or beryllium-contaminated wood is not accurately represented by this volume. The Source Term Database is included in Appendix I. The assumptions used to create the database are listed on pages 3-1 and 3-2 of Appendix I.

B-1.1.2 Batch Waste Source Term Database

The Batch Waste Source Term Database includes the following categories of information for waste treated and/or disposed of at MDA L: date of treatment; waste volume; source area where material originated; waste type (inorganic and organic); impoundment or pit location, if known; treatment method; and the physical form of the waste (LANL 1992, 7669, pp. 5-110–5-116). The records document only the wastes disposed of without treatment or following treatment in Pit A and Impoundment B. The Batch Waste Source Term Database is presented in Appendix I. The assumptions underlying the database are listed on pages 3-3 and 3-4 of Appendix I.

B-1.1.3 Uncertainties in the MDA L Inventory

There are no logbook entries for the waste disposed of at MDA L prior to 1974 and 1975, and there are no logbook entries for treatment in Impoundments C and D. It is possible these impoundments were used for waste treatment and the residues removed and placed elsewhere at MDA L; it is also possible the residues were left in situ and not accounted for in the logbooks. Operating dates for each disposal unit and a summary of the waste inventory compiled from disposal records and the databases for MDA L follows.

Pit A (Late 1950s to December 1978)

Pit A received liquid chemical wastes, including containerized and uncontainerized liquid wastes, and functioned as an evaporation pit where bulk quantities of treated aqueous waste from throughout the Laboratory were discharged, pooled, and allowed to evaporate. Disposal records provided in Appendix I indicate that 5123 cubic ft of waste were disposed of in Pit A. After the aqueous phase evaporated, a salt layer remained on the floor of the disposal pit. When Pit A was decommissioned in 1978, it was covered with crushed tuff.

Impoundments B (January 1979 to June 1985) and C (July 1985 to December 1985)

Impoundments B and C were used for evaporating batch-treated salt solutions and electroplating wastes. Disposal records provided in Appendix I indicate that 2622 cubic ft of aqueous waste were discharged into Impoundment B, pooled, and allowed to evaporate. Upon decommissioning, Impoundments B and C were covered with a minimum of 3 ft of crushed tuff.

The waste streams discharged into Pit A and Impoundments B and C were treated solutions from the following four aqueous treatment processes (LANL 1992, 23247, pp. 5-115–5-116).

- Ammonium bifluoride waste was neutralized with calcium chloride and calcium hydroxide. The end product was an aqueous solution consisting of ammonium chloride, calcium fluoride, and water.
- Acids and caustics in quantities greater than 55 gal. were diluted to 15% or less concentration and neutralized. Acid solutions were neutralized with sodium hydroxide; base solutions were neutralized with mineral acids. Heavy metals were precipitated and removed prior to disposal. Heavy metals precipitated from acid solutions were packaged in 15-gal. drums and disposed of in the same shaft(s) as the neutralized acid solutions, while heavy metals precipitated from caustic solutions were also packaged in 15-gal. drums and disposed of in the same shaft(s) as the neutralized caustic solutions (LANL 2003, 76036).
- Cyanide solutions were treated with calcium hypochlorite or calcium chloride and calcium hydroxide at Technical Area (TA-) 50. The end products of both processes are cyanate, carbon dioxide, and nitrogen. The resulting aqueous solution was tested to ensure complete cyanide treatment. After treatment, the aqueous solution was discharged primarily to Pit A or to one of the evaporation impoundments (B or C). Solids from the process were placed in metal drums, mixed with cement, and disposed of in shafts at MDA L.
- Chromium waste was treated with sodium hydroxide and one of two reducing agents: sulfur dioxide or sodium bisulfate. The end products of this process were sodium sulfate and chromium hydroxide. The treated chromium waste was disposed of in the same shaft(s) as the neutralized acid solutions.

Impoundment D (1972 to 1984)

Impoundment D was used exclusively for treating small-batch quantities of lithium hydride by reaction with water and allowing the neutralized solutions to evaporate. Based on the results of a safety review, this treatment process was discontinued in 1984 because of the reactivity of the lithium hydride, and disposal activities in Impoundment D ceased. Impoundment D was partially filled with crushed tuff in 1985 and completely filled in 1989. Between 1984 and 1989, six aboveground fiberglass used-oil storage tanks (area of concern [AOC] 54-021) were located within a soil-containment berm adjacent to Impoundment D. The tanks, which stored waste oil, were pumped out in 1985 and moved from MDA L to MDA G in 1989 to make room for new waste management facilities on the surface of MDA L. The tanks themselves were subsequently closed in 1990 under RCRA regulations and a closure report was submitted to the New Mexico Environment Department (NMED) in 1991. Any associated contaminated soil from the tanks will be addressed during closure of the RCRA-permitted treatment and storage facility currently located on the surface of MDA L.

Disposal Shafts 1 through 34 (February 1975 to February 1985)

Disposal Shafts 1 through 34 were used for disposing of containerized and uncontainerized liquid chemical wastes and precipitated solids from the treatment of aqueous wastes. Before 1982, containerized liquids were disposed of without adding absorbents to the containers in which they were placed. Frequently, small containers were dropped into a shaft. Larger drums were lowered by crane and arranged in layers of one drum in a 3-ft- or 4-ft-diameter shaft, four to five drums in a 6-ft-diameter shaft, or 6 drums in an 8-ft-diameter shaft. The space around the drums was filled with crushed tuff, and a

6-in. layer of crushed tuff was placed between each layer of drums. Uncontainerized liquid wastes were also disposed of in the shafts.

Between 1982 and 1985, only containerized wastes (including liquids, precipitated heavy metals, and stabilized heavy metals) were disposed of in the shafts.

B-1.2 Previous Field Investigations

On May 7, 1985, the Laboratory received a compliance order from the New Mexico Environmental Improvement Division (NMEID, now NMED) that addressed numerous waste management issues at the Laboratory (NMEID 1985, 75885). The 1985 order specified the following six tasks that involved site investigation activities in and around MDA L:

- Task 1 measures the intrinsic permeability of the tuff,
- Task 2 determines the soil-moisture characteristic curves,
- Task 3 determines the unsaturated hydraulic conductivity of the Bandelier Tuff,
- Task 4 analyzes the infiltration and redistribution of meteoric water in the tuff,
- Task 5 characterizes the core and pore gas in the vadose zone, and
- Task 6 analyzes the potential presence of perched water.

The results and outcomes of the above six tasks are described in a report entitled "Hydrogeologic Assessment of Technical Area 54, Areas G and L" (LANL 1987, 76068, pp. 6-2–6-7), which was submitted in 1987 to the NMEID in response to the 1985 compliance order/schedule.

Task 1: In 1986, five boreholes (three at MDA L and two at MDA G) were advanced to 125 ft below ground surface (bgs) to measure air permeability in units 2 and 1v of the Tshirege Member of the Bandelier Tuff. Field methods included air injection and vacuum testing of five boreholes. Water injection permeability tests conducted in one borehole validated the results of air tests. The intrinsic permeability of four core samples from each borehole was determined in the laboratory via the Klinkenberg and the dynamic methods. Field methods yielded intrinsic permeability in the range of 10^{-8} to 10^{-9} cm^2 and laboratory methods yielded values of 10^{-9} cm^2.

Task 2: According to field and laboratory analyses, the moisture contents of the core range from 2% to 4%, with isolated intervals ranging from 10% to 28%. Soil-moisture characteristic curves were difficult to develop because the samples disaggregated under simulated low-capillary pressures; however, curves were developed for 20 samples. The analyses of these samples showed that high moisture retention values and low moisture content measurements result in vapor as the major mechanism of water transport.

Task 3: Five samples from each of four horizons were analyzed to determine unsaturated hydraulic conductivity using both theoretical and laboratory methods. Theoretical methods yielded an average of 2.64×10^{-4} ft/day and measured values averaged 1.32×10^{-4} ft/day.

Task 4: Analysis of infiltration and redistribution of meteoric water into the core was conducted by neutron-moisture monitoring and measuring matric potential with thermocouple psychrometers. Neutron moisture monitoring and gravimetric moisture measurements indicated that the volumetric moisture content of the tuff below 10 ft is approximately 2% to 4%. In addition, analysis of daily moisture logs after autumn precipitation indicated the depth of infiltration of meteoric water was approximately 10 ft. Moisture was not observed to move deeper than 10 ft and was assumed to be returned to the surface through evapotranspiration. Psychrometers indicated that soil tensions ranged from slightly less than 1 bar to approximately 15 bars. Vertical hydraulic gradients, as determined by psychrometers, ranged from a downward gradient of 10.2 ft/ft to an upward gradient of 4.12 ft/ft.

Calculation of moisture flux rates through porous media using field-derived hydraulic gradients and laboratory-derived unsaturated hydraulic conductivities yielded mean flux rates of 0.036 and 0.211 ft/yr for MDAs L and G, respectively. However, because the moisture content used in calculating unsaturated hydraulic conductivity was greater than that observed in the field, the flux rates calculated were also higher than actual rates.

Task 5: In 1985, four boreholes were drilled at MDA L and two at MDA G; additionally, one background borehole was drilled on the western end of Mesita del Buey for core and pore-gas analyses of the Bandelier Tuff. Core samples collected from each 10-ft interval in all 7 boreholes were analyzed for extraction procedure (EP) toxicity and volatile organic compounds (VOCs). No EP toxic metals were detected in core samples beneath a depth of 20 ft. Part per million (ppm) concentrations of VOCs were detected in core samples from MDA L to depths of 100 ft (maximum depth sampled), and none was detected at MDA G.

A total of 23 sampling ports were installed in the 7 boreholes to collect pore-gas samples to 100-ft depths. Analysis of samples collected by pumping the pore gas through charcoal adsorption tubes showed that VOCs were detected in MDA L in ppm concentrations at all depths sampled and in the part per billion (ppb) range at all depths sampled at MDA G.

Task 6: Four test holes drilled in Cañada del Buey were converted to monitoring wells. Seven test holes were drilled in Pajarito Canyon, and three were converted to monitoring wells to investigate the alluvial, perched water systems potentially present in these canyons. The alluvium in Cañada del Buey was found to be confined to the canyon, and all test holes in the alluvium were dry. In Pajarito Canyon, the boreholes intersected a perched water system. The top of the perched water was about one to five feet below the surface of the alluvium, and the water level fluctuated significantly over short periods of time. It was concluded that perched water in Pajarito Canyon was confined to alluvium within the canyon and did not extend vertically or horizontally into the Bandelier Tuff, which forms Mesita del Buey. No perched water was found in Cañada del Buey. No perched bodies of water, which could be hydraulically connected to the regional aquifer, were found beneath MDAs G and L.

Between 1986 and 1990, the Laboratory voluntarily drilled and instrumented two additional boreholes at MDA G and 20 boreholes in and around MDA L to begin characterizing the nature and extent of the vapor-phase VOC plume. Analytical results from pore-gas samples collected between 1985 and 1990 were reported in "Analysis of the Pore Gas Monitoring at Area L, TA-54" (Trent 1992, 11881) and "Review of Soil-Vapor Sampling Wells and Data from TA-54, Areas G and L, Los Alamos National Laboratory" (LANL 1992, 11729).

A review of analytical data presented in these two reports for MDA L indicates

- releases from MDA L resulted in a subsurface vapor-phase VOC plume extending beneath the site and beyond the boundary of MDA L,
- 1,1,1-trichloroethane (TCA) is the primary constituent of the VOC plume,
- TCA is present to a depth of at least 200 ft below the surface of the mesa, and
- TCA concentrations vary across the plume.

A review of analytical results for pore-gas samples collected in 19 of the boreholes at MDA L between 1988 and 1992 is presented in the report entitled "Pilot Extraction Study Plan for the Organic Vapor

Plume at MDA L" (LANL 1993, 22430). This report describes the VOC plume at MDA L as follows: "the principal vapor phase organic compounds, listed in descending order of concentration were TCA, trichloroethene (TCE), carbon tetrachloride, chloroform, tetrachloroethene (PCE), toluene, and benzene. Other contaminants that have been detected, but at much lower concentrations, include chlorobenzene, xylenes, and 1,2,4-trimethylbenzene. TCA was found in the greatest concentration, and it also exhibits the greatest lateral and vertical extent in the organic vapor plume. The measured concentrations of TCA are almost an order of magnitude greater than values measured for TCE, the contaminant of second highest concentration."

B-2.0 PHASE I RFI FIELD INVESTIGATIONS AND REVIEW OF FIELD SCREENING, SURVEY, AND LABORATORY RESULTS

Field Investigations Summary

Phase I RFI fieldwork was conducted at MDA L from 1993 through 2003. The approved RFI work plan for OU 1148 specified sampling surface soil/sediment, subsurface tuff, surface flux, ambient air, and pore gas (LANL 1992, 7669, pp. 5-139–5-178). Surface water, soil/sediment, core, and particulates from ambient air samples were to be analyzed for inorganic chemicals (target analyte list [TAL] metals and cyanide), organic chemicals (VOCs, semivolatile organic compounds [SVOCs], pesticides, polychlorinated biphenyls [PCBs]), and radionuclides (LANL 1992, 7669). The objectives of the Phase I RFI were to determine the nature and extent of contaminants released from MDA L, to define the extent of the VOC plume and any other identified contaminant releases, to collect data to support and supplement existing data, and to collect data to be used in a risk assessment. Phase I RFI fieldwork conducted at MDA L included

- collecting and analyzing 4 surface drainage sediment samples,
- drilling 7 vertical boreholes and 11 angled boreholes,
- collecting and analyzing 184 core samples,
- collecting and analyzing 280 subsurface pore-gas samples for VOCs,
- collecting and analyzing 102 surface flux samples plus nine duplicates for VOCs, and
- collecting and analyzing 102 ambient air samples for VOCs.

A summary of work plan specifications, the fieldwork performed, and the rationale for deviations from the work plan are provided in Table B-4.

Data Review Summary

The Phase I RFI data set for MDA L includes analytical data from 4 surface channel sediment samples, 184 core samples, including field duplicates, collected from 16 boreholes, 8 surface tritium flux samples, 102 surface VOC EMFLUX® survey samples, as well as 7 field duplicates, 16 ambient air samples, and 280 subsurface pore-gas samples. All data used quantitatively to identify chemicals of potential concern (COPCs) at MDA L were subjected to RRES-RS quality assurance and quality control (QA/QC) procedures. The data review process for identifying COPCs begins with a comparison of site data with

- naturally occurring background concentrations for inorganic chemicals,
- naturally occurring background or fallout concentrations for radionuclides, and
- analytical estimated quantitation limits (EQLs) for organic chemicals.

Background comparisons and a variety of statistical and graphical methods are used to compare site inorganic and radionuclide data with Laboratory background data (LANL 1998, 59730). Organic chemical data were evaluated for only detection status. For background comparisons, the first step was to compare the site data with a background value (BV). A BV may be an estimated value for the background data set (upper tolerance limit [95, 95] or the 95% upper confidence bound on the 95th quantile), a detection limit (DL), a fallout value (FV), a minimum detectable activity, or it may be calculated based on secular equilibrium or a total analysis. The term "background value" will be used in this report to represent any of these values.

If a site-specific datum exceeds its BV, additional evaluation of the datum may be performed by comparing the range of values in the site data set for a chemical to its range of values in the background data set. Graphical analyses (e.g., box plots) may be used, or if adequate data are available, statistical tests that evaluate differences in distribution may be used. Nonparametric tests commonly used to assess data distributions include the Gehan, quantile, and slippage tests. Together, these tests assess complete shifts in distributions, shifts of a subset of the data, and the potential for some of the site data to be greater than the maximum background concentration. Observed significance levels (p-values) are obtained; these values indicate whether a difference exists between the data sets. A p-value of less than 0.05 indicates a difference exists between the distributions (i.e., the site data are different from the background data). A p-value greater than 0.05 indicates that no difference exists between distributions (i.e., site and background data). Statistical tests, graphical analyses, and their results are discussed in Appendix E.

Only data that are relevant for identifying COPCs are discussed in this section; this includes measurements above applicable thresholds or DLs greater than the applicable threshold.

B-2.1 Surface Investigation

B-2.1.1 Channel Sediment Sampling

Runoff from MDA L is concentrated into a single drainage channel that carries surface runoff to the north-northeast into Cañada del Buey (Figure B-2). This drainage includes multiple braided channels traversing a 50-ft- to 65-ft-wide area of a colluvial slope to the floor of a tributary of Cañada del Buey. The channels begin along the eastern fence of MDA L and diverge below the cliffs on the north side of Mesita del Buey.

The Phase I RFI channel sediment sampling was conducted at MDA L in July 1994. Eight locations from within the drainage were selected for sediment sampling to determine if contaminants had migrated from MDA L; the most likely depositional areas (e.g., low areas behind obstructions) for the channel were determined by an on-site geomorphic survey. These locations included areas with coarse sediment deposition on the upper slope and areas with finer sediment deposition on the lower slope. Sample depth ranged from 0 to 4 in. to 0 to 8 in. Eight sediment samples (along with a field duplicate sample and rinsate blank) were collected and field-screened for gross alpha, beta, and gamma radiation to bias sample selection. The sample with the highest gross alpha and gross beta, the sample with the highest gross gamma, and two other samples selected at random (four total) were submitted to an off-site contract laboratory for analysis of TAL metals, PCBs, pesticides, alpha and gamma spectroscopy radionuclides, technicium-99, tritium, strontium-90, and yttrium-90 (LANL 1996, 54462, pp. 57, A2-1–A2-2). Table B-5 lists the sediment sample locations, sample IDs, depths, and requested analyses.

Channel sediments at MDA L are derived from the mesa-top materials, the tuff on the sides of the mesa, and colluvium and soils on the mesa slopes (LANL 1996, 54462, pp. 14–15). The samples were described in the field summary report as soil samples and in the channel sediment report as silt, sand, and gravel mixtures. Sample concentrations were compared with the Laboratory sediment background data set (LANL 1998, 59730), which was derived from sediment samples collected in Indio, Ancho, Los Alamos, Pueblo, and Guaje Canyons. Because these deposits are young alluvium in or near stream channels (LANL 1998, 59730), the Laboratory background data set for sediments may represent a different matrix than the channel sediment samples collected at MDA L.

Inorganic Chemical Comparison with BV

No inorganic chemicals were detected at concentrations above the sediment BVs in any of the channel sediment samples (Table B-6). Although cadmium, selenium, and silver were not detected, the DLs for these inorganic chemicals exceeded their respective BVs. The sediment BVs for cadmium, selenium, and silver were based on nominal DLs. The sample DLs were reported at approximately twice the BV or less. These metals data are evaluated further in Appendix E. Figure E-1 in Appendix E provides more details on the inorganic chemical comparisons. There were no QA/QC issues associated with the channel sediment inorganic chemical results at MDA L. Overall, the sediment inorganic chemical data for MDA L were of good quality and suitable for data assessment. Table C-8 in Appendix C presents the complete data set.

Radionuclide Comparison with BVs and FVs

Except for tritium, no QA/QC issues were associated with the radionuclide results for samples collected at MDA L. The tritium results were qualified J (estimated) because the results from a blind QC sample fell outside sample recovery limits. Overall, the sediment radionuclide data for MDA L are of good quality and suitable for data assessments. Table C-9 in Appendix C provides the complete data set.

Detected concentrations of radionuclides were compared with the sediment BV or the sediment FVs, depending on whether the radionuclide is naturally occurring or a fallout radionuclide (LANL 1998, 59730). Americium-241, cesium-137, cobalt-60, plutonium-238, plutonium-239, strontium-90, and tritium were compared with sediment FVs. Isotopes of uranium and thorium, which are naturally occurring radionuclides, were compared with sediment BVs (Table B-7).

The channel sediment report (LANL 1996, 54462) listed americium-241, polonium-210, technetium-99, and yttrium-90 as COPCs because no BVs and FVs for those radionuclides were available at that time. Currently, americium-241 has a sediment BV of 0.04 pCi/g, which is greater than the detected concentrations in the channel sediment (Table B-7). Polonium-210 and yttrium-90 both have short half-lives (approximately 138 days and 60 hours, respectively), so they are no longer present in the channel sediment and are, therefore, not evaluated in this HIR.

The highest detected concentration for plutonium-238 (0.011 pCi/g) exceeded the associated sediment BV of 0.006 pCi/g (Table B-7). Figure B-3 shows the sample location and detected plutonium-238 concentration. No other radionuclides were detected above their respective sediment BVs or FVs. Plutonium-238 is retained as a COPC in channel sediments at MDA L.

Evaluation of Organic Chemicals

There were no QA/QC issues associated with the analytical data, and the data are of good quality and suitable for data assessment. Table C-10 in Appendix C provides the complete data set.

Figure B-4 shows that methoxychlor was detected in two samples at concentrations of 0.028 mg/kg (location 54-05143) and 0.063 mg/kg (location 54-05145). The concentrations detected are approximately one to three times the EQL (0.02 mg/kg). No other organic chemicals were detected in the sediment samples. Methoxychlor was retained as a COPC in channel sediments at MDA L.

B-2.1.2 Ambient Air Sampling

During the summer of 1994, ambient-air samples were collected in SUMMA canisters for VOC analysis on eight days at two sampling locations (locations 4 and 5 in Figure B-5) on the northern perimeter of MDA L (Mischler and Anderson 1994, 63525 p. 2-1) and at a background location adjacent to Bandelier National Monument (location 3). The samples were collected on June 16, 17, 29, and 30; July 28; and August 1, 2, and 3, 1994. Duplicate samples were also collected on three of the sampling days. The June samples were collected at the height of the dry season on the Pajarito Plateau, while the July and August samples were taken during the rainy season. Samples were collected over an 8-hr period beginning at 8:00 am. Meteorological data (i.e., ambient temperature and wind speed) were also recorded. Samples were analyzed by the US Environmental Protection Agency (EPA) Method TO-14. Ambient-air data from these sampling events were used to evaluate potential air contamination from MDA L.

Measured concentrations of selected aromatic and halogenated hydrocarbons at ambient air sampling locations 4 and 5 (Figure B-5) are shown in Tables B-8 and B-9. Only organic chemicals that were consistently detected in four or more samples are presented. The data set collected at the Bandelier National Monument (location 3) for the analytes listed in these tables is shown in Table B-10. VOCs are identified as COPCs in ambient air.

B-2.1.3 Surface Flux Measurements

Tritium Surface Flux (Chamber) Measurements

Tritium flux was measured using a flux chamber at five locations near MDA L during the summer of 1993 (locations T1, T2, C11, C29, and C30) and three locations during the summer of 1994 (locations S1, S2, and S3). Tritium flux chamber locations are shown in Figure B-6 and results are presented in Table B-11 (Eklund 1995, 56033, p. 3-22). The flux chamber sampling apparatus consisted of a 1300 cm^2 Plexiglas flux chamber pressed about 1 in. into the soil through which a sweep gas was fed at a constant rate. Air was pulled through the chamber with a pump at a rate slightly less than the sweep gas rate to avoid dilution with ambient air. Tritium samples were collected on primary and secondary gel tubes. The tritium fluxes calculated from these samples are provided in Table B-11. Tritium is identified as a COPC in ambient air.

VOC Surface Flux (EMFLUX®) Measurements

VOC surface flux was measured across MDA L in two surveys conducted in August 1993 and August 1994 to identify the nature and extent of potential subsurface VOC contamination. EMFLUX® collectors, consisting of an adsorbent cartridge suspended on a stake beneath a protective shell for 72 hr, were used in the survey. Details of the investigation are reported in Quadrel Services reports (1993, 63868; 1994, 63869). The results of the surface flux VOC measurement investigations are summarized in a report issued by Trujillo et al. (1998, 58242).

In the first survey in August 1993, 70 locations were sampled, and an additional 32 locations were sampled in the August 1994 survey. The majority of the 1993 sample locations were on the mesa top at MDA L, while most of the 1994 sample locations were in the slopes and drainages on the sides of the mesa. The EMFLUX® surface flux measurement locations are shown in Figure B-7. Four field duplicate samples also were collected during the first survey, and three field duplicates were collected during the second survey.

Twenty VOCs were detected in the 102 EMFLUX® samples collected in 1993 and 1994 (Trujillo et al. 1998, 58242). Flux measurements were taken only in areas not covered by asphalt, including perimeter and hillside locations. The detected VOCs in the 1993 samples include acetone, benzene, bromobenzene, 2-butanone, carbon tetrachloride, chlorobenzene, chloroform, chloromethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, 1,2-dichloropropane, ethylbenzene, n-propylbenzene, PCE, toluene, TCA, TCE, Freon 113, and xylene. Fewer VOCs were detected in the 1994 samples from the hillsides and were limited to acetone, chlorobenzene, chloroform, 1,1-dichloroethane, 1,1-dichloroethene, methylene chloride, PCE, toluene, TCA, TCE, Freon 113, and xylene.

The highest surface flux measurements for TCA, PCE, and TCE were found in samples collected in 1993 from the mesa top. Freon 113 and acetone were also detected in many samples at relatively low levels compared to the three main VOCs: TCA, TCE, and PCE. The 1994 EMFLUX® data from the hillsides indicate much lower surface flux than those measured on top of the mesa in 1993; the most prevalent VOCs in the 1994 data were also TCA, PCE, and TCE. The compound 1,1-dichloroethene was also detected at a relatively high frequency in the 1994 samples on the north slope of the mesa. Freon 113 was detected frequently in the 1994 data set at low levels in samples collected on the southern slope of the mesa.

A plot showing the TCA surface flux results at MDA L is provided in Figure B-8. Flux measurements with values less than or equal to 3.1 ng/m^2/min are represented as a small triangle in the figure. These values are the DL of the method.

B-2.2 Subsurface Investigations

B-2.2.1 Subsurface Sampling

Phase I RFI Core Sampling

From September 9, 1993, to May 8, 1995, during the Phase I RFI, seven vertical boreholes and eleven angled boreholes were advanced at MDA L. Detailed borehole logs, including lithologies and a diagram showing pore-gas sampling port construction for the monitoring borehole are presented in Appendix F. Borehole locations and trajectories are shown on Figure B-9. The RFI boreholes are described by depth, declination, and adjacent disposal unit in Table B-12. Table B-12 lists similar information for the pre-RFI boreholes. The exterior and ends of each core barrel and each 5-ft. interval of core were screened for VOCs using a photoionization detector (PID). Each 5-ft interval of core was inspected for fractures or stains, and the results were noted in borehole logs (Appendix F).

During the Phase I RFI at MDA L, 184 core samples including 12 field duplicates were collected from 16 boreholes and submitted to an on-site field laboratory or an off-site contract laboratory for analysis. An additional 402 samples were collected and submitted to a mobile radiological laboratory. Depth intervals for sample collection and analytical suites varied by borehole and are described below. A total of 18 boreholes were drilled during the Phase I RFI; however, core samples were not collected from boreholes 54-01017 and 54-01018. Borehole 54-01017 was designed as the extraction well for the pilot vapor-extraction test, and borehole 54-01018 was drilled as an additional pore-gas monitoring borehole located 20 ft from borehole 54-01017. Table B-13 lists the core sample locations, sample IDs, depths, media sampled, and requested analyses.

In 1993, boreholes 54-01001 through 54-01006 were drilled immediately east of MDA L (Figure B-9). These two vertical and four angled boreholes were drilled to depths ranging between 291 and 340 ft bgs using an 8-in.-diameter hollow-stem auger and a continuous-coring technique. These six boreholes were instrumented with vapor-monitoring systems using SEAMist™ positive-pressure borehole liners. A total of 94 core samples were collected at 20-ft intervals from boreholes 54-01001 through 54-01006 and submitted to an on-site fixed laboratory or off-site contract laboratory for VOC analysis.

Vertical boreholes 54-01007, 54-01008, and 54-01009 were also drilled in 1993 adjacent to numerous shafts and Pit A. Thirty-eight core samples were collected at 10-ft intervals and submitted for on-site fixed laboratory or off-site contract laboratory analysis of TAL metals, cyanide, pesticides/PCBs, herbicides, SVOCs, and VOCs. Five core samples from borehole 54-01009 were also submitted to an off-site contract laboratory for analysis of americium-241 and cesium-137 by gamma spectroscopy and plutonium and uranium isotopes by alpha spectroscopy. Boreholes 54-01007, 54-01008, and 54-01009 were subsequently backfilled.

In 1994, angled boreholes 54-01010 through 54-01014 were advanced using an 8-in.-diameter hollow-stem auger and a continuous-coring technique beneath Pit A and Impoundments B, C, and D at MDA L (Figure B-9). In 1996, the surface casings were removed, and each borehole was backfilled and grouted closed, ensuring that the borehole did not provide a conduit for surface runoff to enter the subsurface. A total of 29 core samples were collected at 10-ft intervals and submitted to an off-site contract laboratory for analysis of TAL metals, pesticides/PCBs, SVOCs, VOCs, total uranium, and tritium. All samples except five from borehole 54-01013 were also analyzed for cyanide.

In 1994 and 1995, two deep-angled boreholes, designated as 54-01015 and 54-01016, were drilled from the adjacent canyon slope northeast of MDA L within Cañada del Buey to investigate the possible presence of vapor-phase contaminants at depth beneath MDA L (Figure B-9). These boreholes were drilled to depths of 530 ft and 600 ft bgs, respectively, beneath MDA L using air-rotary installation of 8-in.-diameter STRATEX® casing to the bottom of each borehole. Borehole 54-01015 was drilled to intersect the region below the closed disposal shafts located in the western part of MDA L. Borehole 54-01016 was drilled to intersect the region below the closed pit, impoundments, and shafts located in the eastern part of MDA L (Figure B-9). The boreholes were selectively cored for approximately 10 ft within every 40-ft interval below a depth of 260 ft bgs. From discontinuous core, 22 samples were collected and analyzed at an off-site contract laboratory for VOCs and tritium. Following the installation of Solinst multiport vapor and lysimeter coupled systems in each borehole, the STRATEX® casing was withdrawn while annular well completion materials were emplaced to complete the borehole for vapor monitoring. Both boreholes are maintained as vapor-monitoring wells.

In 1995, boreholes 54-01017 and 54-01018 were advanced east of MDA L (Figure B-9). Borehole 54-01017 was designed as the extraction well for the pilot vapor extraction test, and borehole 54-01018, located 20 ft south-southeast of borehole 54-01017, was used to monitor pore gas during extractor tests. Borehole 54-01017 was drilled to a depth of 159 ft bgs using an 8-in.-diameter hollow-stem auger and reamed to a 10-in. diameter. The top 75 ft of borehole 54-01017 is cased with 10-in.-diameter steel casing and is open below the casing to a depth of 150 ft. Borehole 54-01018 was drilled to a depth of 328 ft bgs using an 8-in.-diameter hollow-stem auger and a continuous-coring technique. The top 30 ft of borehole 54-01018 is cased 8-in.-diameter steel. No core samples were collected from boreholes 54-01017 and 54-01018 for screening or analysis during the Phase I RFI. Both boreholes are capped at the ground surface.

Results of geologic logging were recorded in the borehole logs (Appendix F). Saturation was not encountered in any of the Phase I RFI boreholes at MDA L; however, moist cuttings and core were observed in RFI boreholes 54-01015 and 54-01016, which were drilled in 1994 and 1995. Borehole logs provided in Appendix F document moist-to-wet cuttings and core at depths of 343 ft bgs (Puye Formation paleosol), 449 ft bgs (basalt), and 475 ft bgs (basalt) in borehole 54-01015. Similarly, the borehole log for borehole 54-01016 shows moist cuttings and core at a depth of 219 ft bgs (Cerro Toledo interval) and at multiple depths within the basalt (312, 370, 371, 397, 459, 479, 497, and 510 ft bgs) beneath MDA L. Instruments to collect both pore vapor and water were installed where moist-to-wet conditions were found at two depths (308.3 and 461.4 ft bgs) in borehole 54-01015 and at four depths (162.3, 274.7, 414.3, and 517.6 ft bgs) in borehole 54-01016. Initial attempts in April 1996 to collect water samples yielded approximately 0.5 to 1 mL for the samples from borehole 54-01015 and no water for the samples from borehole 54-01016 (Lowry 1996, 81612). During quarterly pore-gas monitoring conducted from 1996 through 1999, the ports in target zones of potential perched zones were sampled for pore gas; however, no water was recovered.

Borehole Airflow Velocity (Passive VOC Extraction)

In 1997 and 1998, the former Environmental Restoration Project (now called Risk Reduction and Environmental Stewardship–Remediation Services [RRES-RS]) evaluated the effectiveness of passive vapor extraction of subsurface vapor-phase VOCs at MDA L as specified in Appendix A of the approved RFI work plan for OU 1148 (LANL 1992, 7669). Passive vapor extraction uses natural changes in atmospheric barometric pressure as a pump to exhaust VOCs through the open boreholes. The volume of air flowing out of a borehole and the concentration of VOCs in this air are used to calculate the annual emission rate of VOCs from a borehole.

In 1997, airflow volume and VOC concentrations were measured with a Brüel and Kjaer (B&K) Multigas Analyzer, Model 1302 at borehole 54-01006 and reported in Neeper and Kisiel (1998, 63999). In 1998, the tests were repeated using a one-way valve on borehole 54-01006 to allow only the exhalation of subsurface air during periods of relatively high atmospheric pressure. During the 1998 study, vapor concentrations and pressure were measured at several subsurface ports in boreholes 54-01004, 54-01006, and 54-01018 and in atmospheric air. The 1998 results are presented in Kisiel and Mason (1998, 63526). These data were not used for evaluating the nature and extent of contamination at MDA L.

Pore-Gas Sampling

Subsurface pore gas sampling at MDA L is required by Section C.5 of Module VIII of the Laboratory's Hazardous Waste Facility Permit, "Unsaturated Zone Monitoring" (EPA 1990, 1585; EPA 1994, 44146). The approved sampling and analysis plan (Davis 1993, 38812) requiring collecting pore-gas samples from 12 of 28 available boreholes at MDAs G (4) and L (24) on a quarterly basis is described in the Laboratory's response (Glatzmaier 1993, 30987) to an EPA notice of deficiency ([NOD] Driscoll 1992, 3849). Of the 12 boreholes, 10 boreholes are to be selected every quarter from the available 24 pore-gas monitoring boreholes located at MDA L (Figure B-9).

The depths of pore-gas sampling ports in the 24 operational vapor-monitoring boreholes currently sampled at MDA L are listed in Table B-14. Detailed borehole logs, including lithologies for boreholes 54-01015 and 54-01016, are presented in Appendix F. Borehole logs for the 2000 series locations are included in the Laboratory's response to NMED's 1986 Compliance Order (LANL 1987, 76068). Pore-gas monitoring methods have changed over the years in response to more sensitive detection capabilities. A summary of pore-gas sampling from 1995 through 2003 is included in Appendix D.

The pilot extraction study plan, as originally described in the approved RFI work plan for OU 1148 (LANL 1992, 7669), was modified in 1996 (LANL 1996, 55574) to include the installation of two angled boreholes instead of two vertical boreholes to allow data to be collected beneath multiple disposal units and from deep geologic formations. Between November 1994 and March 1995, two angled boreholes (54-01015 and 54-01016) were drilled into the basalt underlying the Bandelier Tuff. The two boreholes were advanced from Cañada del Buey to vertical depths of 430 and 600 ft, respectively, beneath MDA L.

Since 1997, pore-gas sampling has been aided and directed using soil-gas screening with a B&K Multigas Analyzer, Model 1302. The gas analyzer is capable of measuring up to five analytes and is used to screen for TCA, TCE, PCE, Freon 11, and Freon 113. Screening targets these five analytes because they are the most prominent VOCs in the MDA L vapor plume. The gas analyzer is integrated into a gas-sampling train that allows for subsurface soil-gas purging, screening, and SUMMA canister sampling. Soil-gas ports are purged until subsurface carbon dioxide levels have stabilized to representative soil-gas levels prior to screening and sampling. All sampling ports in all boreholes are screened using the B&K.

Until fiscal year (FY) 2000, the pore-gas procedure called for screening of well ports using the B&K, followed by SUMMA sampling at the highest concentration port in selected vapor-monitoring wells. This procedure provided a good data set for a limited number of ports in a limited number of boreholes. To complete the determination of the data gaps associated with nature and extent of VOC contamination, the procedure was modified in FY 2000 at the request of NMED. All ports in the vapor-monitoring boreholes are still screened using the B&K to provide data regarding changes in the concentrations of VOCs in the plume; however, the screening results are not used to direct SUMMA sampling. Instead, ports are sampled with SUMMA canisters as needed to evaluate changes in the plume stability based on a defined quarterly sampling schedule (LANL 2003, 80901, pp. D1–D4).

B-2.2.2 Subsurface Tuff Samples

A total of 184 subsurface core samples were collected from 16 boreholes at MDA L (Figure B-9). These samples were analyzed for TAL metals and cyanide, pesticides/PCBs, herbicides, VOCs, SVOCs, and radionuclides. As discussed below, not every sample was analyzed for every constituent. Core samples from six boreholes (54-01001 through 54-01006) were drilled to investigate the vapor plume east of MDA L; 95 core samples from these boreholes were analyzed only for VOCs and moisture by an on-site fixed laboratory or an off-site contract laboratory. Two deep characterization boreholes (54-01015 and 54-01016) were drilled at an angle to investigate the potential presence of vapor-phase contaminants at depth below MDA L; the core samples from these boreholes were analyzed for moisture, VOCs, and tritium at off-site contract laboratories. The remaining eight boreholes (54-01007 through 54-01014) were drilled in the vicinity of the disposal units (i.e., pit, impoundments, and shafts)

Samples from all boreholes were analyzed for TAL metals, pesticides, PCBs, SVOCs, and VOCs. All samples except those from borehole 54-01013 were analyzed for cyanide. Samples from boreholes 54-01007 through 54-01009 were analyzed for herbicides. Samples from boreholes 54-01010 through 54-01014 were analyzed for tritium and total uranium. Five samples from borehole 54-01009 were analyzed for americium-241 and cesium-137 by gamma spectroscopy and plutonium and uranium isotopes by alpha spectroscopy. These analyses were conducted at an on-site fixed laboratory or an off-site contract laboratory. Core samples were not collected from two additional boreholes drilled in 1995. Borehole 54-01017 was designed as the extraction well for the pilot vapor extraction test, and borehole 54-01018 was an additional pore-gas monitoring borehole. Table B-13 summarizes the subsurface core samples collected during the Phase I RFI and the requested analyses for each sample.

Inorganic Chemical Comparison with Background

Subsurface core sample data for inorganic chemicals (Table B-13) were obtained from the eight boreholes (54-01007 through 54-01014) in the vicinity of the disposal shafts, impoundments, and pit at MDA L (Figure B-9). Five (out of 67) mercury and cyanide analyses were rejected because the holding times were exceeded, and four out of 67 arsenic and selenium results were rejected because of low analyte recovery from a QC sample. The low recovery indicates potentially inaccurate results for arsenic and selenium. Many results for the inorganic chemicals were qualified J (estimated) because of evidence of variable efficiencies of extraction from the soil matrix or very low reported concentrations relative to DLs. J-qualified data are usable for decision-making purposes but have a greater analytical uncertainty than unqualified data. Overall, except for the rejected data, the data are of good quality and are sufficient for data assessment.

Analytical results for the samples collected from Qbt 2 were compared with BVs for Qbts 2, 3, and 4, and samples from Qbt 1v and Qbt 1g were compared with BVs for those units (LANL 1998, 59730). Tables B-15a and B-15b provide the inorganic chemicals detected in core and their frequency above background. Figure B-10 shows the locations and concentrations of inorganic chemicals detected above BVs in subsurface tuff at MDA L. Analytical results were plotted by depth in each borehole to identify patterns potentially associated with a release and migration through a fractured medium (Appendix E, Figures E-2 and E-7). Table C-12 in Appendix C provides the complete data set.

The data review indicates that barium, chromium, cobalt, copper, manganese, nickel, uranium, and zinc are elevated compared with Laboratory BVs and are retained as COPCs in subsurface tuff at MDA L.

Radionuclide Comparison with BVs and FVs

Core samples from seven boreholes (54-01010 through 54-01016) were analyzed for tritium, and five core samples from borehole 54-01009 were analyzed for americium-241 and cesium-137 by gamma spectroscopy and plutonium and uranium isotopes by alpha spectroscopy (Table B-13). The analytical result from one of 48 core samples analyzed for tritium was rejected because of a laboratory error. A number of the analytical results are J qualified (estimated) because laboratory QC indicators identified more variability in the analytical results than normally expected. With the exception of one (of 48) rejected tritium result, the radionuclide results from subsurface tuff at MDA L are of good quality and are sufficient for data assessment. Naturally occurring uranium isotopes were compared to Laboratory sitewide BVs from the appropriate tuff strata (LANL 1998, 59730). Fallout radionuclides (plutonium-238, plutonium-239, and tritium) were evaluated on the basis of detection status (i.e., if a fallout radionuclide is detected, it is evaluated further).

Data indicate that tritium was detected in 12 of 48 core samples and at several depths in boreholes 54-01010, 54 -01011, 54-01013, 54-01014, and 54-01015. The concentrations ranged from nondetect to 11.6 pCi/g[1] (196 pCi/mL) in borehole 54-01010. Uranium-234 and uranium-238 were detected at concentrations less than the BVs. Therefore, tritium is the only radionuclide identified as a COPC in the core samples. Table B-16 summarizes the frequency of detected radionuclides above BVs for the subsurface core samples. Table B-17 presents the detected tritium concentrations by subsurface sample.

---

[1] The accuracy of the tritium values is questionable. Tritium in core is measured by EPA Method 906.0, which is performed on the water extracted from the core sample. At gravimetric moisture content less than 10%, a 3-in. length of 2-in.-diameter core will yield less water than the minimum required volume of 5 mL. To reach the necessary volume, de-ionized water is added to the extracted water. The reported activity and uncertainty are corrected for the dilution. Therefore, any moisture loss from a core sample prior to analysis at low moisture contents may substantially increase the uncertainty of the measurement. Moreover, the EPA method requires that the core material be ground to a fine mesh before the water is extracted, such that significant moisture loss is inevitable. Given these issues, RRES-RS concluded that tritium contamination is best characterized in low moisture content at MDA environments by using sorbent materials to extract and retain in situ subsurface water samples from pore gas. Disposal of tritium per se is not recorded in the disposal logbooks; however, chemicals containing hydrogen disposed of at MDA L could have contained tritium. Vacuum pump oils would be a likely source. The activity of tritium is low, indicating tritium-contaminated material may have been disposed of at MDA L and not sent to MDA G as radioactive material.

VOCs in Pore-Gas Samples

Pore-gas monitoring methodologies have evolved over time. Appendix D provides a history of the monitoring methodologies, including the current monitoring program. In general, the methods and resulting data quality have improved steadily. For this HIR, the pore-gas monitoring data collected prior to and during 1996 are used only semiquantitatively to assess the history of MDA L's subsurface vapor-phase VOC plume. The data collected from 1997 to the present have been subjected to rigorous QA/QC procedures, both in the field collection and the laboratory. During each round of quarterly sampling, an equipment blank is collected to identify whether laboratory contamination has affected analytical results, a field duplicate is collected to determine if the analytical instrument is within precision limits, and a performance evaluation sample of calibration gases is collected to determine if calibration gases used for the B&K instrument are at the concentration listed on the gas cylinder.

The pore-gas monitoring data for MDA L indicate TCA is the primary VOC, followed consistently in abundance by TCE. The complete pore-gas data set is included in Appendix C, Table C-11. The frequency of detection and range of concentrations for sampling from 1997 through 2003 are presented in Table B-19. VOCs are retained as COPCs in subsurface pore gas at MDA L.

Table B-20 presents the maximum detected concentration for each VOC from the fourth quarter FY 1999 SUMMA canister sampling results, and the location of that sample (borehole and port depth). This data set is representative of the results from the sampling protocol in place prior to FY 2000 when sampling was performed to determine the nature and extent of the VOC plume. Table B-21 provides similar information from the first quarter FY 2002 SUMMA canister sampling results, which are representative of the post-2000 pore-gas sampling protocol to determine trends in the plume's concentration in the source area and at the boundaries of the plume.

Analysis of the pore-gas monitoring data indicates vapors from the two shaft fields (1 through 28 and 29 through 34) are compositionally different, indicating two unique sources. The two sources consist largely of TCA, but the relative concentrations of lesser compounds are different. The two source areas are referred to as the northwest source area and the southeast source area.

Hydraulic Properties

Laboratory tests were performed on 21 core samples from boreholes 54-01001, 54-01002, 54-01003, and 54-01006 to measure hydraulic properties using ASTM methods (LANL 1994, 76071). The laboratory tests included moisture content (ASTM D 2216-90), saturated hydraulic conductivity (ASTM D 2434-68), moisture-retention characteristics (ASTM D 2325-68), particle density (ASTM D 854-91), and the Branauer-Emmet-Teller equation to estimate surface area (various ASTMs). Samples were collected from each unit of Bandelier Tuff down to 271 ft bgs beneath MDA L, including the Cerro Toledo interval. Core samples were collected in 6-in. brass sleeves, capped and sealed in core-protect bags upon recovery using the hollow-stem auger drilling method. The analytical laboratory received one open sample, and it repacked two samples after opening them for analysis.

The gravimetric moisture contents of the undisturbed samples ranged from 0.5% to 13%. Generally, moisture content increased with depth in each borehole. Saturated hydraulic conductivities ranged from 10^{-4} to 10^{-5} cm/sec with no discernable trends. The results were consistent with data from other Mesita del Buey boreholes, with the exception of the disturbed samples described above.

Figure B-3 presents the sample locations and results for the radionuclides detected above BV/FV concentrations in sediment and tuff. Table C-13 contains the complete data set.

Evaluation of Organic Chemicals

A total of 184 core samples, including 12 field duplicates, were collected from ten boreholes and analyzed for VOCs. Sixty-seven core samples collected from the eight boreholes drilled in the vicinity of the disposal shafts and pits (54-01007 through 54-01014) were also analyzed for SVOCs, pesticides, and PCBs. Thirty-eight core samples collected from three boreholes (54-01007 through 54-01009) in closest proximity to the disposal shafts were also analyzed for herbicides.

Ninety-eight VOC results were qualified as not detected (U) because the results were less than five or ten times the concentrations detected in the method blank. Six results were qualified as estimated (J or UJ) because the surrogate recoveries associated with these analytes were low. Eleven results were qualified as estimated (J) for acetone and 2-butanone because the results were less than the practical quantitation limit (PQL) but greater than the method detection limit (MDL). Two results were qualified as estimated (J) because the holding time was exceeded. Overall, the data are of good quality and sufficient for data assessment.

Six SVOC results were qualified as estimated (J or UJ) because the holding time had been exceeded. Two results were qualified as estimated (J) because the results were less than the PQL but greater than the MDL. Three results were rejected (R) and could not be used for data assessment because the surrogate recoveries associated with the analytes were low (10%). Overall, except for the rejected data, the data are of good quality and are sufficient for data assessment.

Herbicides were not detected in any of the subsurface core samples from MDA L. Nineteen VOCs were detected in core, most at trace concentrations (i.e., less than or slightly above the EQLs). Concentrations greater than EQLs were detected at boreholes beneath Pit A (54-01010 and 54-01011), between Pit A and Shafts 1 through 28 (54-01009), and at the east end of the array of Shafts 1 through 28 (54-01007 [Figure B-11]).

Two pesticides, Aroclor-1260, and three SVOCs were detected in one to four samples at several sampling depths in tuff. Aroclor-1260 was reported in one sample from borehole 54-01010 at a concentration (0.313 mg/kg) about 70 times greater than the sample EQL (0.0044 mg/kg). Methoxychlor was detected above the EQL in one sample in borehole 54-01010 (0.0756 mg/kg versus the EQL of 0.0226 mg/kg), and the pesticide dichlorodiphenyldichloroethane (DDD) was detected in one sample and associated field duplicate at concentrations marginally above to approximately three times the EQL (0.0044 mg/kg) in borehole 54-01011.

In summary, several organic chemicals were reported in the subsurface media near Pit A and Shafts 1 through 28. The organic chemicals were detected primarily at concentrations near or below the EQLs at only a few depths. Although some VOCs were detected in the core samples at concentrations approximating EQL values, these measurements were unreliable because VOCs do not adsorb to tuff. Therefore, the nature and extent of the VOC plume at MDA L was better defined using the pore-gas sampling results (see below) than the core results. The sporadic nature of the detections of SVOCs, Aroclor-1260, and pesticides does not indicate a release and has not been evaluated further.

Tables B-18a and B-18b provide the organic chemicals detected in core and their frequency of concentrations. The frequency and range of concentrations for the detected organic chemicals are given in Table B-18a. Figure B-11 presents the sample locations for the detected organic chemicals. Table C-14 in Appendix C presents the complete data set.

B-2.3 Summary of COPCs at MDA L

Table B-22 summarizes the results of the data review and lists all COPCs at MDA L for channel sediments, ambient air, subsurface tuff, and pore-gas samples. For each COPC, or group of COPCs, the table identifies the analytes retained and the ones eliminated from further consideration in the HIR, and the rationale for the decision.

B-2.4 Post-Phase I RFI Groundwater Monitoring

Pursuant to the NMED-approved hydrogeologic work plan for the Laboratory (LANL 1998, 59599), the Laboratory and the Department of Energy (DOE) installed three regional wells in 2002 in the vicinity of MDA L: characterization well R-20 in Pajarito Canyon, upgradient of MDA L and MDA G; well R-21 in Cañada del Buey between MDA L and MDA G; and well R-32 in Pajarito Canyon, downgradient of MDA L (Figure B-12). The Laboratory prepared and submitted completion reports for wells R-20 and R-32 to NMED in June 2003. The report for well R-21 was prepared by the DOE and was also submitted to NMED in June 2003.

The three regional wells are scheduled to be sampled in FY 2004. Regional well R-22, completed downgradient of MDA G, has been sampled, and four quarters of analytical data have been reported in "Characterization Well R-22 Geochemistry Report" (Longmire 2002, 73676).

B-3.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author, publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the RRES-RS Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the RRES-RS project reference set titled "Reference Set for Material Disposal Areas, Technical Area 54."

Copies of the reference sets are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Site Office; US Environmental Protection Agency, Region 6; and RRES-RS project. The sets were developed to ensure that the administrative authority has all material needed to review this document, and they are updated periodically as needed. Documents previously submitted to the administrative authority are not included.

Davis, A., December 14, 1993. "RFI Work Plan for OU 1148, Approval, Los Alamos National Laboratory NM0890010515," Memorandum to J. Vozella, DOE, Region VI, from A. Davis, EPA, Region VI, Los Alamos, New Mexico. (Davis 1993, 38812)

DOE (US Department of Energy) February 1987. Engineering Drawing ENG-C-45259, number LA-ZU-B-C4, prepared by Black and Veatch for the Department of Energy, Los Alamos Area Office, Los Alamos, New Mexico. (LASL 1987, 25606)

Driscoll, B. November 1992. "Overall Comments Regarding Notice of Deficiency," Memorandum from B. Driscoll, EPA, to C. Rofer, Los Alamos National Laboratory, Los Alamos, New Mexico. (Driscoll 1992, 3849)

Eklund, B., March 15, 1995. "Measurement of Emission Fluxes from Technical Area 54, Areas G and L, Final Report," prepared under DOE Subcontract No. 63545L0014-31 by Radian Corporation, Austin, Texas. (Eklund 1995, 56033)

EPA (US Environmental Protection Agency), April 10, 1990. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1990, 1585)

EPA (US Environmental Protection Agency), April 19, 1994. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, new requirements issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 19, 1994, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1994, 44146)

Glatzmaier, T., November 12, 1993. "Final Notice of Deficiency (NOD) Response for Operable Unit (OU) 1148," Los Alamos National Laboratory letter (EM-13:93-A232) to T. Taylor, DOE, from T. Glatzmaier, EM-13, Los Alamos, New Mexico. (Glatzmaier 1993, 30987)

Glatzmaier, T. June 1994. "Proposed Modification to the Resource Conservation and Recover Act (RCRA) Facility Investigation (RFI) for Operable Unit (OU) 1148,"Los Alamos National Laboratory letter (EM/ER:94-A199) to T. Taylor, DOE-LAAO, from T. Glatzmaier, EM, Los Alamos, New Mexico. (Glatzmaier 1994, 52015)

Jansen, J., and T. Taylor, July 17, 1996. "Modification to Resource Conservation and Recovery Act Facility Investigation (RFI) Work Plan for Operable Unit (OU) 1148, Field Unit 5, MDA G," Los Alamos National Laboratory Letter (EM/ER:96-234) to B. Garcia, NMED from J. Jansen, LANL (ER/EM) and T. Taylor, DOE, Los Alamos, New Mexico. (Jansen and Taylor 1996, 54959)

Kisiel, K., and N. Mason, October 1998. "Passive Vapor Extraction Test with a One-Way Valve at Borehole 54-1006, MDA L, TA-54," Science & Engineering Associates report SEASF-TR-98-215, Santa Fe, New Mexico. (Kisiel and Mason 1998, 63526)

LANL (Los Alamos National Laboratory), 1987. "Hydrogeologic Assessment of Technical Area 54, Areas G and L, Los Alamos National Laboratory," Docket Number NMHWA 001007, Los Alamos, New Mexico. (LANL 1987, 76068)

LANL (Los Alamos National Laboratory), July 1991. "Review of Soil Vapor Sampling Wells and Data from TA-54, Areas G and L, Los Alamos National Laboratory," report prepared by IT Corporation, Los Alamos, New Mexico. (LANL 1991, 11729)

LANL (Los Alamos National Laboratory), May 1992. "RFI Work Plan for Operable Unit 1148," Los Alamos National Laboratory document LA-UR-92-855, Los Alamos, New Mexico. (LANL 1992, 7669)

LANL (Los Alamos National Laboratory), September 1992. "Operable Unit 1148 Data Report," Los Alamos, New Mexico. (LANL 1992, 23247)

LANL (Los Alamos National Laboratory), September 1993. Engineering Drawing AB-113, number C1, prepared by Johnson Controls for Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 1987, 76052)

LANL (Los Alamos National Laboratory), July 1993. "Pilot Extraction Study Plan for the Organic Vapor Plume at MDA L," Los Alamos, New Mexico. (LANL 1993, 22430)

LANL (Los Alamos National Laboratory), June 1994. "Laboratory Analysis of Soil Hydraulic Properties of Boreholes 54-1001, 1002, 1003, and 1006," report prepared by Daniel B. Stephens & Associates, Inc., Albuquerque, New Mexico. (LANL 1994, 76071)

LANL (Los Alamos National Laboratory), February 1996. "RFI Report for Channel Sediment Pathways from MDAs G, H, J, and L, TA-54," Los Alamos National Laboratory document LA-UR-96-110, Los Alamos, New Mexico. (LANL 1996, 54462)

LANL (Los Alamos National Laboratory), December 1996. "Installation Work Plan for Environmental Restoration Program," Revision 6, Los Alamos National Laboratory document LA-UR-96-4629, Los Alamos, New Mexico. (LANL 1996, 55574)

LANL (Los Alamos National Laboratory), September 22, 1998. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-98-4847, Los Alamos, New Mexico. (LANL 1998, 59730)

LANL (Los Alamos National Laboratory), May 22, 1998. "Hydrogeologic Workplan," Los Alamos, New Mexico. (LANL 1998, 59599),

LANL (Los Alamos National Laboratory), August 2003. TA-54, Area G, Los Alamos National Laboratory Logbooks from January 1966 to January 1996, RRES Record Package 661, Los Alamos New Mexico. (LANL 2003, 76036)

LANL (Los Alamos National Laboratory), November 2003. "Quarterly Technical Report, July to September 2003," Los Alamos National Laboratory document LA-UR-03-8200, Los Alamos, New Mexico. (LANL 2003, 80901)

Longmire, P., September 2002. "Characterization Well R-22 Geochemistry Report," Los Alamos National Laboratory report LA-13986, Los Alamos, New Mexico. (Longmire 2002, 73676)

Lowry, W. E., May 29, 1996. Letter describing water sampling activity at boreholes 54-1015 and 54-1016 to R. Gilkeson, ERM/Golder Los Alamos Project Team, from W. E. Lowry, Science and Engineering Associate, Inc., Los Alamos, New Mexico. (Lowry 1996, 81612)

Mischler, S., and E. Anderson, March 15, 1994. "Ambient Monitoring of Volatile Organic Compounds at Los Alamos National Laboratory in Technical Area 54, Areas G & L," prepared under DOE Subcontract No. 63545L0014-31 by Radian Corporation, Austin, Texas. (Mischler and Anderson 1994, 63525)

Neeper, D., and K. Kisiel, May 5, 1998. "Passive Vapor Extraction Test at TA-54, Well 54-1006 During 1997," Science and Engineering Associates report SEA-SF-TR-98-195, Santa Fe, New Mexico. (Neeper and Kisiel 1998, 63999)

NMEID (New Mexico Environmental Improvement Division), May 1985. In the Matter of LANL EPA ID #NM0890010515, Docket Number NMHWA 001007, Compliance Order/Schedule. (NMEID 1985, 75885)

Quadrel (Quadrel Services, Inc.), September 1993. "EMFLUX® Soil-Gas Survey of Technical Area 54 (MDA G) Los Alamos National Laboratory," Quadrel Report Number QS1135, Maryland Spectral Services, Inc., Forest Hill, Maryland. (Quadrel 1993, 63868)

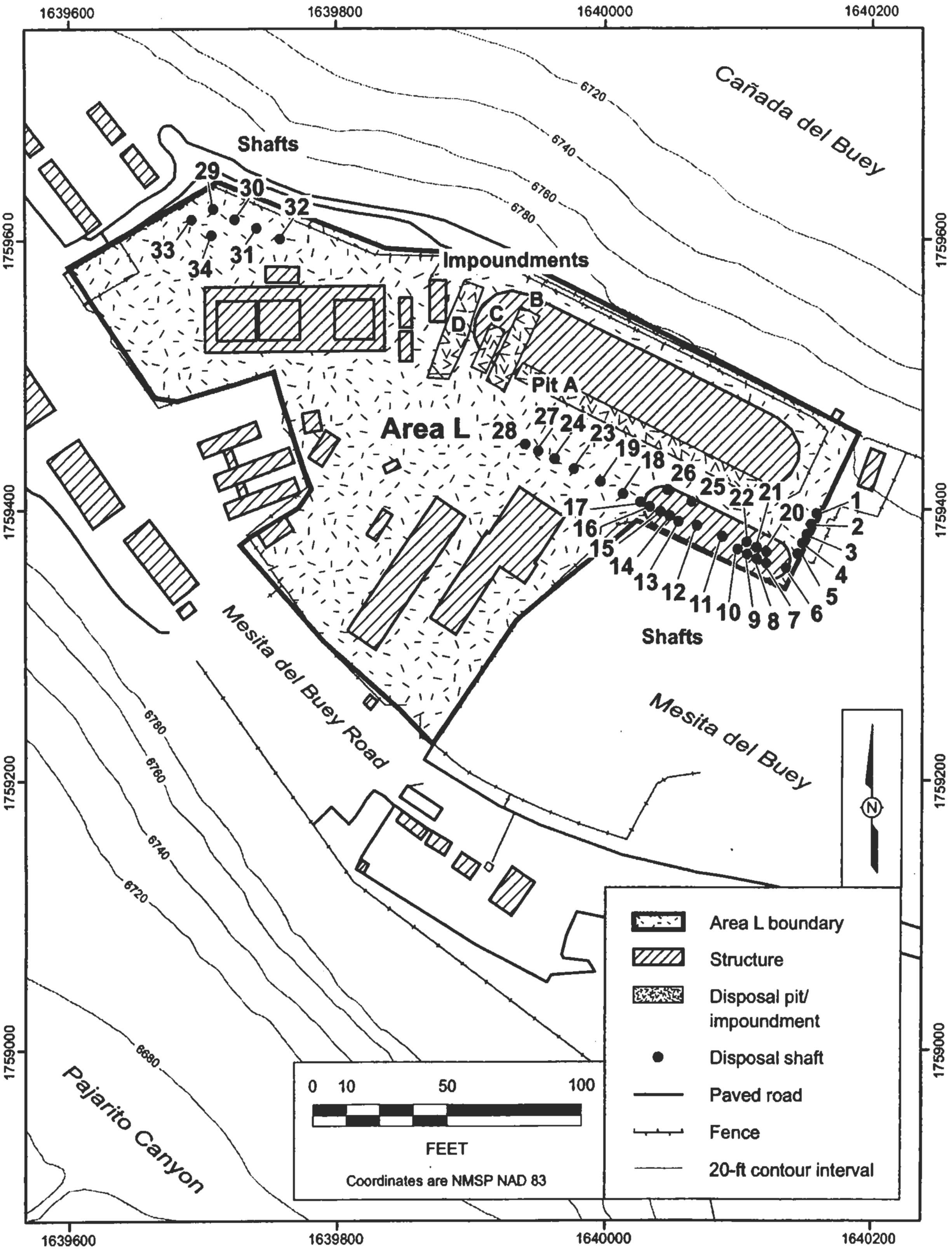
Quadrel (Quadrel Services, Inc.), September 1994. "EMFLUX® Soil-Gas Survey of Technical Area 54, Los Alamos National Laboratory," Quadrel Report Number QS1190, Maryland Spectral Services, Inc., Forest Hill, Maryland. (Quadrel 1993, 63869)

Rogers, M. A., June 1977. "History and Environmental Setting of LASL Near-Surface Land Disposal Facilities for Radioactive Wastes (Areas A, B, C, D, E, F, G, and T)," Los Alamos Scientific Laboratory report LA-6848-MS, Volume I, Los Alamos, New Mexico. (Rogers 1977, 5707)

Rogers, M., June 1977. "History and Environmental Setting of LASL Near-Surface Land Disposal Facilities for Radioactive Wastes (Areas A, B, C, D, E, F, G, and T)," Los Alamos Scientific Laboratory report LA-6848-MS, Volume II, Los Alamos, New Mexico. (Rogers 1977, 5708)

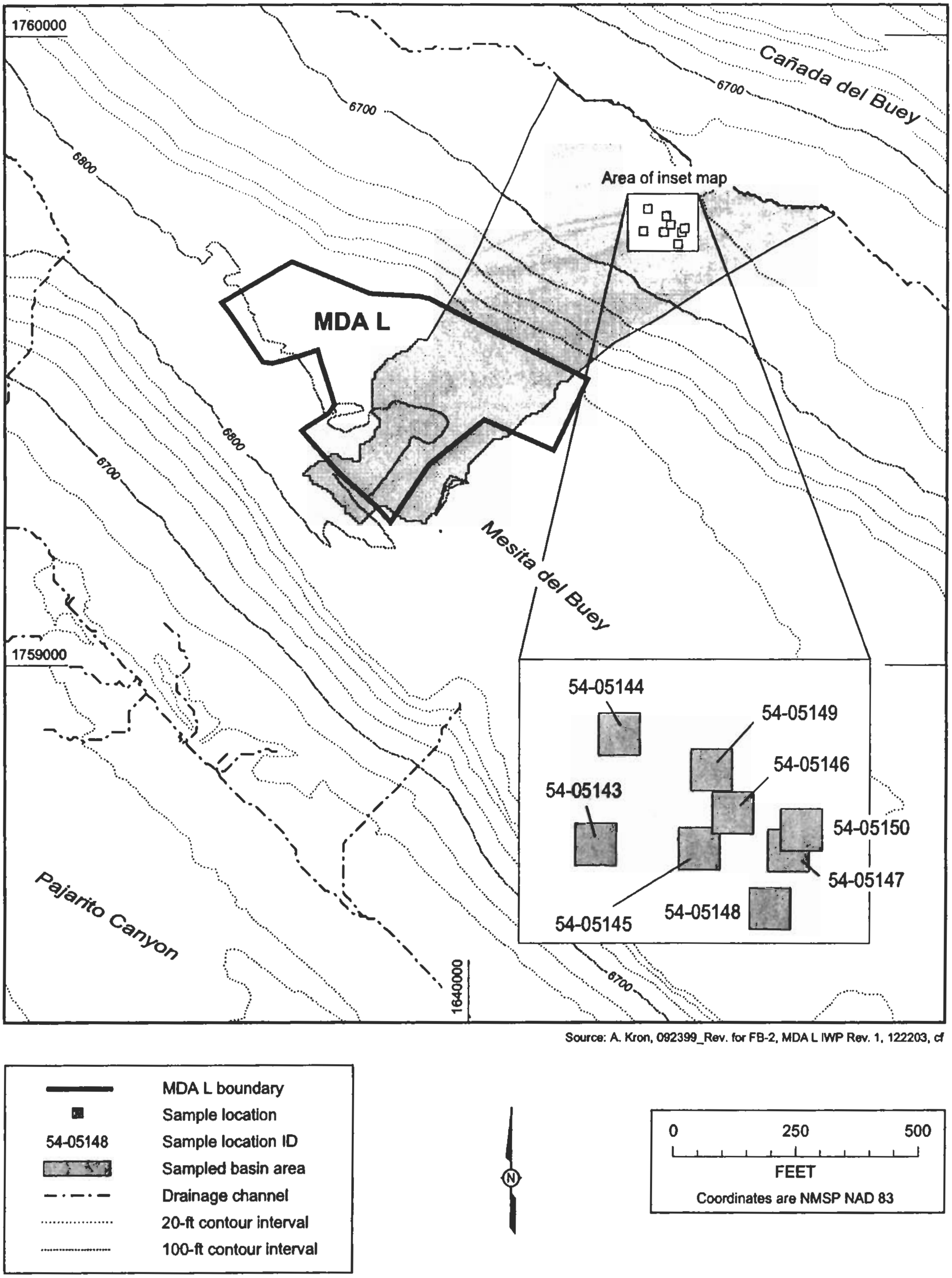
Trent, B., May 15, 1992. "Analysis of the Pore Gas Monitoring at Area L, TA-54 Los Alamos National Laboratory," Los Alamos National Laboratory report, Los Alamos, New Mexico. (Trent 1992, 11881)

Trujillo, V., R. Gilkeson, M. Morgenstern, and D. Krier, June 1998. "Measurement of Surface Flux Rates for Volatile Organic Compounds at Technical Area 54," Los Alamos National Laboratory report LA-13329, Los Alamos, New Mexico. (Trujillo et al. 1998, 58242)



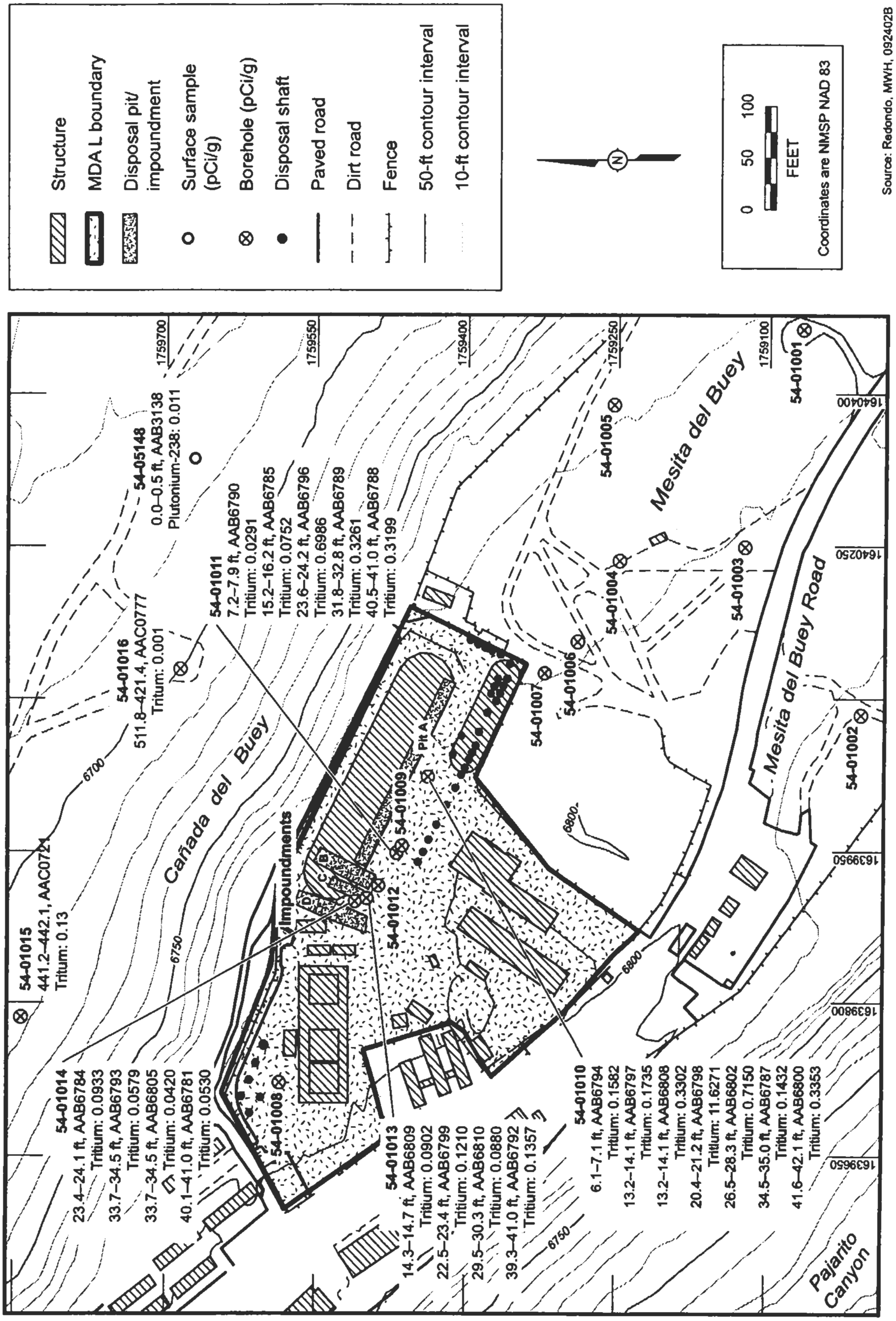
Source: RRES-RS map R03074, 082003, MO_Rev. for FB-1, MDA L IWP Rev.1, 121903, cf

Figure B-1. Locations of subsurface disposal units at Area L (SWMU 54-006)



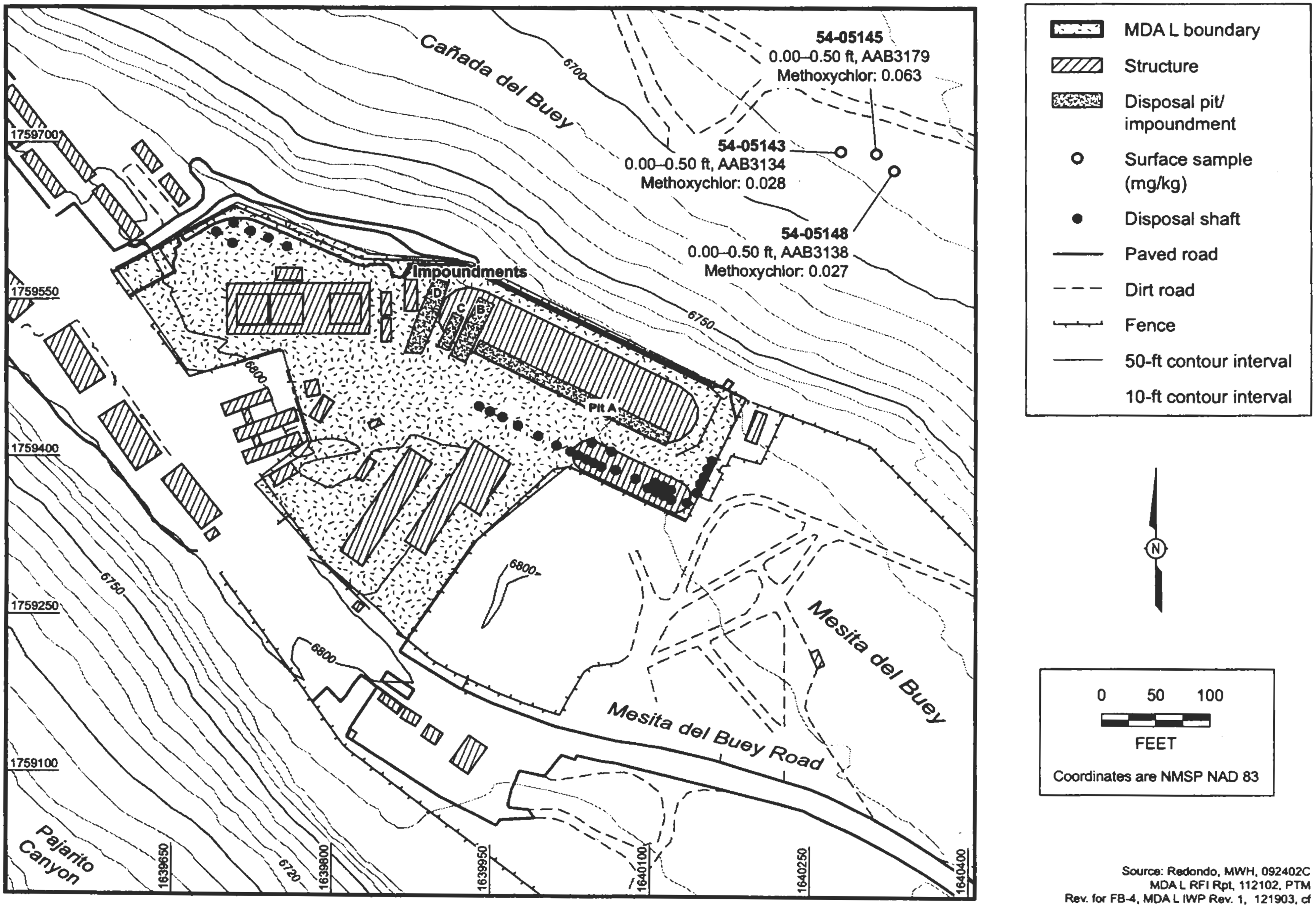
Source: A. Kron, 092399_Rev. for FB-2, MDA L IWP Rev. 1, 122203, cf

Figure B-2. **Phase I RFI sediment sample locations at MDA L**



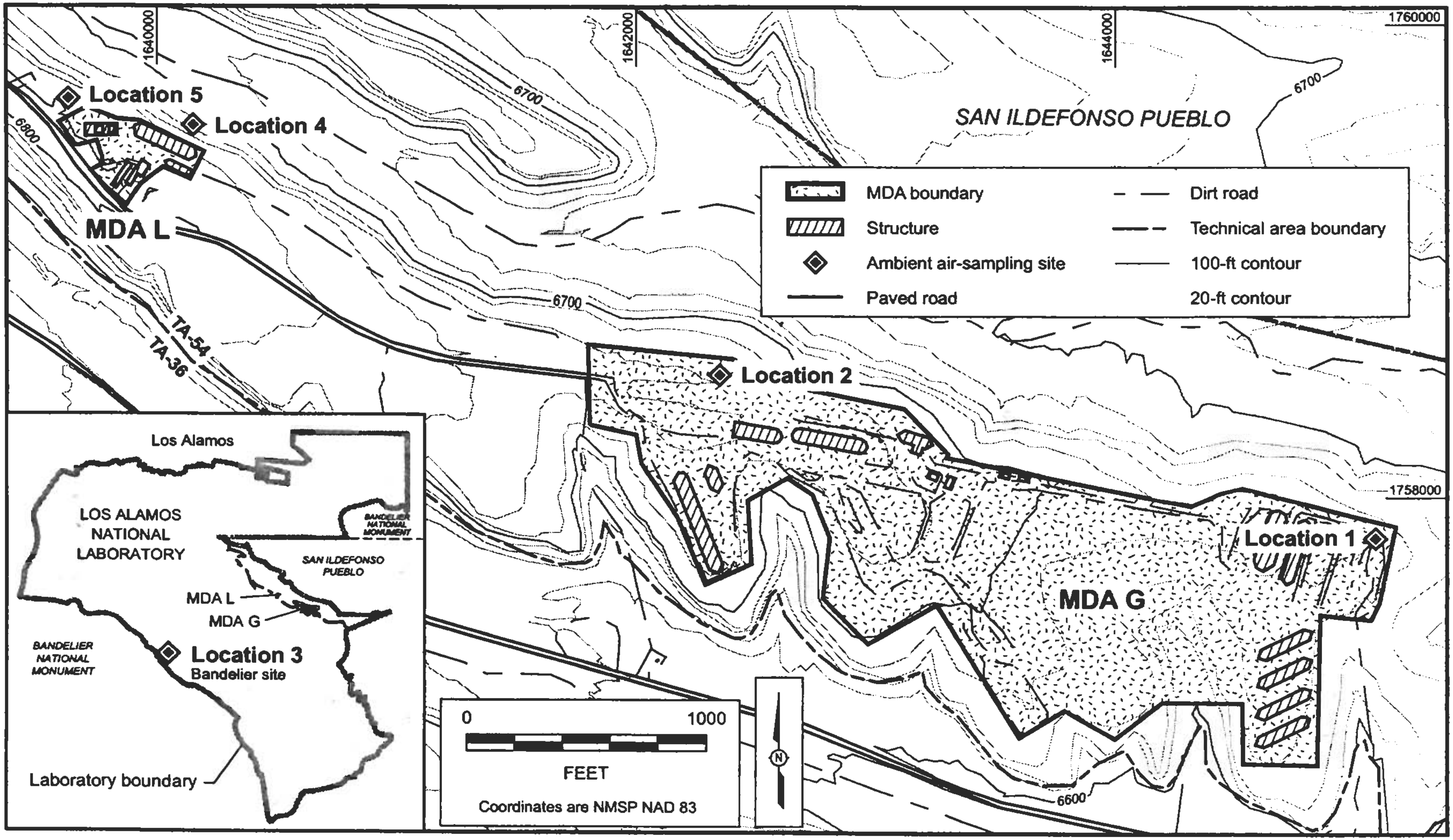
Source: Redondo, MWH, 092402B
MDA L RFI Rpt, 120302, PTM
Rev. for FB-3, MDA L IWP, 082803, cf
Revisions for MDA L Rev. 1 by MH, SEA, 120403

Figure B-3. Radionuclide detections above BVs/FVs at MDA L



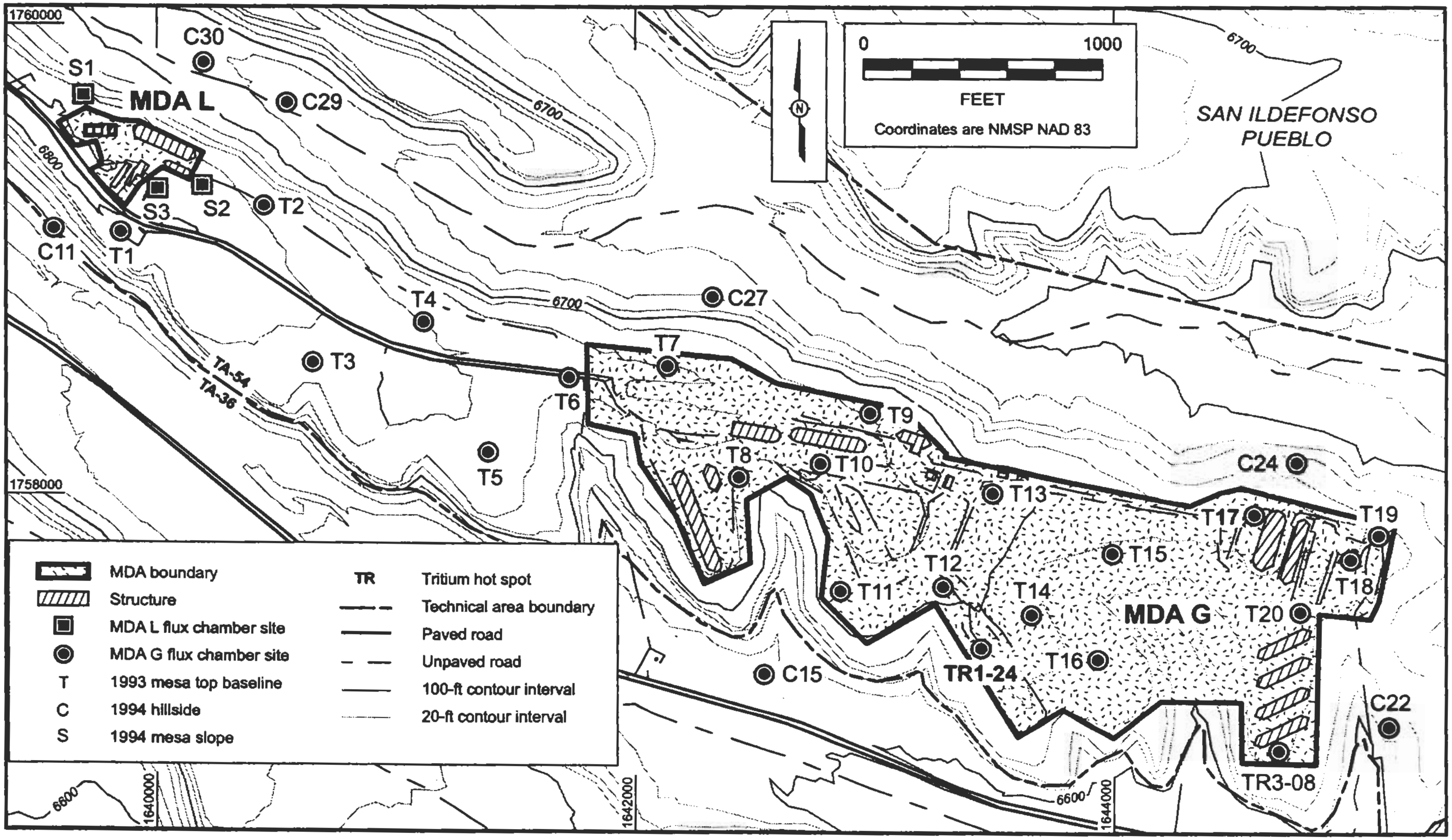
Source: Redondo, MWH, 092402C
MDA L RFI Rpt, 112102, PTM
Rev. for FB-4, MDA L IWP Rev. 1, 121903, cf

Figure B-4. Organic chemicals detected in channel sediments at MDA L



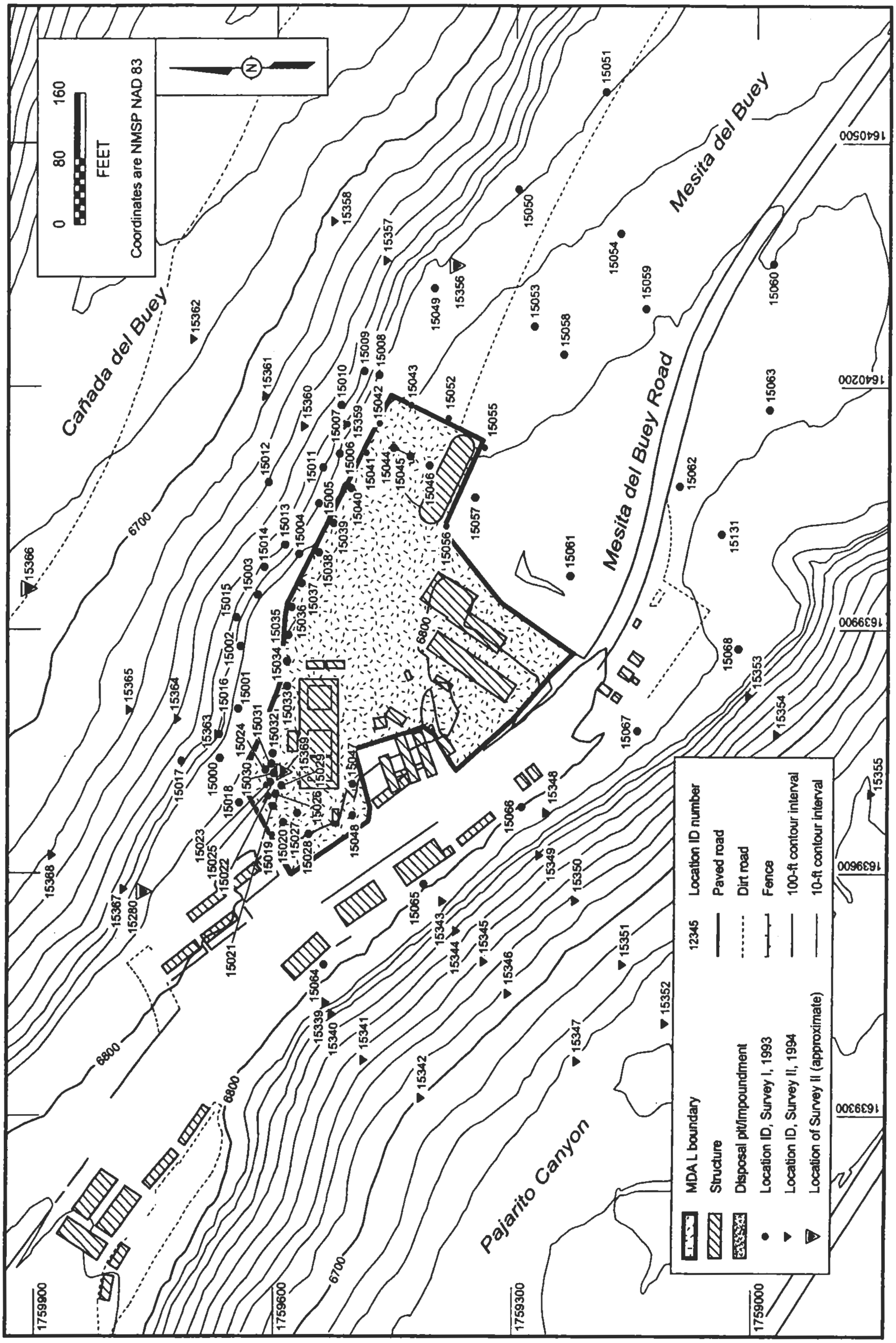
Source: FIMAD map G107980, 072999_MDA L RFI r, 120302, PTM_Rev. for FB-5, MDA L IWP Rev. 1, 121903, cf

Figure B-5. Ambient air VOC sample locations at MDAs G and L



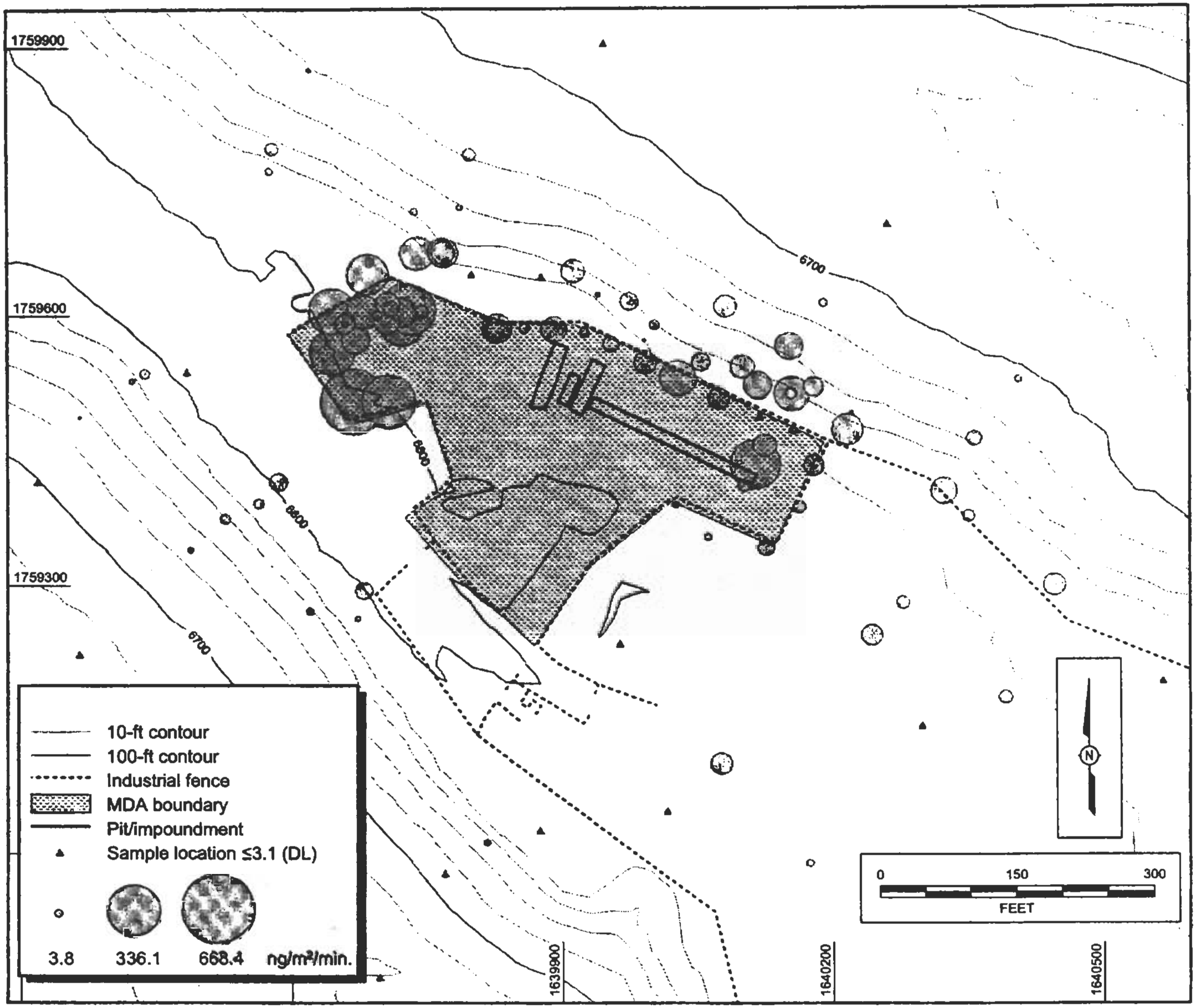
Source: FIMAD map G107980, 072999
MDA L RFI rpt, 121902, PTM_Rev. for FB-6, MDA L IWP Rev. 1, 122203, cf

Figure B-6. Locations of VOC and tritium flux chamber samples at MDAs G and L



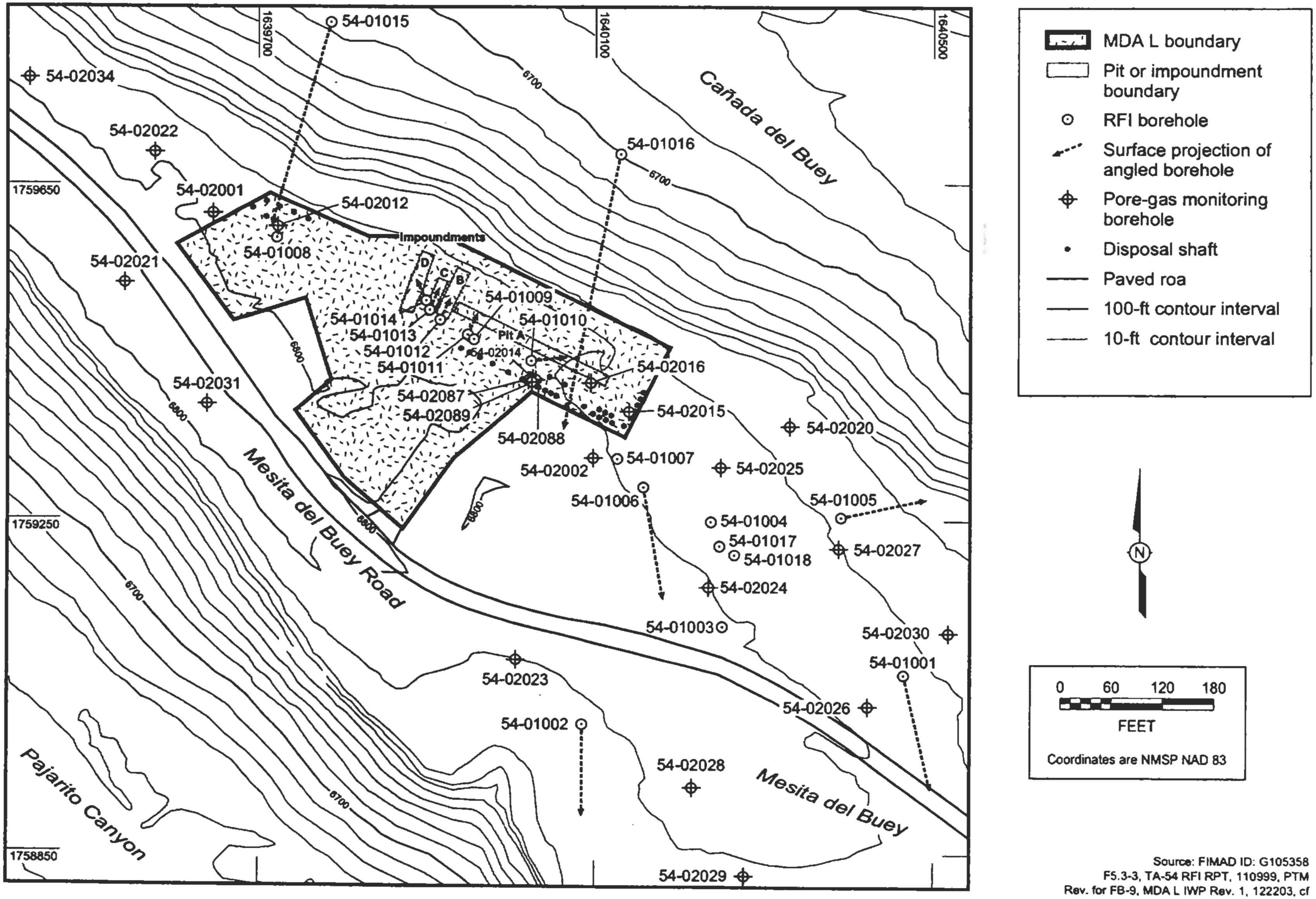
Source: FIMAD map G104040, 011396
F5.3-2, TA-54 RFI Rpt., 11299, PTM
Rev. for FB-7, MDA L IWP Rev.1, 121903, cf

Figure B-7. EMFLUX® sample locations at MDA L



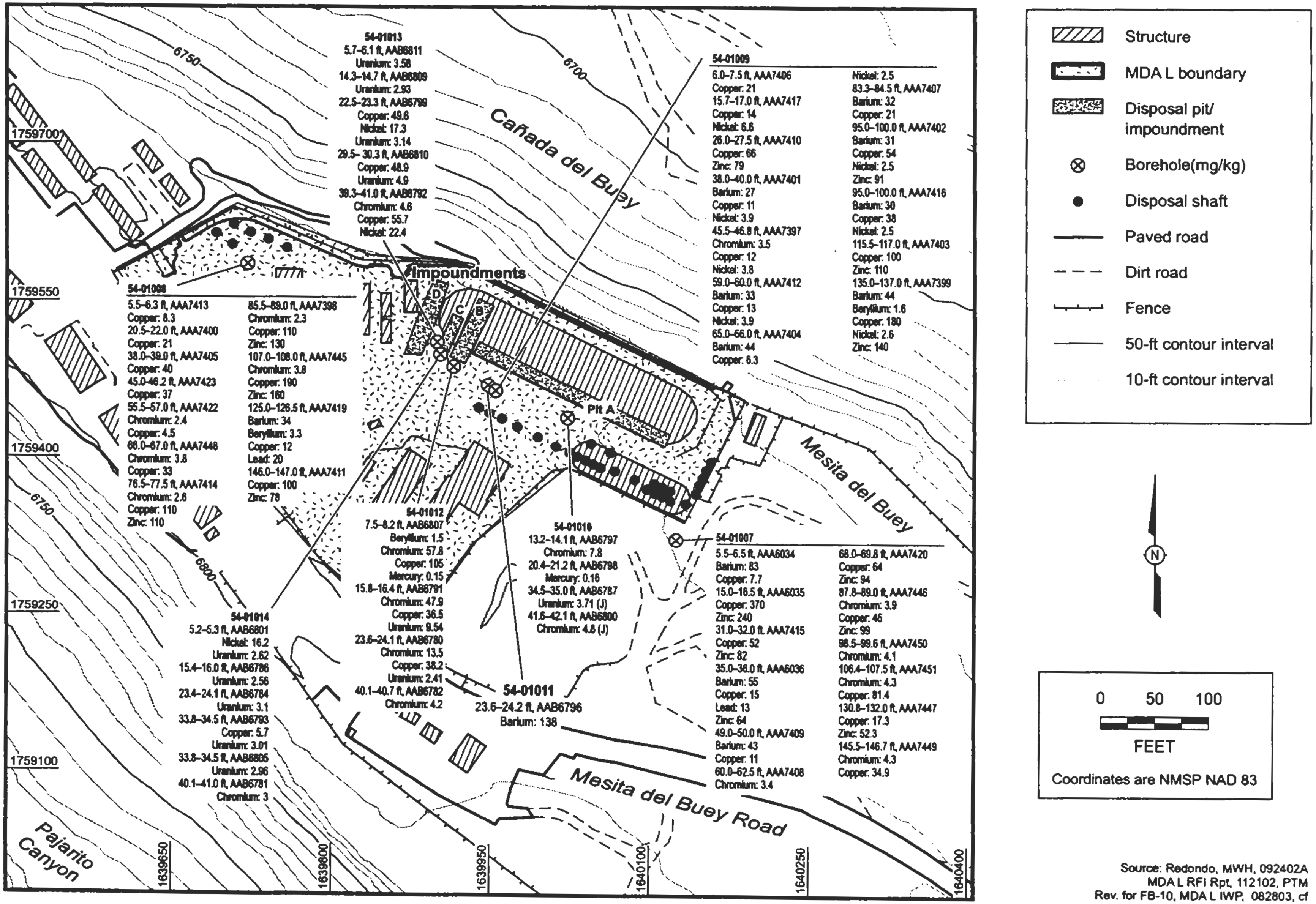
MDA L RFI rpt, 120402, PTM_Rev. for MDA L IWP Rev. 1, 082503, cf

Figure B-8. Surface flux concentrations of TCA at MDA L



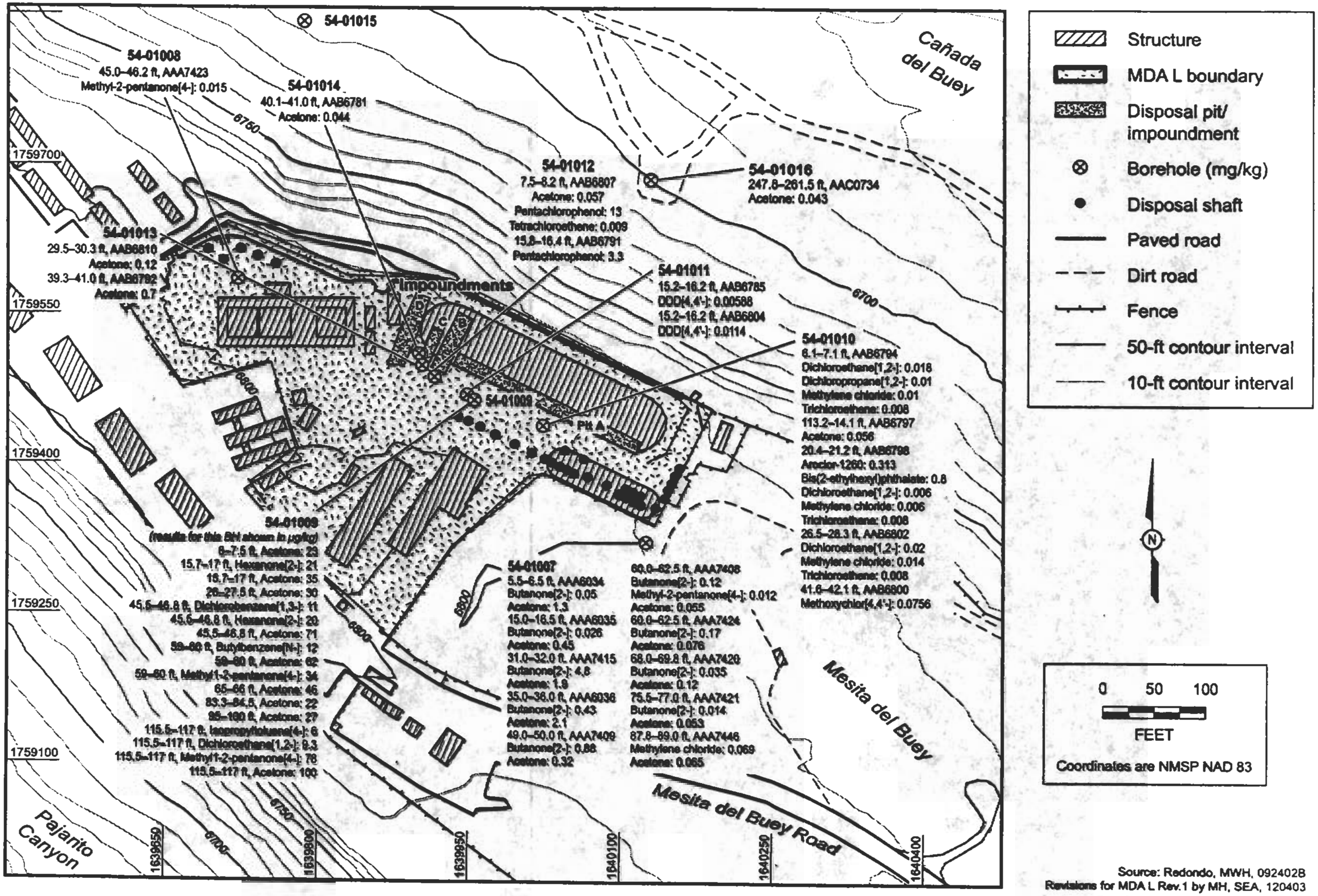
Source: FIMAD ID: G105358
F5.3-3, TA-54 RFI RPT, 110999, PTM
Rev. for FB-9, MDA L IWP Rev. 1, 122203, cf

Figure B-9. Locations of Phase I RFI boreholes at MDA L



Source: Redondo, MWH, 092402A
MDA L RFI Rpt, 112102, PTM
Rev. for FB-10, MDA L IWP, 082803, cf
Rev. for MDA L Rev.1 by MH, SEA, 120403

Figure B-10. Inorganic chemicals detected above BVs in the subsurface tuff at MDA L



Source: Redondo, MWH, 092402B
Revisions for MDA L Rev.1 by MH, SEA, 120403
Rev. for FB-11, MDA L IWP, 121803, cf

Figure B-11. Organic chemicals detected in the subsurface at MDA L

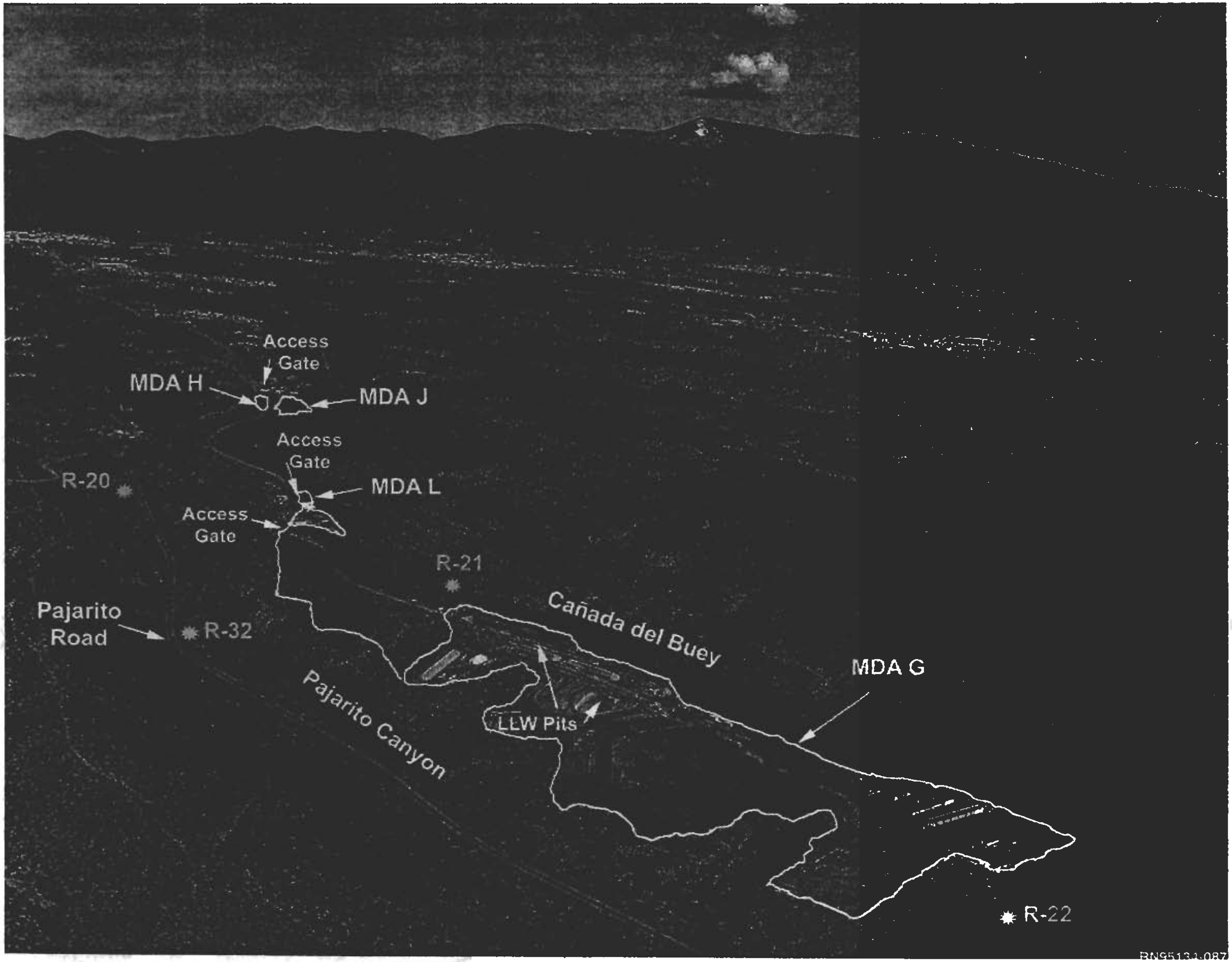


Figure B-12. Aerial photograph of Mesita del Buey showing MDAs, gates, and characterization wells R-20, R-21, R-22, and R-32 in the vicinity of MDA L

Table B-1
Dimensions, Dates of Operation, and Capacity of Pit and Impoundments at MDA L

Impoundment/Pit	Dimensions (ft) (width x length x depth)	Period of Use	Months Used	Total Capacity (ft^3)
A	200 x 12 x 12	1950s–12/78	>228	28,800
B	60 x 18 x 10	1/79–6/85	78	7560
C	35 x 12 x 10	7/85–12/86	18	2940
D	75 x 18 x 10	1972–1984	156	9450

Table B-2
Dimensions of Disposal Shafts at MDA L

Shaft	Diameter (ft)	Depth (ft)	Shaft	Diameter (ft)	Depth (ft)
1	3	60	18	8	60
2	3	60	19	8	60
3	3	60	20	3	60
4	3	60	21	3	60
5	3	60	22	3	60
6	4	60	23	4	60
7	3	60	24	4	60
8	3	60	25	6	60
9	3	60	26	6	60
10	3	60	27	4	60
11	8	60	28	4	60
12	4	60	29	6	65
13	8	60	30	6	65
14	3	60	31	6	61
15	3	60	32	4	15
16	3	60	33	6	65
17	3	60	34	6	63

Table B-3
Dates of Operation and Capacity for Disposal Shafts at MDA L

Shaft	Period of Use	Months Used	Total Capacity (ft³)	Shaft	Period of Use	Months Used	Total Capacity (ft³)
1	4/80–8/83	41	424	18	6/79–5/80	12	3016
2	2/75–6/79	53	424	19	4/80–4/82	25	3016
3	2/75–10/78	45	424	20	3/82–8/83	18	424
4	2/75–4/80	63	424	21	3/82–12/84	46	424
5	2/75–5/77	28	424	22	3/82–8/83	18	424
6	6/75–5/79	48	754	23	4/82–2/84	23	754
7	6/75–5/79	48	424	24	4/82–3/84	24	754
8	6/75–5/79	48	424	25	9/82–4/85	32	1696
9	6/75–5/79	48	424	26	9/82–2/84	18	1696
10	6/75–5/79	48	424	27	1/83–1/85	25	754
11	1/78–6/79	18	3016	28	1/82–4/85	40	754
12	1/78–6/79	18	754	29	12/83–7/84	8	1838
13	6/79–4/82	35	3016	30	12/83–4/84	5	1838
14	6/79–4/82	35	424	31	12/83–8/84	9	1725
15	6/79–4/82	36	424	32	3/84–8/84	6	188
16	6/79–4/82	35	424	33	3/84–1/85	11	1838
17	6/79–4/82	35	424	34	2/85–4/85	2	1781

Note: Information was taken from the OU 1148 work plan (LANL 1992, 07669, p. 5-106).

Table B-4
Summary of Work Plan Specifications, Actual Fieldwork, and Rationale for Deviations

Media	Work Plan Specification[a]		Actual Fieldwork Performed		Rationale for Deviation
	Sample Number	Analytes Measured	Sample Number	Analytes Measured	
Sediment (drainages)	9	VOCs, SVOCs, inorganic chemicals, pesticides/PCBs, herbicides, cyanide, gamma spectroscopy, gross alpha, beta, and gamma radiation	8 total for gross radiation screening; Subset of 4 samples for off-site contract laboratory analysis	4 samples analyzed for pesticides/PCBs, herbicides, inorganic chemicals, gamma spec, Am-241, Sr-90, isotopic Pu, isotopic U, isotopic thorium, and tritium.	Eight samples were collected based on the geomorphic survey. All samples were field screened for alpha, beta, and gamma radiation to bias sample selection. One sample with the highest gross gamma level, the sample with the highest gross alpha and beta levels, and two other samples were sent to an off-site contract laboratory for analysis (Glatzmaier 1994, 52015).
Core	126 (16 boreholes) See proposed drilling modifications (Glatzmaier 1994, 52015)	VOCs, SVOCs, inorganic chemicals, pesticides/PCBs, cyanide, gross alpha and beta radiation, and gamma spectroscopy	184 total from 16 boreholes	VOCs, SVOCs, pesticides/ PCBs, herbicides, inorganic chemicals, cyanide, tritium, isotopic Pu, and isotopic U 184 – VOCs 67 – SVOCs 67 – TAL metals 62 – cyanide 29 – total uranium 48 – tritium 67 – pesticides/PCBs 38 – herbicides 5 – alpha spectroscopy/ gamma spectroscopy	Vertical boreholes 54-1007, 54-01008, and 54-01009 were also drilled adjacent to numerous shafts and Pit A to a total depth (TD) of 150 ft. Thirty-eight core samples were collected at 10-ft intervals and submitted for on-site fixed laboratory or off-site contract laboratory analysis of TAL metals, cyanide, pesticides/PCBs, herbicides, SVOCs, and VOCs. Five core samples from borehole 54-01009 were also submitted for off-site contract analysis of Pu and U isotopes, and gamma spectroscopy. for Am-241 and Cs-137. Boreholes 54-01007, 54-01008, and 54-01009 were subsequently backfilled. Angle boreholes 54-01010 through 54-01014 were advanced beneath Pit A and Impoundments B, C, and D. The boreholes were backfilled and grouted closed. A total of 29 core samples were collected at 10-ft intervals and submitted to an off-site contract laboratory for analysis of TAL metals, total uranium, pesticides/PCBs, SVOCs, VOCs, and tritium. All core samples except the five from borehole 54-01013 were analyzed for cyanide.

Table B-4 (continued)

Media	Work Plan Specification[a]		Actual Fieldwork Performed		Rationale for Deviation
	Sample Number	Analytes Measured	Sample Number	Analytes Measured	
					from boreholes 54-01010, 54-01013, and 54-01014 for total uranium. Two deep angled boreholes, 54-01015 and 54-01016, were drilled from the adjacent canyon slope northeast of MDA L within Cañada del Buey to investigate the possible presence of vapor-phase contaminants at depth beneath MDA L. These boreholes were drilled to depths of 465.3 ft and 523 ft, respectively. The boreholes were completed as vapor monitoring boreholes. Twenty-two samples were collected and submitted for off-site contract laboratory analysis. Nineteen of these samples were also analyzed for tritium. Boreholes 54-01017 and 54-01018 were advanced directly east of MDA L. Borehole 54-01017 was designed as the extraction well for the pilot vapor-extraction test, and borehole 54-01018, located 20 ft south-southeast of borehole 54-01017, was used to monitor pore gas. Both boreholes are maintained for vapor monitoring and are capped at the ground surface. A total of 95 core samples were collected at 20-ft intervals from boreholes 54-01001 through 54-01006 and submitted for on-site fixed laboratory or off-site laboratory analysis for VOCs. The six boreholes were instrumented for vapor monitoring. The RFI work plan specified locations for boreholes. Actual borehole locations were selected to maximize the area sampled and avoid obstacles such as buried utilities and waste.

Table B-4 (continued)

Media	Work Plan Specification[a]		Actual Fieldwork Performed		Rationale for Deviation
	Sample Number	Analytes Measured	Sample Number	Analytes Measured	
Pore gas	99	VOCs	280	VOCs (EPA Method TO-14)	VOCs do not adsorb to the tuff matrix; gas phase analysis provides information about the nature and extent of VOCs in the subsurface. A summary of quarterly pore-gas monitoring results for pore-gas samples collected from 1985-2001 are provided in Appendix C.
VOC surface flux	136	VOCs	102 8	VOCs Tritium	Surface flux data can help identify lateral extent of subsurface VOC contamination. Surface flux locations were restricted by asphalt and site structures on the surface of MDA L.
Air (Ambient)	48	Total suspended particulates, VOCs, SVOCs, inorganic chemicals, pesticides/PCBs, cyanide, and radionuclides	16	VOCs	ESH-17 air monitoring data from MDA L were reviewed for nature and extent of VOCs. (Jansen and Taylor 1996, 54959)
Air-Flow Velocity Passive Vapor Extraction Test	n/a[b]	n/a	n/a	In 1997, air-flow volume and VOC concentrations were measured at borehole 54-01006. The tests were repeated in 1998 using a one-way valve on borehole 54-01006 to allow only the exhalation of subsurface vapor during periods of relatively high atmospheric pressure. During the 1998 study, vapor concentrations and pressure were measured at several subsurface ports in boreholes 54-01004, 54-01006, and 54-01018 and in atmospheric air.	None

[a] Based on proposed modifications to the RFI Work Plan for OU 1148 for drilling and core sampling at MDA L (Glatzmaier 1994, 52015)

[b] n/a = Not applicable.

Table B-5
Summary of Phase I RFI Channel Sediment Samples Collected at MDA L

Location ID	Sample ID	Depth (ft)	Media	Metals	Herbicides	PCBs	Pesticides	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90
54-05143	AAB3134	0–0.5	Sediment	18931	18049	18049	18049	18973	18973	18973	18973	18973	18973	18973
54-05145	AAB3179	0–0.5	Sediment	18931	18049	18049	18049	18973	18973	18973	18973	18973	18973	18973
54-05147	AAB3149	0–0.67	Sediment	18931	18049	18049	18049	18973	18973	18973	18973	18973	18973	18973
54-05148	AAB3138	0–0.5	Sediment	18931	18049	18049	18049	18973	18973	18973	18973	18973	18973	18973

Table B-6
Frequency of Detected Inorganic Chemicals Above BVs in Channel Sediment Samples at MDA L

Analyte	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value[b] (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	4	4	2270 to 3940	15400	0/4	0/4
Antimony	4	0	[0.2 to 0.21]	0.83	0/4	0/4
Arsenic	4	0	[0.78 to 1.5]	3.98	0/4	0/4
Barium	4	3	[37] to 65.7	127	0/4	0/4
Beryllium	4	0	[0.25 to 0.51]	1.31	0/4	0/4
Cadmium	4	0	[0.4 to 0.67]	0.4	0/4	3/4
Calcium	4	4	1130 to 1830	4420	0/4	0/4
Chromium	4	4	2 to 4.2	10.5	0/4	0/4
Cobalt	4	0	[1.4 to 2.6]	4.73	0/4	0/4
Copper	4	0	[3.6 to 4.7]	11.2	0/4	0/4
Iron	4	4	3540 to 4870	13800	0/4	0/4
Lead	4	4	7.3 to 15.3	19.7	0/4	0/4
Magnesium	4	0	[506 to 872]	2370	0/4	0/4
Manganese	4	4	138 to 224	543	0/4	0/4
Mercury	4	0	[0.02 to 0.02]	0.1	0/4	0/4
Nickel	4	0	[2.7 to 3.8]	9.38	0/4	0/4
Potassium	4	0	[545 to 805]	2690	0/4	0/4
Selenium	4	0	[0.6 to 0.64]	0.3	0/4	4/4
Silver	4	0	[2 to 2.1]	1	0/4	4/4
Sodium	4	0	[35.6 to 74]	1470	0/4	0/4
Thallium	4	0	[0.2 to 0.21]	0.73	0/4	0/4
Vanadium	4	0	[4.7 to 7.7]	19.7	0/4	0/4
Zinc	4	4	20.7 to 30.3	60.2	0/4	0/4

[a] Values in square brackets indicate detection limits for nondetects.

[b] Sediment BVs obtained from LANL 1998, 59730.

Table B-7
Frequency of Detected Radionuclides Above BVs in Channel Sediment Samples at MDA L

Analyte	Number of Analyses	Number of Detects	Concentration Range[a] (pCi/g)	Background Value[b] (pCi/g)	Frequency of Detects Above Background Value
Americium-241	4	4	0.004 to 0.009	0.04	0/4
Cesium-137	4	2	[0.09] to 0.38	0.9	0/4
Cobalt-60	4	0	[0.02 to 0.09]	na[c]	0/4
Plutonium-238	4	4	0.003 to 0.011	0.006	1/4
Plutonium-239	4	4	0.01 to 0.017	0.068	0/4
Strontium-90	4	4	-0.04 to 0.12	1.04	0/4
Technitium-99	4	0	[0.2] to [0.2]	na	0/4
Thorium-228	4	4	1.26 to 1.92	2.28	0/4
Thorium-230	4	4	1.12 to 1.69	2.29	0/4
Thorium-232	4	4	1.28 to 1.84	2.33	0/4
Tritium	4	4	6.84E-03 to 3.30E-02	0.093	0/4
Uranium-234	4	4	1.12 to 1.81	2.59	0/4
Uranium-235	4	4	0.07 to 0.1	0.2	0/4
Uranium-238	4	4	1.37 to 2.03	2.29	0/4

[a] Values in square brackets indicate detection limits for nondetects.

[b] Sediment background and fallout values obtained from LANL 1998, 59730.

[c] na = Not available.

Table B-8
Air Concentrations of Selected VOCs at MDA L, Location 4

VOC	Ambient Concentration (ppbv)							
	6/16/94	6/17/94	6/29/94	6/30/94	7/28/94	8/01/94	8/02/94	8/03/94
Chlorodifluoromethane	0.6	0.2	0.3	0.6	ND*	ND	ND	ND
Chloromethane	0.3	0.3	ND	0.6	ND	0.3	ND	ND
Dichlorodifluoromethane	0.4	0.4	0.4	0.4	0.3	0.4	0.06	0.07
n-hexane	ND	ND	ND	ND	0.2	0.3	0.3	0.5
Trichlorofluoromethane	0.2	0.2	0.1	0.1	0.1	0.2	0.05	0.03
Freon 113	0.04	0.05	0.03	0.06	ND	0.06	ND	ND
TCA	0.7	0.4	0.9	0.4	1.0	0.7	0.5	0.4
Benzene	0.2	0.1	0.2	0.2	0.2	0.4	0.4	0.6
Carbon tetrachloride	0.1	0.06	0.06	ND	0.06	0.07	0.05	0.08
Trichloroethene	ND	0.1	0.06	ND	0.3	0.1	0.07	ND
Toluene	0.2	0.1	0.2	0.2	0.4	1.0	0.8	0.9

*ND = Not detected.

Table B-9
Air Concentrations of Selected VOCs at MDA L, Location 5

VOC	Ambient Concentration (ppbv)							
	6/16/94	**6/17/94**	**6/29/94**	**6/30/94**	**7/28/94**	**8/01/94**	**8/02/94**	**8/03/94**
Chloromethane	0.3	0.3	ND*	0.7	ND	0.7	ND	0.2
Dichlorodifluoromethane	0.5	0.3	0.3	0.4	0.2	0.4	0.06	0.4
Trichlorofluoromethane	0.2	0.2	0.2	0.2	0.09	0.3	0.08	0.2
Methylene chloride	1.6	0.4	1.3	1.2	0.6	1.0	1.7	0.9
Freon 113	0.2	0.1	0.1	0.3	0.07	0.4	0.2	ND
TCA	15.2	6.0	8.6	4.0	0.6	1.0	0.8	2.4
Benzene	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2
Carbon tetrachloride	ND	0.1	ND	0.05	0.05	0.1	ND	0.07
Trichloroethene	ND	0.2	0.1	0.03	0.1	ND	0.06	0.1
Toluene	0.3	0.2	0.3	0.6	0.3	0.2	0.3	0.2
Xylene	ND	ND	0.1	0.2	0.2	0.09	0.1	ND

*ND = Not detected.

Table B-10
Air Concentrations of Selected VOCs at Bandelier National Monument, Location 3 (Background)

VOC	Background Ambient Concentration (ppbv)							
	6/16/94	**6/17/94**	**6/29/94**	**6/30/94**	**7/28/94**	**8/01/94**	**8/02/94**	**8/03/94**
Chlorodifluoromethane	ND*	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	0.4	ND	0.6	ND	ND	ND	ND
Dichlorodifluoromethane	0.3	0.3	0.3	0.4	0.2	0.3	ND	ND
n-hexane	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	0.1	0.1	0.1	0.05	0.07	0.09	0.03	ND
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND
Freon 113	ND	ND	ND	0.04	ND	ND	0.03	ND
TCA	0.1	0.1	0.08	ND	0.04	0.03	ND	ND
Benzene	ND	0.2	ND	0.02	ND	0.1	0.1	0.2
Carbon tetrachloride	ND	0.05	0.04	ND	0.04	0.03	ND	ND
Trichloroethene	ND	0.05	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	0.1	ND	0.1	0.1	0.2	0.1
Xylene	ND	ND	ND	ND	ND	0.1	ND	ND

*ND = not detected.

Table B-11
Calculated Tritium Surface Flux Concentration for Phase I RFI Samples Collected at MDA L

Sample Location	Collection Date	Emission Flux (pCi/min/m²)
T1	1993	1.65
T2	1993	2.26
C11	1993	3.40
C29	1993	3.69
C30	1993	5.45*
S1	1994	2.90
S2	1994	19,500
S3	1994	28,600

*Higher of two duplicate samples.

Table B-12
Borehole Information

Borehole ID	Year Installed	Depth (ft from mesa-top surface)	Declination (degrees from horizontal)	Adjacent Waste Disposal Unit	Current Status
Phase I RFI					
54-01001	1993	315	63.5	None	Surface cap
54-01002	1993	310	69	None	Surface cap
54-01003	1993	299	Vertical	None	Surface cap
54-01004	1993	340	Vertical	None	Surface cap
54-01005	1993	291	69	None	Surface cap
54-01006	1993	320	65	None	Surface cap
54-01007	1993	150	Vertical	Shafts 1–6	Backfilled
54-01008	1993	150	Vertical	Shafts 30–34	Backfilled
54-01009	1993	150	Vertical	Shaft 27; Pit A	Backfilled
54-01010	1994	60	45	Pit A	Backfilled
54-01011	1994	50	55	Pit A	Backfilled
54-01012	1994	50	55	Impoundment B	Backfilled
54-01013	1994	50	55	Impoundment C	Backfilled
54-01014	1994	50	55	Impoundments D and C	Backfilled
54-01015	1995	530	61.5	None	Pore-gas monitoring borehole
54-01016	1995	607	59.5	None	Pore-gas monitoring borehole
54-01017	1995	159	Vertical	None	Surface cap
54-01018	1995	328	Vertical	None	Surface cap

Table B-12 (continued)

Borehole ID	Year Installed	Depth (ft from mesa-top surface)	Declination (degrees from horizontal)	Adjacent Waste Disposal Unit	Current Status
Pre-RFI					
54-02001	1986	200	Vertical	Lead stringer shafts; Shaft 33	Buried
54-02002	1986	200	Vertical	Shafts 7–11	Pore-gas monitoring borehole
54-02012	1985	42	Vertical	Shafts 30–34	Pore-gas monitoring borehole
54-02013	1985	63	Vertical	None	Pore-gas monitoring borehole
54-02014	1985	86	Vertical	Shafts 17–18	Pore-gas monitoring borehole
54-02015	1985	82	Vertical	Shafts 3–5	Pore-gas monitoring borehole
54-02016	1985	82	Vertical	Pit A	Pore-gas monitoring borehole
54-02020	1986	200	Vertical	None	Pore-gas monitoring borehole
54-02021	1986	200	Vertical	None	Pore-gas monitoring borehole
54-02022	1986	197	Vertical	None	Pore-gas monitoring borehole
54-02023	1986	200	Vertical	None	Pore-gas monitoring borehole
54-02024	1986	200	Vertical	None	Pore-gas monitoring borehole
54-02025	1988	190	Vertical	None	Pore-gas monitoring borehole
54-02026	1988	215	Vertical	None	Pore-gas monitoring borehole
54-02027	1988	250	Vertical	None	Pore-gas monitoring borehole
54-02028	1988	250	Vertical	None	Pore-gas monitoring borehole
54-02029	1988	288	Vertical	None	Pore-gas monitoring borehole
54-02030	1989	243	Vertical	None	Pore-gas monitoring borehole
54-02031	1989	260	Vertical	None	Pore-gas monitoring borehole
54-02034	1988	300	Vertical	None	Pore-gas monitoring borehole
54-02087	1985?	86	Vertical	None	Pore-gas monitoring borehole
54-02088	1985?	86	Vertical	None	Pore-gas monitoring borehole
54-02089	1985?	86	Vertical	None	Pore-gas monitoring borehole

Note: The -01000 series boreholes are Phase I RFI characterization boreholes. The -02000 series boreholes are pre-RFI boreholes drilled for pore-gas monitoring.

Table B-13
Summary of Phase I RFI Subsurface Core Samples Collected at MDA L

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Uranium	Herbicides	PCBs	Pesticides	SVOCs	VOCs	Tritium	Alpha Spectroscopy	Gamma Spectroscopy
54-01001	AAA4228	17.9–19	Qbt 2	—	—	—	—	—	—	—	15640	—	—	—
54-01001	AAA4233	35.8–38	Qbt 1v	—	—	—	—	—	—	—	15661	—	—	—
54-01001	AAA4237	53.3–54.6	Qbt 1v	—	—	—	—	—	—	—	15661	—	—	—
54-01001	AAA4245	53.3–54.6	Qbt 1v	—	—	—	—	—	—	—	15661	—	—	—
54-01001	AAA4241	72–73.8	Qbt 1v	—	—	—	—	—	—	—	15664	—	—	—
54-01001	AAA5537	89.8–91.1	Qbt 1v	—	—	—	—	—	—	—	15664	—	—	—
54-01001	AAA4248	108.3-109.2	Qbt 1v	—	—	—	—	—	—	—	15664	—	—	—
54-01001	AAA4257	125.6–127.5	Qbt 1g	—	—	—	—	—	—	—	15664	—	—	—
54-01001	AAA4253	143.5–144.1	Qbt 1g	—	—	—	—	—	—	—	15664	—	—	—
54-01001	AAA4261	161.1–162.4	Qbt 1g	—	—	—	—	—	—	—	15681	—	—	—
54-01001	AAA4273	179.4–180.3	Qbt 1g	—	—	—	—	—	—	—	15681	—	—	—
54-01001	AAA4265	198.2–200.9	Qbt 1g	—	—	—	—	—	—	—	15681	—	—	—
54-01001	AAA4269	215.7–218.8	Qbt 1g	—	—	—	—	—	—	—	15699	—	—	—
54-01001	AAA4277	233.4–234	Qbt 1g	—	—	—	—	—	—	—	15699	—	—	—
54-01001	AAA4278	251.6–251.8	Qbt 1g	—	—	—	—	—	—	—	15699	—	—	—
54-01001	AAA4324	268.6–269.3	Qct	—	—	—	—	—	—	—	15699	—	—	—
54-01002	AAA4323	14.3–14.9	Qbt 2	—	—	—	—	—	—	—	15727	—	—	—
54-01002	AAA4321	37.4–38.1	Qbt 2	—	—	—	—	—	—	—	15753	—	—	—
54-01002	AAA5373	58–58.8	Qbt 1v	—	—	—	—	—	—	—	15753	—	—	—
54-01002	AAA5378	75–76.6	Qbt 1v	—	—	—	—	—	—	—	15753	—	—	—
54-01002	AAA5374	93.5–96	Qbt 1v	—	—	—	—	—	—	—	15753	—	—	—
54-01002	AAA4320	96–96.9	Qbt 1v	—	—	—	—	—	—	—	15753	—	—	—
54-01002	AAA4322	113–114.4	Qbt 1v	—	—	—	—	—	—	—	15765	—	—	—
54-01002	AAA5377	131–132.6	Qbt 1v	—	—	—	—	—	—	—	15765	—	—	—

Table B-13 (continued)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Uranium	Herbicides	PCBs	Pesticides	SVOCs	VOCs	Tritium	Alpha Spectroscopy	Gamma Spectroscopy
54-01002	AAA5540	149.8–150.8	Qbt 1g	—	—	—	—	—	—	—	15765	—	—	—
54-01002	AAA5542	168.2–169.4	Qbt 1g	—	—	—	—	—	—	—	15765	—	—	—
54-01002	AAA5541	187–187.6	Qbt 1g	—	—	—	—	—	—	—	15765	—	—	—
54-01002	AAA5376	206.8–208.7	Qbt 1g	—	—	—	—	—	—	—	15785	—	—	—
54-01002	AAA5488	224.3–225	Qbt 1g	—	—	—	—	—	—	—	15785	—	—	—
54-01002	AAA5486	243.5–244.1	Qbt 1g	—	—	—	—	—	—	—	15785	—	—	—
54-01002	AAA5483	261.4–263.3	Qct	—	—	—	—	—	—	—	15785	—	—	—
54-01002	AAA5375	280.5–281.2	Qct	—	—	—	—	—	—	—	15785	—	—	—
54-01003	AAA5433	20.8–21.5	Qbt 2	—	—	—	—	—	—	—	15931	—	—	—
54-01003	AAA5430	43.8–45	Qbt 1v	—	—	—	—	—	—	—	15972	—	—	—
54-01003	AAA5586	44–45	Qbt 1v	—	—	—	—	—	—	—	15972	—	—	—
54-01003	AAA5422	66.5–67.7	Qbt 1v	—	—	—	—	—	—	—	15972	—	—	—
54-01003	AAA5429	81–81.5	Qbt 1v	—	—	—	—	—	—	—	15972	—	—	—
54-01003	AAA5423	103.8–104.5	Qbt 1v	—	—	—	—	—	—	—	15972	—	—	—
54-01003	AAA5489	120–123.2	Qbt 1v	—	—	—	—	—	—	—	15967	—	—	—
54-01003	AAA5425	145.6–147	Qbt 1g	—	—	—	—	—	—	—	15967	—	—	—
54-01003	AAA5481	160.8–162	Qbt 1g	—	—	—	—	—	—	—	15967	—	—	—
54-01003	AAA5478	180.8–181.5	Qbt 1g	—	—	—	—	—	—	—	15967	—	—	—
54-01003	AAA5380	201–202	Qbt 1g	—	—	—	—	—	—	—	15967	—	—	—
54-01003	AAA5431	220.8–221.5	Qbt 1g	—	—	—	—	—	—	—	15988	—	—	—
54-01003	AAA5588	240–240.7	Qbt 1g	—	—	—	—	—	—	—	15988	—	—	—
54-01003	AAA5587	260.7–263	Qbt 1g	—	—	—	—	—	—	—	15988	—	—	—
54-01003	AAA5594	281.6–282.5	Qct	—	—	—	—	—	—	—	15988	—	—	—
54-01004	AAA5424	21.5–22.2	Qbt 2	—	—	—	—	—	—	—	16009	—	—	—
54-01004	AAA5477	41.7–42.7	Qbt 1v	—	—	—	—	—	—	—	16013	—	—	—
54-01004	AAA5484	60.8–61.5	Qbt 1v	—	—	—	—	—	—	—	16013	—	—	—

Table B-13 (continued)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Uranium	Herbicides	PCBs	Pesticides	SVOCs	VOCs	Tritium	Alpha Spectroscopy	Gamma Spectroscopy
54-01004	AAA5379	80.3–81.5	Qbt 1v	—	—	—	—	—	—	—	16013	—	—	—
54-01004	AAA5432	100.3–102.5	Qbt 1v	—	—	—	—	—	—	—	16013	—	—	—
54-01004	AAA5590	101.5–102.5	Qbt 1v	—	—	—	—	—	—	—	16013	—	—	—
54-01004	AAA5485	120.8–121.5	Qbt 1v	—	—	—	—	—	—	—	16013	—	—	—
54-01004	AAA5487	140–140.7	Qbt 1g	—	—	—	—	—	—	—	16021	—	—	—
54-01004	AAA5482	160.3–161	Qbt 1g	—	—	—	—	—	—	—	16021	—	—	—
54-01004	AAA5539	180.8–181.5	Qbt 1g	—	—	—	—	—	—	—	16021	—	—	—
54-01004	AAA5535	200.8–201.5	Qbt 1g	—	—	—	—	—	—	—	16021	—	—	—
54-01004	AAA5534	221.3–222	Qbt 1g	—	—	—	—	—	—	—	16021	—	—	—
54-01004	AAA5536	240.3–241	Qbt 1g	—	—	—	—	—	—	—	16021	—	—	—
54-01004	AAA5663	261–261.7	Qbt 1g	—	—	—	—	—	—	—	16021	—	—	—
54-01004	AAA5664	280.8–281.5	Qct	—	—	—	—	—	—	—	16021	—	—	—
54-01004	AAA5533	300.8–301.5	Qbo	—	—	—	—	—	—	—	16039	—	—	—
54-01004	AAA5531	320.8–321.5	Qbo	—	—	—	—	—	—	—	16039	—	—	—
54-01005	AAA7958	22.7–23.3	Qbt 2	—	—	—	—	—	—	—	16376	—	—	—
54-01005	AAA7957	35.9–36.6	Qbt 1v	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7953	56.8–57.4	Qbt 1v	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7950	73.8–74.7	Qbt 1v	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7954	73.8–74.9	Qbt 1v	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7959	92.6–93.4	Qbt 1v	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7952	110.6–111.3	Qbt 1v	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7966	131.2–131.9	Qbt 1g	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7946	148.4–149.4	Qbt 1g	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7949	167.4–168	Qbt 1g	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7956	188.4–189.1	Qbt 1g	—	—	—	—	—	—	—	16416	—	—	—
54-01005	AAA7945	207–207.7	Qbt 1g	—	—	—	—	—	—	—	16416	—	—	—

Table B-13 (continued)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Uranium	Herbicides	PCBs	Pesticides	SVOCs	VOCs	Tritium	Alpha Spectroscopy	Gamma Spectroscopy
54-01005	AAA7955	222.8–223.6	Qbt 1g	—	—	—	—	—	—	—	16437	—	—	—
54-01005	AAA8002	242–242.7	Qbt 1g	—	—	—	—	—	—	—	16437	—	—	—
54-01005	AAA8004	259.5–260.2	Qct	—	—	—	—	—	—	—	16439	—	—	—
54-01006	AAA5480	18.3–19.6	Qbt 2	—	—	—	—	—	—	—	15801	—	—	—
54-01006	AAA5434	42.5–43.2	Qbt 1v	—	—	—	—	—	—	—	15862	—	—	—
54-01006	AAA5428	63.3–64	Qbt 1v	—	—	—	—	—	—	—	15862	—	—	—
54-01006	AAA5427	80.8–81.5	Qbt 1v	—	—	—	—	—	—	—	15859	—	—	—
54-01006	AAA5479	101–102	Qbt 1v	—	—	—	—	—	—	—	15859	—	—	—
54-01006	AAA5426	123.4–124	Qbt 1v	—	—	—	—	—	—	—	15859	—	—	—
54-01006	AAA5595	140–140.7	Qbt 1v	—	—	—	—	—	—	—	15859	—	—	—
54-01006	AAA5589	164.5–165.1	Qbt 1g	—	—	—	—	—	—	—	15875	—	—	—
54-01006	AAA5592	182–182.6	Qbt 1g	—	—	—	—	—	—	—	15875	—	—	—
54-01006	AAA5591	200.1–200.7	Qbt 1g	—	—	—	—	—	—	—	15875	—	—	—
54-01006	AAA5543	218.2–219.3	Qbt 1g	—	—	—	—	—	—	—	15875	—	—	—
54-01006	AAA5583	218.2–219.3	Qbt 1g	—	—	—	—	—	—	—	15875	—	—	—
54-01006	AAA5584	236.5–237.2	Qbt 1g	—	—	—	—	—	—	—	15875	—	—	—
54-01006	AAA5585	253.8–254.9	Qbt 1g	—	—	—	—	—	—	—	15895	—	—	—
54-01006	AAA5538	271.9–272.5	Qct	—	—	—	—	—	—	—	15895	—	—	—
54-01007	AAA6034	5.5–6.5	Qbt 2	16354	16354	—	16344	16344	16344	16344	16344	—	—	—
54-01007	AAA6035	15–16.5	Qbt 2	16354	16354	—	16344	16344	16344	16344	16344	—	—	—
54-01007	AAA7415	31–32	Qbt 2	16354	16354	—	16344	16344	16344	16344	16344	—	—	—
54-01007	AAA6036	35–36	Qbt 2	16354	16354	—	16344	16344	16344	16344	16344	—	—	—
54-01007	AAA7409	49–50	Qbt 1v	16356	16356	—	16346	16346	16346	16346	16346	—	—	—
54-01007	AAA7408	60–62.5	Qbt 1v	16356	16356	—	16346	16346	16346	16346	16346	—	—	—
54-01007	AAA7424	60–62.5	Qbt 1v	16356	16356	—	16346	16346	16346	16346	16346	—	—	—
54-01007	AAA7420	68–69.8	Qbt 1v	16356	16356	—	16346	16346	16346	16346	16346	—	—	—

Table B-13 (continued)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Uranium	Herbicides	PCBs	Pesticides	SVOCs	VOCs	Tritium	Alpha Spectroscopy	Gamma Spectroscopy
54-01007	AAA7421	75.5–77	Qbt 1v	16356	16356	—	16346	16346	16346	16346	16346	—	—	—
54-01007	AAA7446	87.8–89	Qbt 1v	16356	16356	—	16346	16346	16346	16346	16346	—	—	—
54-01007	AAA7450	98.5–99.6	Qbt 1v	16388	16388	—	16375	16375	16375	16375	16375	—	—	—
54-01007	AAA7451	106.4–107.5	Qbt 1v	16388	16388	—	16375	16375	16375	16375	16375	—	—	—
54-01007	AAA7447	130.8–132	Qbt 1g	16388	16388	—	16375	16375	16375	16375	16375	—	—	—
54-01007	AAA7449	145.5–146.7	Qbt 1g	16388	16388	—	16375	16375	16375	16375	16375	—	—	—
54-01008	AAA7413	5.5–6.3	Qbt 2	16352	16352	—	16324	16324	16324	16324	16324	—	—	—
54-01008	AAA7400	20.5–22	Qbt 2	16352	16352	—	16324	16324	16324	16324	16324	—	—	—
54-01008	AAA7418	25–26.2	Qbt 2	16352	16352	—	16324	16324	16324	16324	16324	—	—	—
54-01008	AAA7405	38–39	Qbt 1v	16352	16352	—	16324	16324	16324	16324	16324	—	—	—
54-01008	AAA7423	45–46.2	Qbt 1v	16352	16352	—	16324	16324	16324	16324	16324	—	—	—
54-01008	AAA7422	55.5–57	Qbt 1v	16336	16336	—	16325	16325	16325	16325	16325	—	—	—
54-01008	AAA7448	66–67	Qbt 1v	16336	16336	—	16325	16325	16325	16325	16325	—	—	—
54-01008	AAA7414	76.5–77.5	Qbt 1v	16336	16336	—	16325	16325	16325	16325	16325	—	—	—
54-01008	AAA7398	85.5–89	Qbt 1v	16336	16336	—	16325	16325	16325	16325	16325	—	—	—
54-01008	AAA7445	107–108	Qbt 1v	16336	16336	—	16325	16325	16325	16325	16325	—	—	—
54-01008	AAA7419	125–126.5	Qbt 1v	16336	16336	—	16325	16325	16325	16325	16325	—	—	—
54-01008	AAA7411	146–147	Qbt 1g	16336	16336	—	16325	16325	16325	16325	16325	—	—	—
54-01009	AAA7406	6–7.5	Qbt 2	16360	16360	—	16337	16337	16337	16342	16342	—	16565	16565
54-01009	AAA7417	15.7–17	Qbt 2	16360	16360	—	16337	16337	16337	16359	16342	—	—	—
54-01009	AAA7410	26–27.5	Qbt 2	16360	16360	—	16337	16337	16337	16342	16342	—	—	—
54-01009	AAA7401	38–40	Qbt 1v	16360	16360	—	16337	16337	16337	16359	16342	—	16565	16565
54-01009	AAA7397	45.5–46.8	Qbt 1v	16360	16360	—	16337	16337	16337	16359	16342	—	—	—
54-01009	AAA7412	59–60	Qbt 1v	16360	16360	—	16337	16337	16337	16359	16342	—	16565	16565
54-01009	AAA7404	65–66	Qbt 1v	16360	16360	—	16337	16337	16337	16359	16342	—	16565	16565
54-01009	AAA7407	83.3–84.5	Qbt 1v	16360	16360	—	16337	16337	16337	16342	16342	—	—	—

Table B-13 (continued)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Uranium	Herbicides	PCBs	Pesticides	SVOCs	VOCs	Tritium	Alpha Spectroscopy	Gamma Spectroscopy
54-01009	AAA7402	95–100	Qbt 1v	16360	16360	—	16337	16337	16337	16342	16342	—	—	—
54-01009	AAA7416	95–100	Qbt 1v	16360	16360	—	16337	16337	16337	16342	16342	—	—	—
54-01009	AAA7403	115.5–117	Qbt 1v	16360	16360	—	16337	16337	16337	16359	16342	—	16565	16565
54-01009	AAA7399	135–137	Qbt 1g	16360	16360	—	16337	16337	16337	16342	16342	—	—	—
54-01010	AAB6794	6.1–7.1	Qbt 2	18580	19207	—	—	18356	18356	18356	18356	19207	—	—
54-01010	AAB6797	13.2–14.1	Qbt 2	18580	19207	—	—	18356	18356	18356	18356	19207	—	—
54-01010	AAB6808	13.2–14.1	Qbt 2	18580	19207	—	—	18356	18356	18356	18356	19207	—	—
54-01010	AAB6798	20.4–21.2	Qbt 2	18580	19207	—	—	18356	18356	18356	18356	19207	—	—
54-01010	AAB6802	26.5–28.3	Qbt 2	18580	19207	—	—	18356	18356	18356	18356	19207	—	—
54-01010	AAB6787	34.5–35	Qbt 2	18643	18643	19662	—	18326	18326	18326	18326	19662	—	—
54-01010	AAB6800	41.6–42.1	Qbt 1v	18643	18643	19662	—	18326	18326	18326	18326	19662	—	—
54-01011	AAB6790	7.2–7.9	Qbt 2	18300	19183	—	—	18273	18273	18273	18273	19183	—	—
54-01011	AAB6785	15.2–16.2	Qbt 2	18300	19183	—	—	18273	18273	18273	18273	19183	—	—
54-01011	AAB6804	15.2–16.2	Qbt 2	18300	19183	—	—	18273	18273	18273	18273	19183	—	—
54-01011	AAB6796	23.6–24.2	Qbt 2	18300	19183	—	—	18273	18273	18273	18273	19183	—	—
54-01011	AAB6789	31.8–32.8	Qbt 2	18300	19183	—	—	18273	18273	18273	18273	19183	—	—
54-01011	AAB6788	40.5–41	Qbt 1v	18300	19183	—	—	18273	18273	18273	18273	19183	—	—
54-01012	AAB6807	7.5–8.2	Qbt 2	18579	19180	—	—	18309	18309	18309	18309	19180	—	—
54-01012	AAB6791	15.8–16.4	Qbt 2	18579	19180	—	—	18309	18309	18309	18309	19180	—	—
54-01012	AAB6780	23.6–24.1	Qbt 2	18579	19180	—	—	18309	18309	18309	18309	19180	—	—
54-01012	AAB6783	31.6–32.5	Qbt 2	18579	19180	—	—	18309	18309	18309	18309	19180	—	—
54-01012	AAB6782	40–40.7	Qbt 1v	18579	19180	—	—	18309	18309	18309	18309	19180	—	—
54-01013	AAB6811	5.7–6.1	Qbt 2	—	19974	20168	—	18407	18407	18407	18407	20168	—	—
54-01013	AAB6809	14.3–14.7	Qbt 2	—	20263	20170	—	18400	18400	18400	18400	20170	—	—
54-01013	AAB6799	22.5–23.3	Qbt 2	—	20263	20170	—	18400	18400	18400	18400	20170	—	—
54-01013	AAB6810	29.5–30.3	Qbt 2	—	19028	—	—	18295	18295	18295	18295	19028	—	—

Table B-13 (continued)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Uranium	Herbicides	PCBs	Pesticides	SVOCs	VOCs	Tritium	Alpha Spectroscopy	Gamma Spectroscopy
54-01013	AAB6792	39.3–41	Qbt 1v	—	19028	—	—	18295	18295	18295	18295	19028	—	—
54-01014	AAB6801	5.2–5.3	Qbt 2	18313	18313	20396	—	18311	18311	18311	18311	20396	—	—
54-01014	AAB6786	15.4–16	Qbt 2	18313	18313	20396	—	18311	18311	18311	18311	20396	—	—
54-01014	AAB6784	23.4–24.1	Qbt 2	18313	18313	20374	—	18311	18311	18311	18311	20374	—	—
54-01014	AAB6793	33.7–34.5	Qbt 2	18313	18313	20396	—	18311	18311	18311	18311	20396	—	—
54-01014	AAB6805	33.7–34.5	Qbt 2	18313	18313	20396	—	18311	18311	18311	18311	20396	—	—
54-01014	AAB6781	40.1–41	Qbt 1v	18313	18313	20396	—	18311	18311	18311	18311	20396	—	—
54-01015	AAC0746	230.7–232	Qbo	—	—	—	—	—	—	—	20381	20382	—	—
54-01015	AAC0731	266.7–267.6	Qbo	—	—	—	—	—	—	—	20451	—	—	—
54-01015	AAC0748	304.9–305.8	Qbo	—	—	—	—	—	—	—	20474	20475	—	—
54-01015	AAC0730	337–337.9	TCB	—	—	—	—	—	—	—	20552	—	—	—
54-01015	AAC0722	372.2–373.1	TCB	—	—	—	—	—	—	—	20658	20660	—	—
54-01015	AAC0729	408.2–408.6	TCB	—	—	—	—	—	—	—	20703	—	—	—
54-01015	AAC0721	441.2–442	TCB	—	—	—	—	—	—	—	20772	20773	—	—
54-01015	AAC0724	441.2–442	TCB	—	—	—	—	—	—	—	20772	20773	—	—
54-01015	AAC0723	451.7–452.6	TCB	—	—	—	—	—	—	—	20782	20783	—	—
54-01016	AAC0725	226.2–227.5	Qbo	—	—	—	—	—	—	—	21306	21307	—	—
54-01016	AAC0734	260.6–261.5	Qbo	—	—	—	—	—	—	—	21294	21299	—	—
54-01016	AAC0735	268.8–270.1	Qbo	—	—	—	—	—	—	—	21315	21324	—	—
54-01016	AAC0736	276.2–276.6	TCB	—	—	—	—	—	—	—	21342	21343	—	—
54-01016	AAC0737	277.4–278	TCB	—	—	—	—	—	—	—	21342	21343	—	—
54-01016	AAC0738	311–311.7	TCB	—	—	—	—	—	—	—	21342	21343	—	—
54-01016	AAC0739	346.8–348.1	TCB	—	—	—	—	—	—	—	21398	21399	—	—
54-01016	AAC0745	381.7–382.4	TCB	—	—	—	—	—	—	—	21426	21427	—	—
54-01016	AAC0747	416.4–417	TCB	—	—	—	—	—	—	—	21443	21444	—	—
54-01016	AAC0740	452.3–453	TCB	—	—	—	—	—	—	—	21458	21459	—	—

Table B-13 (continued)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Uranium	Herbicides	PCBs	Pesticides	SVOCs	VOCs	Tritium	Alpha Spectroscopy	Gamma Spectroscopy
54-01016	AAC0741	488.1–489	TCB	—	—	—	—	—	—	—	21492	21494	—	—
54-01016	AAC0770	511.9–514.2	TCB	—	—	—	—	—	—	—	21523	21524	—	—
54-01016	AAC0777	511.9–514.2	TCB	—	—	—	—	—	—	—	21523	21524	—	—

Table B-14
Depths of Pore-Gas Sampling Ports in Boreholes at MDA L

Borehole Number	Sample Port Depth (ft from surface of MDA L)
54-01015	129.6, 254.3, 397.6, 428.3, 472.3, 516.2, 551.4
54-01016	121, 252, 364, 426, 504.4, 549.2, 607.8
54-02001	20, 40, 60, 80, 100, 130, 140, 160, 180, 200
54-02002	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
54-02012	7, 27, 42
54-02014	13, 31, 46, 86
54-02015	8, 31, 82
54-02016	7, 8, 31, 82
54-02020	20, 40, 60, 80, 100, 130, 140, 160, 180, 200
54-02021	20, 40, 60, 80, 100, 130, 140, 160, 180, 200
54-02022	20, 40, 60, 80, 100, 120, 140, 160, 180, 197
54-02023	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
54-02024	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
54-02025	20, 60, 100, 160, 190
54-02026	20, 60, 100, 160, 200, 215
54-02027	20, 60, 100, 160, 200, 220, 250
24-02028	20, 60, 100, 160, 200, 220, 250
54-02029	20, 60, 100, 160, 200, 220, 260, 288
54-02030	20, 60, 100, 160, 200, 220, 243
54-02031	20, 60, 100, 160, 200, 220, 260
54-02034	60, 100, 160, 200, 220, 260, 300
54-02087	13, 31, 46, 86
54-02088	13, 31, 46, 86
54-02089	13, 31, 46, 86

Note: The -01000 series boreholes are Phase I RFI characterization boreholes. The -02000 series boreholes are pre-RFI boreholes drilled for pore-gas monitoring.

Table B-15a
Inorganic Chemicals Detected Above BVs in Phase I RFI Subsurface Core Samples at MDA L

Location ID	Sample ID	Depth (ft)	Media	Aluminum	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)
Qbt 2 Background Value[a]				**7340**	**46**	**1.21**	**na[b]**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**
Qbt 1v Background Value[a]				**8170**	**26.5**	**1.70**	**na**	**0.40**	**3700**	**2.24**	**1.78**	**3.26**	**0.5**
Qbt 1g Background Value[a]				**3560**	**25.7**	**1.44**	**na**	**0.40**	**1900**	**2.60**	**8.89**	**3.96**	**0.5**
54-01007	AAA6034	5.5–6.5	Qbt 2	—[c]	83	—	—	—	79000	—	—	7.7	—
54-01007	AAA6035	15–16.5	Qbt 2	10000	—	—	4.0	—	—	—	—	370	—
54-01007	AAA6036	35–36	Qbt 2	—	55	—	—	—	—	—	—	—	—
54-01007	AAA7415	31–32	Qbt 2	—	—	—	—	—	—	—	—	52	—
54-01007	AAA6036	35–36	Qbt 2	—	—	—	—	—	—	—	—	15	—
54-01007	AAA7409	49–50	Qbt 1v	—	43	—	—	—	—	—	—	11	—
54-01007	AAA7408	60–62.5	Qbt 1v	—	—	—	—	—	—	3.4	—	—	—
54-01007	AAA7420	68–69.8	Qbt 1v	—	—	—	—	—	—	—	—	64	—
54-01007	AAA7421	75.5–77	Qbt 1v	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7446	87.8–89	Qbt 1v	—	—	—	—	—	—	3.9	—	46	—
54-01007	AAA7450	98.5–99.6	Qbt 1v	—	—	—	—	—	—	4.1	—	—	—
54-01007	AAA7451	106.4–107.5	Qbt 1v	—	—	—	—	—	—	4.3	—	81.4	—
54-01007	AAA7447	130.8–132	Qbt 1g	—	—	—	—	—	—	—	—	17.3	—
54-01007	AAA7449	145.5–146.7	Qbt 1g	—	—	—	—	—	—	4.3	—	34.9	—
54-01008	AAA7413	5.5–6.3	Qbt 2	—	—	—	—	—	—	—	—	8.3	—
54-01008	AAA7400	20.5–22	Qbt 2	—	—	—	—	—	—	—	—	21	—
54-01008	AAA7405	38–39	Qbt 1v	—	—	—	—	—	—	—	1.8	40	—
54-01008	AAA7423	45–46.2	Qbt 1v	—	—	—	—	—	—	—	6.1	37	—
54-01008	AAA7422	55.5–57	Qbt 1v	—	—	—	—	—	—	2.4	—	4.5	—
54-01008	AAA7448	66–67	Qbt 1v	—	—	—	—	—	—	3.8	—	33	—

Table B-15a (continued)

Location ID	Sample ID	Depth (ft)	Media	Aluminum	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)
Qbt 2 Background Value[a]				7340	46	1.21	na[b]	1.63	2200	7.14	3.14	4.66	0.5
Qbt 1v Background Value[a]				8170	26.5	1.70	na	0.40	3700	2.24	1.78	3.26	0.5
Qbt 1g Background Value[a]				3560	25.7	1.44	na	0.40	1900	2.60	8.89	3.96	0.5
54-01008	AAA7414	76.5–77.5	Qbt 1v	—	—	—	—	—	—	2.6	—	110	—
54-01008	AAA7398	85.5–89	Qbt 1v	—	—	—	—	—	—	2.3	—	110	—
54-01008	AAA7445	107–108	Qbt 1v	—	—	—	—	—	—	3.8	1.8	190	—
54-01008	AAA7419	125–126.5	Qbt 1v	—	34	3.3	—	—	—	—	1.8	12	—
54-01008	AAA7411	146–147	Qbt 1g	—	—	—	—	—	—	—	—	100	—
54-01009	AAA7406	6–7.5	Qbt 2	—	—	—	—	—	—	—	—	21	—
54-01009	AAA7417	15.7–17	Qbt 2	—	—	—	—	—	—	—	—	14	—
54-01009	AAA7410	26–27.5	Qbt 2	—	—	—	—	—	—	—	—	66	—
54-01009	AAA7401	38–40	Qbt 1v	—	27	—	—	—	—	—	—	11	—
54-01009	AAA7397	45.5–46.8	Qbt 1v	—	—	—	—	—	—	3.5	—	12	—
54-01009	AAA7412	59–60	Qbt 1v	—	33	—	—	—	—	—	—	13	—
54-01009	AAA7404	65–66	Qbt 1v	—	44	—	—	—	—	—	—	6.3	—
54-01009	AAA7407	83.3–84.5	Qbt 1v	—	32	—	—	—	—	—	—	21	—
54-01009	AAA7402	95–100	Qbt 1v	—	31	—	—	—	—	—	—	54	—
54-01009	AAA7416	95–100	Qbt 1v	—	30	—	—	—	—	—	—	38	—
54-01009	AAA7403	115.5–117	Qbt 1v	—	—	—	—	—	—	—	—	100	—
54-01009	AAA7399	135–137	Qbt 1g	—	44	1.6	—	—	—	—	—	180	—
54-01010	AAB6797	13.2–14.1	Qbt 2	—	—	—	—	—	—	7.8	—	—	—
54-01010	AAB6808	13.2–14.1	Qbt 2	—	—	—	—	—	—	—	3.9	—	—
54-01010	AAB6798	20.4–21.2	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01010	AAB6787	34.5–35	Qbt 2	—	—	—	—	—	—	—	—	—	—

Table B-15a (continued)

Location ID	Sample ID	Depth (ft)	Media	Aluminum	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)
Qbt 2 Background Value[a]				**7340**	**46**	**1.21**	**na**[b]	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**
Qbt 1v Background Value[a]				**8170**	**26.5**	**1.70**	**na**	**0.40**	**3700**	**2.24**	**1.78**	**3.26**	**0.5**
Qbt 1g Background Value[a]				**3560**	**25.7**	**1.44**	**na**	**0.40**	**1900**	**2.60**	**8.89**	**3.96**	**0.5**
54-01010	AAB6800	41.6–42.1	Qbt 1v	—	—	—	—	—	—	4.8 (J)[d]	—	—	—
54-01011	AAB6796	23.6–24.1	Qbt 2	—	138	—	—	—	—	—	—	—	—
54-01012	AAB6807	7.5–8.2	Qbt 2	—	—	1.5	—	—	—	57.8	—	105 (J)	—
54-01012	AAB6791	15.8–16.4	Qbt 2	—	—	—	—	—	—	47.9	—	36.5 (J)	—
54-01012	AAB6780	23.6–24.1	Qbt 2	—	—	—	—	—	—	13.5	—	38.2 (J)	0.96 (J)
54-01012	AAB6782	40–40.7	Qbt 1v	—	—	—	—	1.7	—	4.2	—	—	—
54-01013	AAB6811	5.7–6.1	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01013	AAB6809	14.3–14.7	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01013	AAB6799	22.5–23.3	Qbt 2	—	—	—	—	—	—	—	—	49.6 (J)	—
54-01013	AAB6810	29.5–30.0	Qbt 2	—	—	—	—	—	—	—	—	48.9	—
54-01013	AAB6792	39.3–41	Qbt 1v	—	—	—	—	—	—	4.6	—	55.7	—
54-01014	AAB6801	5.2–5.3	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01014	AAB6786	15.4–16	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01014	AAB6784	23.4–24.1	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01014	AAB6793	33.7–34.5	Qbt 2	—	—	—	—	—	—	—	—	5.7	—
54-01014	AAB6805	33.7–34.5	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01014	AAB6781	40.1–41	Qbt 1v	—	—	—	—	—	—	3.0	—	—	—

Table B-15a (continued)

Location ID	Sample ID	Depth (ft)	Media	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Uranium	Vanadium	Zinc
Qbt 2 Background Value[a]				**14,500**	**11.2**	**482**	**0.1**	**na**	**6.58**	**0.3**	**2.4**	**17**	**63.5**
Qbt 1v Background Value[a]				**9900**	**18.4**	**408**	**0.1**	**na**	**2.0**	**0.3**	**6.22**	**4.48**	**84.6**
Qbt 1g Background Value[a]				**3700**	**13.5**	**189**	**0.1**	**na**	**2.0**	**0.3**	**0.72**	**4.59**	**40**
54-01007	AAA6034	5.5–6.5	Qbt 2	—	—	—	—	—	—	1.0	—	—	—
54-01007	AAA6035	15–16.5	Qbt 2	—	—	—	—	—	—	—	—	—	240
54-01007	AAA6036	35–36	Qbt 2	—	—	770	—	—	—	—	—	—	—
54-01007	AAA7415	31–32	Qbt 2	—	—	—	—	—	—	—	—	—	82
54-01007	AAA6036	35–36	Qbt 2	—	13	—	—	—	—	—	—	—	64
54-01007	AAA7409	49–50	Qbt 1v	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7408	60–62.5	Qbt 1v	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7420	68–69.8	Qbt 1v	—	—	—	—	—	—	—	—	—	94
54-01007	AAA7421	75.5–77	Qbt 1v	—	—	430	—	—	—	—	—	—	—
54-01007	AAA7446	87.8–89	Qbt 1v	—	—	—	—	—	—	—	—	—	99
54-01007	AAA7450	98.5–99.6	Qbt 1v	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7451	106.4–107.5	Qbt 1v	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7447	130.8–132	Qbt 1g	—	—	—	—	—	—	—	—	—	52.3
54-01007	AAA7449	145.5–146.7	Qbt 1g	—	—	—	—	—	—	—	—	—	—
54-01008	AAA7413	5.5–6.3	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01008	AAA7400	20.5–22	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01008	AAA7405	38–39	Qbt 1v	—	—	—	—	—	—	—	—	—	—
54-01008	AAA7423	45–46.2	Qbt 1v	—	—	—	—	3.4	—	—	—	—	—
54-01008	AAA7422	55.5–57	Qbt 1v	—	—	410	—	—	—	—	—	—	—
54-01008	AAA7448	66–67	Qbt 1v	—	—	—	—	—	—	—	—	—	—
54-01008	AAA7414	76.5–77.5	Qbt 1v	—	—	—	—	—	—	—	—	—	110

Table B-15a (continued)

Location ID	Sample ID	Depth (ft)	Media	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Uranium	Vanadium	Zinc
Qbt 2 Background Value[a]				**14,500**	**11.2**	**482**	**0.1**	**na**	**6.58**	**0.3**	**2.4**	**17**	**63.5**
Qbt 1v Background Value[a]				**9900**	**18.4**	**408**	**0.1**	**na**	**2.0**	**0.3**	**6.22**	**4.48**	**84.6**
Qbt 1g Background Value[a]				**3700**	**13.5**	**189**	**0.1**	**na**	**2.0**	**0.3**	**0.72**	**4.59**	**40**
54-01008	AAA7398	85.5–89	Qbt 1v	—	—	—	—	—	—	—	—	—	130
54-01008	AAA7445	107–108	Qbt 1v	—	—	—	—	—	—	—	—	—	160
54-01008	AAA7419	125–126.5	Qbt 1v	—	20	—	—	—	—	—	—	4.5	—
54-01008	AAA7411	146–147	Qbt 1g	5000	—	—	—	—	—	—	—	—	78
54-01009	AAA7406	6–7.5	Qbt 2	—	—	—	—	0.3	—	—	—	—	—
54-01009	AAA7417	15.7–17	Qbt 2	—	—	—	—	0.5	6.6	—	—	—	—
54-01009	AAA7410	26–27.5	Qbt 2	—	—	—	—	0.4	—	—	—	—	79
54-01009	AAA7401	38–40	Qbt 1v	—	—	—	—	0.4	3.9	—	—	—	—
54-01009	AAA7397	45.5–46.8	Qbt 1v	—	—	—	—	0.4	3.8	—	—	—	—
54-01009	AAA7412	59–60	Qbt 1v	—	—	—	—	0.5	3.9	—	—	—	—
54-01009	AAA7404	65–66	Qbt 1v	—	—	—	—	0.4	2.5	—	—	—	—
54-01009	AAA7407	83.3–84.5	Qbt 1v	—	—	—	—	0.3	—	—	—	—	—
54-01009	AAA7402	95–100	Qbt 1v	—	—	—	—	0.4	2.5	—	—	—	91
54-01009	AAA7416	95–100	Qbt 1v	—	—	—	—	0.4	2.5	—	—	—	—
54-01009	AAA7403	115.5–117	Qbt 1v	—	—	—	—	0.8	—	—	—	—	110
54-01009	AAA7399	135–137	Qbt 1g	—	—	210	—	0.7	2.6	—	—	—	140
54-01010	AAB6797	13.2–14.1	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01010	AAB6808	13.2–14.1	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01010	AAB6798	20.4–21.2	Qbt 2	—	—	—	0.16	—	—	—	—	—	—
54-01010	AAB6787	34.5–35	Qbt 2	—	—	—	—	—	—	—	3.71 (J)	—	—
54-01010	AAB6800	41.6–42.1	Qbt 1v	—	—	—	—	—	—	—	—	—	—

Table B-15a (continued)

Location ID	Sample ID	Depth (ft)	Media	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Uranium	Vanadium	Zinc
Qbt 2 Background Value[a]				**14,500**	**11.2**	**482**	**0.1**	**na**	**6.58**	**0.3**	**2.4**	**17**	**63.5**
Qbt 1v Background Value[a]				**9900**	**18.4**	**408**	**0.1**	**na**	**2.0**	**0.3**	**6.22**	**4.48**	**84.6**
Qbt 1g Background Value[a]				**3700**	**13.5**	**189**	**0.1**	**na**	**2.0**	**0.3**	**0.72**	**4.59**	**40**
54-01011	AAB6796	23.6–24.1	Qbt 2	—	—	—	—	—	—	—	—	—	—
54-01012	AAB6807	7.5–8.2	Qbt 2	—	—	—	0.15	—	—	—	—	—	—
54-01012	AAB6791	15.8–16.4	Qbt 2	—	—	—	—	—	—	—	9.54	—	—
54-01012	AAB6780	23.6–24.1	Qbt 2	—	—	—	—	—	—	—	2.41	—	—
54-01012	AAB6782	40–40.7	Qbt 1v	—	—	—	—	—	—	—	—	—	—
54-01013	AAB6811	5.7–6.1	Qbt 2			—	—	—	—	—	3.58	—	—
54-01013	AAB6809	14.3–14.7	Qbt 2			—	—	—	—	—	2.93	—	—
54-01013	AAB6799	22.5–23.3	Qbt 2	—	—	—	—	—	17.3	—	3.14	—	—
54-01013	AAB6810	29.5–30.0	Qbt 2	—	—	—	—	—	—	—	4.90	—	—
54-01013	AAB6792	39.3–41	Qbt 1v	—	—	—	—	—	22.4	—	—	—	—
54-01014	AAB6801	5.2–5.3	Qbt 2			—	—	—	16.2	—	2.62 (J)	—	—
54-01014	AAB6786	15.4–16	Qbt 2			—	—	—	—	—	2.56 (J)	—	—
54-01014	AAB6784	23.4–24.1	Qbt 2			—	—	—	—	—	3.10	—	—
54-01014	AAB6793	33.7–34.5	Qbt 2	—	—	—	—	—	—	—	3.01 (J)	—	—
54-01014	AAB6805	33.7–34.5	Qbt 2	—	—	—	—	—	—	—	2.96 (J)	—	—
54-01014	AAB6781	40.1–41	Qbt 1v	—	—	—	—	—	—	—	—	—	—

Note: Units are mg/kg.

[a] Tuff BVs/FVs obtained from LANL 1998, 59730.

[b] na = Not available.

[c] Dash indicates that the concentration was not above the BV/FV.

[d] (J) indicates estimated value.

Table B-15b
Frequency of Inorganic Chemicals Detected Above BVs in Subsurface Core Samples at MDA L

Analyte	Geologic Unit	Number of Analyses	Number of Detects	Concentration Range (mg/kg)[a]	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Qbt 2	34	34	130 to 10000	7340	1/34	0/34
Aluminum	Qbt 1g	4	4	563 to 1200	3560	0/4	0/4
Aluminum	Qbt 1v	29	29	270 to 4700	8170	0/29	0/29
Antimony	Qbt 2	34	1	[0.1 to 4.5]	0.5	0/34	1/34
Antimony	Qbt 1g	4	0	[0.2 to 0.3]	0.5	0/4	0/4
Antimony	Qbt 1v	29	0	[0.12 to 0.3]	0.5	0/29	0/29
Arsenic	Qbt 2	34	9	[0.2 to 1.6]	2.79	0/34	0/34
Arsenic	Qbt 1g	4	1	[0.2 to 1.5]	0.56	0/4	2/4
Arsenic	Qbt 1v	29	13	[0.2] to 1.7	1.81	0/29	0/29
Barium	Qbt 2	34	11	3.5 to 138	46	3/34	0/34
Barium	Qbt 1g	4	2	[16.4] to 44	25.7	1/4	0/4
Barium	Qbt 1v	29	21	[3.4] to 44	26.5	8/29	029
Beryllium	Qbt 2	34	7	[0.08] to 1.5	1.21	1/34	0/34
Beryllium	Qbt 1g	4	2	[0.42] to 1.6	1.44	1/4	0/4
Beryllium	Qbt 1v	29	18	[0.22] to 3.3	1.7	1/29	0/29
Boron	Qbt 2	27	1	[1.7 to 6.8]	na[b]	1/27	na
Boron	Qbt 1g	3	0	[3 to 4.1]	na	0/3	na
Boron	Qbt 1v	20	0	[1.7 to 3.9]	na	0/20	na
Cadmium	Qbt 2	34	2	[0.04] to 1.4	1.63	0/34	0/34
Cadmium	Qbt 1g	4	0	[0.3 to 0.64]	0.4	0/4	2/4
Cadmium	Qbt 1v	29	1	[0.27] to 1.7	0.4	1/29	4/29
Calcium	Qbt 2	34	9	[203] to 79000	2200	1/34	3/34
Calcium	Qbt 1g	4	1	[784 to 3100]	1900	0/4	1/4
Calcium	Qbt 1v	29	16	[565 to 3100]	3700	0/29	0/29
Chromium	Qbt 2	34	24	[0.5] to 57.8	7.14	4/34	0/34
Chromium	Qbt 1g	4	3	0.4 to 4.3	2.6	1/4	0/4
Chromium	Qbt 1v	29	27	0.6 to 4.8	2.24	14/29	0/29
Cobalt	Qbt 2	34	10	[0.51 to 3.9]	3.14	1/34	1/34
Cobalt	Qbt 1g	4	2	0.7 to 2.4	8.89	0/4	0/4
Cobalt	Qbt 1v	29	20	[0.5] to 6.1	1.78	4/29	2/29
Copper	Qbt 2	34	16	[0.63] to 370	4.66	15/34	0/34
Copper	Qbt 1g	4	4	17.3 to 180	3.96	4/4	0/4
Copper	Qbt 1v	29	24	[0.64] to 190	3.26	21/29	1/29
Cyanide (total)	Qbt 2	30	1	[0.00005] to 0.96	0.5	1/30	na

Table B-15b (continued)

Analyte	Geologic Unit	Number of Analyses	Number of Detects	Concentration Range (mg/kg)[a]	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Cyanide (Total)	Qbt 1g	4	0	[0.00005 to 0.21]	0.5	0/4	na
Cyanide (Total)	Qbt 1v	28	0	[0.00005 to 0.34]	0.5	0/28	na
Iron	Qbt 2	34	34	1020 to 10000	14500	0/34	0/34
Iron	Qbt 1g	4	4	1450 to 5000	3700	1/4	0/4
Iron	Qbt 1v	29	29	2550 to 9700	9900	0/29	0/29
Lead	Qbt 2	34	30	1.2 to 13	11.2	1/34	0/34
Lead	Qbt 1g	4	3	3 to 7.1	13.5	0/4	0/4
Lead	Qbt 1v	29	27	3.5 to 20	18.4	1/29	0/29
Magnesium	Qbt 2	33	9	52 to 1300	1690	0/33	0/33
Magnesium	Qbt 1g	4	2	[59 to 309]	739	0/4	0/4
Magnesium	Qbt 1v	28	21	[48.5] to 730	780	0/28	0/28
Manganese	Qbt 2	34	34	79 to 770	482	1/34	0/34
Manganese	Qbt 1g	4	4	149 to 210	189	1/4	0/4
Manganese	Qbt 1v	29	29	156 to 460	408	4/29	0/29
Mercury	Qbt 2	30	2	[0.02] to 0.16	0.1	2/30	0/230
Mercury	Qbt 1g	4	0	[0.02 to 0.1]	0.1	0/4	0/4
Mercury	Qbt 1v	28	0	[0.02 to 0.1]	0.1	0/28	0/28
Molybdenum	Qbt 2	30	3	0.3 to [5.9]	na	3/30	na
Molybdenum	Qbt 1g	4	1	0.7 to [6.2]	na	1/4	na
Molybdenum	Qbt 1v	28	9	0.3 to [5.9]	na	9/28	na
Nickel	Qbt 2	34	7	[1.3] to 17.3	6.58	3/34	0/34
Nickel	Qbt 1g	4	1	[2] to 2.6	2	1/4	2/4
Nickel	Qbt 1v	29	7	[1.3] to 22.4	2	7/29	4/29
Potassium	Qbt 2	34	10	120 to 1000	3500	0/34	0/34
Potassium	Qbt 1g	4	2	[220 to 777]	2390	0/4	0/4
Potassium	Qbt 1v	29	22	140 to [754]	6670	0/29	0/29
Selenium	Qbt 2	24	3	[0.2] to 1	0.3	1/24	14/24
Selenium	Qbt 1g	4	0	[0.2 to 0.43]	0.3	0/4	2/4
Selenium	Qbt 1v	26	1	[0.2 to 0.67]	0.3	0/26	4/26
Silver	Qbt 2	34	0	[0.06 to 2.2]	1	0/34	1/34
Silver	Qbt 1g	4	0	[0.3 to 1.1]	1	0/4	1/4
Silver	Qbt 1v	29	0	[0.3 to 2.2]	1	0/29	1/29
Sodium	Qbt 2	34	13	[135] to 2100	2770	0/34	0/34
Sodium	Qbt 1g	4	2	[256] to 720	4350	0/4	0/4
Sodium	Qbt 1v	29	23	150 to 1090	6330	0/29	0/29
Thallium	Qbt 2	34	1	[0.1 to 0.62]	1.1	0/34	0/34

Table B-15b (continued)

Analyte	Geologic Unit	Number of Analyses	Number of Detects	Concentration Range (mg/kg)[a]	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Thallium	Qbt 1g	4	0	[0.2 to 0.3]	1.22	0/4	0/4
Thallium	Qbt 1v	29	0	[0.12 to 0.4]	1.24	0/29	0/29
Uranium	Qbt 2	24	24	0.601 to 9.54	2.4	12/24	0/24
Uranium	Qbt 1v	5	5	0.628 to 5.9	6.22	0/5	0/5
Vanadium	Qbt 2	34	9	[0.8] to 9.5	17	0/34	0/34
Vanadium	Qbt 1g	4	2	0.7 to 1.7	4.59	0/4	0/4
Vanadium	Qbt 1v	29	21	0.8 to 4.5	4.48	1/29	0/29
Zinc	Qbt 2	34	34	12 to 240	63.5	4/34	0/34
Zinc	Qbt 1g	4	4	34.3 to 140	40	3/4	0/4
Zinc	Qbt 1v	29	29	23.7 to 160	84.6	7/29	0/29

[a] Values in square brackets indicate detection limits for nondetects.

[b] na = Not available.

Table B-16
Frequency of Detected Radionuclides Above BV or Detects (for Fallout Radionuclides) in Subsurface Samples at MDA L

Analyte	Geologic Unit	Number of Analyses	Number of Detects	Concentration Range (pCi/g)[a]	Background Value (pCi/g)	Frequency of Detects Above Background Value
Plutonium-238	Qbt 2	1	0	[0.003 to 0.003]	n/a[b]	0/1
Plutonium-238	Qbt 1v	4	0	[0 to 0.004]	n/a	0/4
Plutonium-239	Qbt 2	1	0	[0.001 to 0.001]	n/a	0/1
Plutonium-239	Qbt 1v	4	0	[-0.001 to 0.005]	n/a	0/4
Tritium	Qbt 2	24	16	[-1.95E-02] to 11.63	n/a	16/24
Tritium	Qbo	5	0	[-5.50E-02 to 3.91E-02]	n/a	0/5
Tritium	Qbt 1v	5	4	5.30E-02 to 0.34	n/a	4/5
Tritium	TCB[c]	14	2	[-9.9E-04] to 0.13	n/a	2/14
Uranium-234	Qbt 2	1	1	1.617 to 1.617	1.98	0/1
Uranium-234	Qbt 1v	4	4	1.953 to 2.479	3.12	0/4
Uranium-235	Qbt 2	1	0	[0.084 to 0.084]	0.09	0/1
Uranium-235	Qbt 1v	4	0	[0.075 to 0.144]	0.14	0/4
Uranium-238	Qbt 2	1	1	1.733 to 1.733	1.93	0/1
Uranium-238	Qbt 1v	4	4	2.24 to 2.777	3.05	0/4

[a] Values in brackets indicate detection limits for nondetects.

[b] n/a = Not applicable.

[c] TCB = Tertiary Cerros del Rio basalts.

Table B-17
Summary of Tritium Concentrations in Subsurface Samples at MDA L

Location ID	Sample ID	Depth (ft bgs of MDA L)	Geologic Unit	Concentration (pCi/g)
54-01010	AAB6798	20.4–21.2	Qbt 2	11.63
54-01010	AAB6787	34.5–35.0	Qbt 2	0.14
54-01010	AAB6800	41.6–42.1	Qbt 1v	0.34
54-01011	AAB6788	40.5–41.0	Qbt 1v	0.32
54-01013	AAB6809	14.3–14.7	Qbt 2	0.09
54-01013	AAB6799	22.5–23.3	Qbt 2	0.12
54-01013	AAB6810	29.5–30.3	Qbt 2	0.09
54-01013	AAB6792	39.3–41.0	Qbt 1v	0.14
54-01014	AAB6784	23.4–24.1	Qbt 2	0.09
54-01014	AAB6793	33.7–34.5	Qbt 2	0.06
54-01014	AAB6805	33.7–34.5	Qbt 2	0.04
54-01014	AAB6781	40.1–41.0	Qbt 1v	0.05
54-01015	AAC0721	531.2–532.0	TCB*	0.13

*TCB = Tertiary Cerros del Rio basalts.

Table B-18a
Organic Chemicals Detected in Phase I RFI Subsurface Core Samples at MDA L

Location ID	Sample ID	Depth (ft)	Media	Acetone	Aroclor-1260	Bis(2-ethylhexyl)phthalate	Bromobenzene	2-Butanone	n-Butylbenzene	4,4'-DDD	Dibromomethane	1,2-Dichlrobenzene	1,3-Dichlrobenzene	1,2-Dichloroethane	1,2-Dichloropropane
54-01001	AAA5537	89.8–91.1	Qbt 1v	0.022	—[a]	—	—	—	—	—	—	—	—	—	—
54-01001	AAA4324	268.6–269.3	Qct	0.023	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA4321	37.4–38.1	Qbt 2	0.033	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5373	58–58.8	Qbt 1v	0.025	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5378	75–76.6	Qbt 1v	0.021	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5374	93.5–96	Qbt 1v	0.027	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA4320	96–96.9	Qbt 1v	0.036	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA4322	113–114.4	Qbt 1v	0.098	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5377	131–132.6	Qbt 1v	0.040	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5540	149.8–150.8	Qbt 1g	0.046	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5541	187–187.6	Qbt 1g	0.034	—	—	—	—	—	—	—	—	—	—	—
54-01003	AAA5422	66.5–67.7	Qbt 1v	—	—	—	0.0075	—	—	—	0.0073	0.013	—	—	—
54-01005	AAA7958	22.7–23.3	Qbt 2	0.20 (J)	—	—	—	—	—	—	—	—	—	—	—
54-01006	AAA5480	18.3–19.6	Qbt 2	0.022	—	—	—	—	—	—	—	—	—	—	—
54-01007	AAA6034	5.5–6.5	Qbt 2	1.3 (J)	—	—	—	0.050 (J)[b]	—	—	—	—	—	—	—
54-01007	AAA6035	15–16.5	Qbt 2	0.45 (J)	—	—	—	0.026 (J)	—	—	—	—	—	—	—
54-01007	AAA7415	31–32	Qbt 2	1.9 (J)	—	—	—	4.8 (J)	—	—	—	—	—	—	—
54-01007	AAA6036	35–36	Qbt 2	2.1 (J)	—	—	—	0.43 (J)	—	—	—	—	—	—	—
54-01007	AAA7409	49–50	Qbt 1v	0.32 (J)	—	—	—	0.88 (J)	—	—	—	—	—	—	—
54-01007	AAA7408	60–62.5	Qbt 1v	0.055 (J)	—	—	—	0.12 (J)	—	—	—	—	—	—	—
54-01007	AAA7424	60–62.5	Qbt 1v	0.076 (J)	—	—	—	0.17 (J)	—	—	—	—	—	—	—
54-01007	AAA7420	68–69.8	Qbt 1v	—	—	—	—	0.035 (J)	—	—	—	—	—	—	—
54-01007	AAA7421	75.5–77	Qbt 1v	0.053 (J)	—	—	—	0.014 (J)	—	—	—	—	—	—	—
54-01008	AAA7423	45–46.2	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—

Table B-18a (continued)

Location ID	Sample ID	Depth (ft)	Media	Acetone	Aroclor-1260	Bis(2-ethylhexyl)phthalate	Bromobenzene	2-Butanone	n-Butylbenzene	4,4'-DDD	Dibromomethane	1,2-Dichlrobenzene	1,3-Dichlrobenzene	1,2-Dichloroethane	1,2-Dichloropropane
54-01009	AAA7406	6–7.5	Qbt 2	0.023	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7417	15.7–17	Qbt 2	0.035	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7410	26–27.5	Qbt 2	0.030	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7401	38–40	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7397	45.5–46.8	Qbt 1v	0.071	—	—	—	—	0.012	—	—	—	0.011	—	—
54-01009	AAA7412	59–60	Qbt 1v	0.062	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7404	65–66	Qbt 1v	0.046	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7407	83.3–84.5	Qbt 1v	0.022	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7402	95–100	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7416	95–100	Qbt 1v	0.027	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7403	115.5–117	Qbt 1v	0.10	—	—	—	—	—	—	—	—	—	0.0093	—
54-01010	AAB6794	6.1–7.1	Qbt 2	—	—	—	—	—	—	—	—	—	—	0.018	0.010
54-01010	AAB6797	13.2–14.1	Qbt 2	0.056	—	—	—	—	—	—	—	—	—	—	—
54-01010	AAB6798	20.4–21.2	Qbt 2	—	0.313	0.80	—	—	—	—	—	—	—	0.006	—
54-01010	AAB6802	26.5–28.3	Qbt 2	—	—	—	—	—	—	—	—	—	—	0.020	—
54-01010	AAB6800	41.6–42.1	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01011	AAB6785	15.2–16.2	Qbt 2	—	—	—	—	—	—	0.00588	—	—	—	—	—
54-01011	AAB6804	15.2–16.2	Qbt 2	—	—	—	—	—	—	0.0114	—	—	—	—	—
54-01012	AAB6807	7.5–8.2	Qbt 2	0.057	—	—	—	—	—	—	—	—	—	—	—
54-01012	AAB6791	15.8–16.4	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01013	AAB6810	29.5–30.3	Qbt 2	0.12	—	—	—	—	—	—	—	—	—	—	—
54-01013	AAB6792	39.3–41	Qbt 1v	0.70	—	—	—	—	—	—	—	—	—	—	—
54-01014	AAB6781	40.1–41	Qbt 1v	0.044	—	—	—	—	—	—	—	—	—	—	—
54-01016	AAC0734	260.6–261.5	Qbo	0.043	—	—	—	—	—	—	—	—	—	—	—

Table B-18a (continued)

Location ID	Sample ID	Depth (ft)	Media	1,3-Dichloropropane	Di-n-butylphthalate	2-Hexanone	4-Isopropyltoluene	4,4'-Methoxychlor	4-Methy-2-pentanone	Methylene chloride	Pentachlorophenol	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	1,2,3-Trichloropropane
54-01001	AAA5537	89.8–91.1	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01001	AAA4324	268.6–269.3	Qct	—	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA4321	37.4–38.1	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5373	58–58.8	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5378	75–76.6	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5374	93.5–96	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA4320	96–96.9	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA4322	113–114.4	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5377	131–132.6	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5540	149.8–150.8	Qbt 1g	—	—	—	—	—	—	—	—	—	—	—	—
54-01002	AAA5541	187–187.6	Qbt 1g	—	—	—	—	—	—	—	—	—	—	—	—
54-01003	AAA5422	66.5–67.7	Qbt 1v	0.0068	—	—	0.0052	—	—	—	—	—	—	—	0.014
54-01005	AAA7958	22.7–23.3	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01006	AAA5480	18.3–19.6	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01007	AAA6034	5.5–6.5	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01007	AAA6035	15–16.5	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7415	31–32	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01007	AAA6036	35–36	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7409	49–50	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7408	60–62.5	Qbt 1v	—	—	—	—	—	0.012	—	—	—	—	—	—
54-01007	AAA7424	60–62.5	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7420	68–69.8	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01007	AAA7421	75.5–77	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01008	AAA7423	45–46.2	Qbt 1v	—	—	—	—	—	0.015	—	—	—	—	—	—
54-01009	AAA7406	6–7.5	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7417	15.7–17	Qbt 2	—	—	0.021	—	—	—	—	—	—	—	—	—

Table B-18a (continued)

Location ID	Sample ID	Depth (ft)	Media	1,3-Dichloropropane	Di-n-butylphthalate	2-Hexanone	4-Isopropyltoluene	4,4'-Methoxychlor	4-Methy-2-pentanone	Methylene chloride	Pentachlorophenol	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	1,2,3-Trichloropropane
54-01009	AAA7410	26–27.5	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7401	38–40	Qbt 1v	—	1.0	0.020	—	—	—	—	—	—	—	—	—
54-01009	AAA7397	45.5–46.8	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7412	59–60	Qbt 1v	—	—	—	—	—	0.034	—	—	—	—	—	—
54-01009	AAA7404	65–66	Qbt 1v	—	0.45	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7407	83.3–84.5	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7402	95–100	Qbt 1v	—	0.44	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7416	95–100	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01009	AAA7403	115.5–117	Qbt 1v	—	0.75	—	0.0060	—	0.078	—	—	—	—	—	—
54-01010	AAB6794	6.1–7.1	Qbt 2	—	—	—	—	—	—	0.010	—	—	0.015	0.008	—
54-01010	AAB6797	13.2–14.1	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01010	AAB6798	20.4–21.2	Qbt 2	—	—	—	—	—	—	0.006	—	—	—	0.008	—
54-01010	AAB6802	26.5–28.3	Qbt 2	—	—	—	—	—	—	0.014	—	—	0.008	0.008	—
54-01010	AAB6800	41.6–42.1	Qbt 1v	—	—	—	—	0.0756	—	—	—	—	—	—	—
54-01011	AAB6785	15.2–16.2	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01011	AAB6804	15.2–16.2	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01012	AAB6807	7.5–8.2	Qbt 2	—	—	—	—	—	—	—	13 (J)	0.009	—	—	—
54-01012	AAB6791	15.8–16.4	Qbt 2	—	—	—	—	—	—	—	3.3 (J)	—	—	—	—
54-01013	AAB6810	29.5–30.3	Qbt 2	—	—	—	—	—	—	—	—	—	—	—	—
54-01013	AAB6792	39.3–41	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01014	AAB6781	40.1–41	Qbt 1v	—	—	—	—	—	—	—	—	—	—	—	—
54-01016	AAC0734	260.6–261.5	Qbo	—	—	—	—	—	—	—	—	—	—	—	—

Note: Units are mg/kg.

[a] Dash indicates that the concentration was not above the BV/FV.

[b] (J) indicates estimated value.

Table B-18b
Frequency of Detected Organic Chemicals in the Subsurface Core Samples at MDA L

Analyte	Geologic Unit	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	EQL[b] (mg/kg)	Frequency of Detects
Acetone	Qbt 2	31	7	[0.01] to 2.1	0.06	7/31
Acetone	Qbo	6	1	[0.022 to 0.043]	0.06	1/6
Acetone	Qbt 1v	21	6	[0.01] to 0.7	0.06	6/21
Aroclor-1260	Qbt 2	34	1	[0.013] to 0.313	0.033	1/34
Bis(2-ethylhexyl)phthalate	Qbt 2	31	1	[0.14] to 0.8	0.59	1/31
Butanone[2-]	Qbt 2	31	4	[0.01] to 4.8	0.027	4/31
Butanone[2-]	Qbt 1v	21	5	[0.01] to 0.88	0.027	5/21
DDD[4,4'-]	Qbt 2	34	2	[0.00067] to 0.0114	0.004	2/34
Dichloroethane[1,2-]	Qbt 2	31	3	[0.005] to 0.02	0.006	3/31
Dichloropropane[1,2-]	Qbt 2	31	1	[0.005] to 0.01	0.006	1/31
Methoxychlor[4,4'-]	Sediment	4	2	[0.0171] to 0.063	0.022	2/4
Methoxychlor[4,4'-]	Qbt 1v	29	1	[0.00067] to 0.076	0.027	1/29
Methyl-2-pentanone[4-]	Qbt 1v	21	2	[0.01 to 0.022]	0.027	2/21
Methylene chloride	Qbt 2	31	3	[0.005] to 0.014	0.028	3/31
Pentachlorophenol	Qbt 2	31	2	[0.83] to 13	1.2	2/31
Tetrachloroethene	Qbt 2	31	1	[0.005] to 0.009	0.007	1/31
Trichloroethane[1,1,1-]	Qbt 2	31	2	[0.005] to 0.015	0.006	2/31
Trichloroethene	Qbt 2	31	3	[0.005] to 0.008	0.006	3/31

[a] Values in square brackets indicate detection limits for nondetects.

[b] EQL is the maximum EQL reported for the organic chemical.

Table B-19
Frequency of VOCs Detected in Pore Gas at MDA L
Second Quarter FY 1997 through Fourth Quarter 2003

Analyte	Number of Analyses	Number of Detects	Concentration[a] (ppbv)	EQL (ppbv)	Frequency of Detects
Acetone	260	38	0.5 to [1100000]	5	38/260
Acetonitrile	148	3	1.8 to [210000]	1	3/148
Acetophenone	69	1	[5 to 10000]	0.2	1/69
Acrylonitrile	151	2	[1.2 to 110000]	0.5	2/151
Benzene	269	71	0.13 to [42000]	0.2	71/269
Benzonitrile	69	5	1.2 to [10000]	0.5	5/69
Bromodichloromethane	259	1	[0.47 to 42000]	0.2	1/259
Bromoform	260	6	[0.47 to 42000]	0.2	6/260
Bromomethane	269	9	[0.47 to 42000]	0.5	9/269
Butadiene[1,3-]	259	2	[0.47 to 42000]	0.2	2/259
Butane[n-]	152	64	[0.48 to 42000]	0.2	64/152

Table B-19 (continued)

Analyte	Number of Analyses	Number of Detects	Concentration[a] (ppbv)	EQL (ppbv)	Frequency of Detects
Butanol[1-]	256	3	[1.2 to 110000]	0.5	3/256
Butanone[2-]	260	2	[1.2 to 110000]	0.5	2/260
Butene[1-]	69	41	[1.6] to 2950	0.2	41/69
Butene[cis-2-]	69	33	[0.19] to 8550	0.2	33/69
Butene[trans-2-]	69	23	[0.15 to 1000]	0.2	23/69
Carbon disulfide	260	7	[0.12 to 42000]	0.2	7/260
Carbon Tetrachloride	269	136	0.47 to [42000]	0.2	136/269
Chloro-1,3-butadiene[2-]	68	2	[0.5 to 1000]	0.2	2/68
Chlorobenzene	270	45	0.04 to [42000]	0.2	45/270
Chlorodibromomethane	259	2	0.4 to [42000]	0.2	2/259
Chlorodifluoromethane	191	25	[0.47 to 42000]	0.2	25/191
Chloroethane	269	31	[0.47 to 42000]	0.5	31/269
Chloroform	269	193	0.26 to 46700	0.2	193/269
Chloromethane	269	23	[0.79 to 110000]	0.5	23/269
Cyclohexane	260	61	0.44 to [73000]	0.5	61/260
Cyclohexanone	69	1	[5 to 10000]	0.2	1/69
Cyclopentane	69	41	0.12 to 1340	0.2	41/69
Cyclopentene	69	12	0.2 to [1000]	0.2	12/69
Dibromoethane[1,2-]	232	8	[0.47 to 42000]	0.2	8/232
Dichloro-1,1,2,2-tetrafluoroethane[1,2-]	232	4	[0.47 to 42000]	0.2	4/232
Dichlorobenzene[1,2-]	270	2	0.2 to [42000]	0.2	2/270
Dichlorobenzene[1,4-]	270	22	[0.2 to 42000]	0.2	22/270
Dichlorodifluoromethane	232	153	[2.4 to 42000]	0.2	153/232
Dichloroethane[1,1-]	268	225	0.29 to 287000	0.2	225/268
Dichloroethane[1,2-]	269	138	0.22 to 240000	0.2	138/269
Dichloroethene[1,1-]	269	247	3.4 to 49000	0.2	247/269
Dichloroethene[cis-1,2-]	269	21	[0.47 to 42000]	0.2	21/269
Dichloroethene[trans-1,2-]	258	21	[0.47 to 42000]	0.2	21/258
Dichloropropane[1,2-]	269	108	[0.47] to 144000	0.2	108/269
Dichloropropene[cis-1,3-]	269	3	[0.47 to 42000]	0.2	3/269
Dichloropropene[trans-1,3-]	268	2	[0.47 to 42000]	0.2	2/268
Diethyl Ether	152	23	[1.2 to 110000]	0.5	23/152
Dimethylbutane[2,2-]	69	37	[0.12 to 1000]	0.2	37/69
Dimethylbutane[2,3-]	69	29	[0.5] to 2370	0.2	29/69
Dimethylpentane[2,3-]	64	29	[0.14] to 1888	0.2	29/64
Dioxane[1,4-]	177	2	[3.2 to 35000]	1	2/177
Ethanol	177	11	1.8 to 58000	0.5	11/177

Table B-19 (continued)

Analyte	Number of Analyses	Number of Detects	Concentration[a] (ppbv)	EQL (ppbv)	Frequency of Detects
Ethyl acrylate	69	1	4 to [10000]	0.2	1/69
Ethyl tert-butyl ether	69	3	0.8 to [10000]	0.2	3/69
Ethylbenzene	270	25	0.22 to [42000]	0.2	25/270
Hexachlorobutadiene	270	5	[0.05 to 42000]	0.2	5/270
Hexane	259	55	0.1 to [42000]	0.2	55/259
Hexanone[2-]	259	1	[1.2 to 110000]	0.5	1/259
Hexene[cis-3-]	69	7	[0.5 to 1000]	0.2	7/69
Hexene[trans-2-]	69	6	[0.5 to 1000]	0.2	6/69
Isobutane	69	57	1.13 to 3290	0.2	57/69
Isooctane	69	45	0.02 to 2230	0.2	45/69
Isopentane	68	53	0.4 to 1010	0.2	53/68
Isoprene	69	12	[0.5 to 1000]	0.2	12/69
Isopropylbenzene	152	8	[0.47 to 42000]	0.2	8/152
Methanol	251	19	[2.4 to 2100000]	10	19/251
Methyl methacrylate	69	3	0.05 to [10000]	0.2	3/69
Methyl tert-butyl ether	260	4	[1.2 to 110000]	0.2	4/260
Methyl-1-butene[3-]	69	20	0.2 to [1000]	0.2	20/69
Methyl-1-pentene[2-]	69	13	[0.5 to 1000]	0.2	13/69
Methyl-1-pentene[4-]	69	13	[0.5 to 1000]	0.2	13/69
Methyl-2-butene[2-]	69	24	0.05 to [1000]	0.2	24/69
Methyl-2-pentanone[4-]	260	7	[1.2 to 110000]	0.5	7/260
Methylcyclohexane	69	53	0.2 to 3530	0.2	53/69
Methylcyclopentane	69	60	[0.22] to 3180	0.2	60/69
Methylene chloride	269	210	[0.28] to 660000	0.2	210/269
Methylheptane[2-]	69	18	[0.02 to 1000]	0.2	18/69
Methylheptane[3-]	69	17	[0.01 to 1000]	0.2	17/69
Methylhexane[2-]	67	15	[0.01 to 1000]	0.2	15/67
Methylhexane[3-]	69	39	[0.13] to 3980	0.2	39/69
Methylpentane[2-]	69	50	[0.17] to 2330	0.2	50/69
Methylpentane[3-]	68	52	0.2 to 2360	0.2	52/68
Methylstyrene[alpha-]	152	1	0.3 to [42000]	0.2	1/152
Naphthalene	83	1	[0.47 to 42000]	na[b]	1/83
n-Heptane	258	23	[0.47 to 42000]	na	23/258
Nitrobenzene	69	1	[5 to 10000]	0.2	1/69
Nitropropane[2-]	69	2	0.8 to [10000]	0.2	2/69
Nonane[1-]	152	14	[0.3 to 42000]	0.2	14/152
Octane[n-]	152	14	[0.47 to 42000]	0.2	14/152
Pentane	151	62	0.68 to [110000]	0.5	62/151

Table B-19 (continued)

Analyte	Number of Analyses	Number of Detects	Concentration[a] (ppbv)	EQL (ppbv)	Frequency of Detects
Pentene[1-]	69	17	[0.08 to 1000]	0.2	17/69
Pentene[cis-2-]	69	15	0.2 to [1000]	0.2	15/69
Pentene[trans-2-]	69	12	0.3 to [1000]	0.2	12/69
Pinene[alpha-]	69	7	[0.5 to 1000]	0.2	7/69
Pinene[beta-]	69	7	[0.5 to 1000]	0.2	7/69
Propanol[2-]	177	13	0.6 to 120000	0.5	13/177
Propylbenzene[1-]	152	7	0.4 to [42000]	0.2	7/152
Propylene	176	48	[1.51 to 35000]	0.2	48/176
Styrene	270	6	[0.47 to 42000]	0.2	6/270
Tetrachloroethane[1,1,2,2-]	270	9	[0.47 to 42000]	0.2	9/270
Tetrachloroethene (PCE)	270	255	[0.48] to 1130000	0.2	255/270
Tetrahydrofuran	177	16	[3.2] to 36600	0.2	16/177
Toluene	269	81	0.41 to [42000]	0.2	81/269
Trichloro-1,2,2-trifluoroethane[1,1,2-] (Freon 113)	269	261	1.5 to 400000	0.2	261/269
Trichlorobenzene[1,2,4-]	270	7	[0.47 to 42000]	0.2	7/270
Trichloroethane[1,1,1-] (TCA)	269	267	3.9 to 6970000	0.2	267/269
Trichloroethane[1,1,2-]	269	24	[0.47 to 42000]	0.2	24/269
Trichloroethene (TCE)	269	267	[0.48] to 2600000	0.2	267/269
Trichlorofluoromethane	232	196	2 to 81000	0.2	196/232
Trimethylbenzene[1,2,4-]	270	17	[0.04 to 42000]	0.2	17/270
Trimethylbenzene[1,3,5-]	270	6	[0.47 to 42000]	0.2	6/270
Trimethylpentane[2,3,4-]	69	16	0.4 to [1000]	0.2	16/69
Undecane[n-]	83	1	[0.47 to 42000]	na	1/83
Vinyl acetate	260	3	[1.2 to 110000]	0.5	3/260
Vinyl chloride	268	33	0.08 to [42000]	0.2	33/268
Xylene (total)	88	6	[0.49 to 42000]	na	6/88
Xylene[1,2-]	270	39	0.3 to [42000]	0.2	39/270
Xylene[1,3-]	81	24	0.4 to [8400]	0.2	24/81
Xylene[1,3-]+xylene[1,4-]	101	9	[0.47 to 27000]	na	9/101

[a] Values in square brackets indicate detection limits for nondetects.

[b] na = Not available.

Table B-20
Maximum Pore-Gas Concentrations in the Fourth Quarter of FY 1999 (EPA Method TO-14) at MDA L

Compound[a]	Well Number	Port Depth (ft)	Maximum Concentration (ppmv)[b]
1,1,1-Trichloroethane (TCA)	54-02012	28	2600
Trichloroethene (TCE)	54-02012	28	2100
Methylene Chloride	54-02012	28	190
Trichloro-1,2,2-trifluoroethane[1,1,2-] (Freon 113)	54-02089	31	160
Tetrachloroethene (PCE)	54-02012	28	120
Dichloroethane[1,1-]	54-02012	28	82
Trichlorofluoromethane (Freon 11)	54-02002	180	36
Chloroform	54-02002	180	14
Toluene	54-02002	180	9.9
Dichlorodifluoromethane	54-02034	160	0.044

[a] Listed in order of decreasing concentration.

[b] ppmv = Parts per million by volume.

Table B-21
Maximum Pore-Gas Concentrations in the First Quarter of FY 2002 (EPA Method TO-14) at MDA L

Compound[a]	Well Number	Port Depth (ft)	Maximum Concentration (ppmv)[b]
1,1,1-Trichloroethane (TCA)	54-02002	100	390
Trichloroethene (TCE)	54-02002	100	78
Ethanol	54-02002	100	58
Trichloro-1,2,2-trifluoroethane(Freon 113)	54-02002	100	49
Methanol	54-02009	62	35
Methylene chloride	54-02002	100	23
Trichlorofluoromethane (Freon 11)	54-02002	100	18
1,2-Dichloropropane	54-02002	100	16
2-Propanol	54-02002	100	16
Tetrahydrofuran	54-02002	100	13
Chloroform	54-02002	100	9.4
Carbon tetrachloride	54-02030	100	8.9
Tetrachloroethene (PCE)	54-02002	100	7.4
1,1-Dichloroethane	54-02002	100	6.8
Toluene	54-02002	100	5.6
m,p-Xylene	54-02002	100	2.3
Dichlorodifluoromethane	54-02021	100	0.35
Tetrachloroethene (PCE)	54-02023	153	0.26
Benzene	54-01015	338	0.003

[a] Listed in order of decreasing concentration.

[b] ppmv = parts per million by volume.

Table B-22
Summary of Data Review Results

Analyte	Medium	COPC?	Rationale	Appendix D Table
Inorganic chemicals (except cadmium, selenium, and silver)	Sediment	No	Inorganic chemical data were either less than the BVs or not different from background data sets	D-2.0-1
Cadmium	Sediment	Yes	Elevated DLs > BV	
Selenium	Sediment	Yes	Elevated DLs > BV	
Silver	Sediment	Yes	Elevated DLs > BV	
Inorganic chemicals (except for barium, cobalt, copper, chromium, manganese, nickel, uranium, and zinc)	Tuff	No	Inorganic chemical data were either less than the BVs or not different from background data sets	D-2.0-5
Barium	Tuff	Yes	Detected above BV in 11 samples	
Cobalt	Tuff	Yes	Detected above BV in 5 samples	
Copper	Tuff	Yes	Detected above BV in 40 samples	
Chromium	Tuff	Yes	Detected above BV in 19 samples	
Manganese	Tuff	Yes	Detected above BV in 6 samples	
Nickel	Tuff	Yes	Detected above BV in 11 samples	
Uranium	Tuff	Yes	Detected above BV in 12 samples	
Zinc	Tuff	Yes	Detected above BV in 14 samples	
Radionuclides (except tritium and plutonium)	Sediment, ambient air, pore gas, tuff	No	Radiological data were either less than the BVs or not detected	D-2.02, D-2.0-4, D-2.0-6
Tritium	Ambient air, tuff	Yes	Tritium was detected in these media	
	Sediment	No	Not detected above sediment BV	
Plutonium-238	Sediment	Yes	Detected above sediment BV in one sample	
Organic chemicals				D-2.0-4
VOCs	Tuff	Yes	Detected in the media	
	Ambient air	Yes	Detected in the media	
	Pore gas	Yes	Detected in the media	
SVOCs	Air/pore gas			D-2.0-7
	Tuff	No	Detected but extent defined	
Pesticides				D-2.0-3
Methoxychlor	Tuff	No	Detected but extent defined	
	Sediment	Yes	Detected in 3 sediment samples	
DDD	Tuff	No	Detected but extent defined	
PCBs				D-2.0-3
Aroclor-1260	Tuff	No	Detected but extent defined	