B-1.0 INTRODUCTION

This appendix summarizes the field methods used during the 2010–2011 investigation of the DP Site Aggregate Area Delayed Sites and DP East building footprints at Technical Area 21 (TA-21) at Los Alamos National Laboratory (LANL or Laboratory). Table B-1.0-1 presents a summary of the methods used, and the following sections provide more detailed descriptions of the methods as well as deviations that occurred during execution of the work plan. All activities were conducted in accordance with approved subcontractor procedures that are technically equivalent to Laboratory standard operating procedures (SOPs) listed in Table B-1.0-2 and are available at http://www.lanl.gov/environment/all/qa/wes.shtml and http://www.lanl.gov/environment/all/qa/adep.shtml.

B-2.0 EXPLORATORY DRILLING CHARACTERIZATION

No exploratory drilling characterization was conducted during the 2011 investigation.

B-3.0 FIELD-SCREENING METHODS

This section summarizes the field-screening methods used during the investigation activities. Field screening for organic vapors was performed as necessary for health and safety purposes. Field screening for radioactivity was performed on every sample submitted to the Sample Management Office (SMO). Field-screening results for all investigation activities are described in section 4.2.2 and are presented in Table 4.2-2 of the investigation report.

B-3.1 Field Screening for Organic Vapors

Field screening for organic vapors was conducted for all samples at all locations outside of the former buildings, including Solid Waste Management Unit (SWMU) 21-011(b) and Consolidated Unit 21-004(b)-99. Screening was conducted using a MiniRAE 2000 photoionization detector (PID) equipped with an 11.7-electron volt lamp. Screening was performed in accordance with the manufacturer's specifications and SOP-06.33, Headspace Vapor Screening with a Photo Ionization Detector. Screening was performed on each sample collected, and screening measurements were recorded on the field sample collection logs (SCLs) and chain-of-custody (COC) forms, provided on DVD in Appendix C. The field-screening results are presented in Table 4.2-2 of the investigation report.

B-3.2 Field Screening for Radioactivity

All samples collected were field screened for radioactivity (targeting alpha and beta/gamma emitters) before they were submitted to the SMO. A Laboratory radiation control technician (RCT) conducted radiological screening using an HP 210 pancake probe, a Ludlum 2221 probe, an Eberline 50 cm^2 alpha probe, Spa 3 type sodium iodine probe, a Ludlum 2929 smear counter, and a low-volume air-sampler. Screening measurements were recorded on the SCLs and COC forms and are provided in Appendix C on DVD. The screening results are presented in Table 4.2-2 of the investigation report.

B-3.3 Radiological Survey

Alpha/beta, low-energy gamma, and high-energy gamma radiological surveys were conducted at SWMU 21-011(b) and Consolidated Unit 21-004(b)-99 to identify areas of elevated radiological activities, after structure removal. The surveys did not identify any areas of radiation significantly different from background. The results of the surveys did not change any predetermined sampling locations. Details of the radiological surveys and the results are presented in Appendix D.

B-4.0 FIELD INSTRUMENT CALIBRATION

All instruments were calibrated before use. All calibrations were performed according to the manufacturers' specifications and requirements.

B-5.0 SURFACE AND SUBSURFACE SAMPLING

This section summarizes the methods used to collect surface and subsurface samples, including soil and tuff samples, according to the approved investigation work plans (LANL 2009, 108166.9; LANL 2010, 110082.4; NMED 2010, 108443; NMED 2010, 110422).

B-5.1 Surface Sampling Methods

Surface samples were collected using either hand-auger or spade-and-scoop methods. Surface samples were collected in accordance with approved subcontractor procedures technically equivalent to SOP-06.10, Hand Auger and Thin-Wall Tube Sampler, or SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples. A hand auger or spade and scoop were used to collect material in prescribed sampling increments.

Deeper subsurface samples (20–30 ft below ground surface [bgs]) and samples in locations where a hand auger met refusal were drilled with a mechanical auger. Two different mechanical augers were used for the investigation. For depths between 5 and 10 ft bgs, a 5.5 horsepower (hp) "Little Beaver Portable Mechanical Earth Drill with 3-ft-long, 4-in.-diameter auger flights was used. For depths greater than 10 ft bgs, a truck-mounted 10.5 hp Mobile Drill Minuteman with 3-ft-long, 4-in.-diameter auger flights was used. In both cases, the mechanical auger was used to advance the hole to 6 in. above the top of the planned sample collection depth using 4-in.-diameter augers fitted with a center bit. A 4-in.-diameter stainless-steel hand auger was then used to remove any slough from the bottom of the hole. A tape measure was used to verify the depth of the hole. The hole was then advanced to collection depth using the same 4-in.-diameter hand auger. Before the sample was collected, the depth was verified again, the hand auger bucket was decontaminated, and the sample was collected.

Samples were preserved using coolers to maintain the required temperature and chemical preservatives, such as nitric acid, in accordance with an approved subcontractor procedure technically equivalent to SOP-5056, Sample Containers and Preservation.

Samples were appropriately labeled, sealed with custody seals, and documented before being transported to the SMO. Samples were managed according to approved subcontractor procedures technically equivalent to SOP-5057, Handling, Packaging, and Transporting Field Samples, and SOP-5058, Sample Control and Field Documentation.

Sample collection tools were decontaminated immediately before each sample was collected in accordance with a subcontractor procedure technically equivalent to SOP-5061, Field Decontamination of Equipment (see section B-5.7).

B-5.2 Borehole Logging

The required sampling depths at all locations were reached by hand augers or a power auger attachment. A drill rig was not used to collect subsurface samples, and therefore collection of lithologic data from core samples was not possible (see section B-8.0, Deviations from the Work Plans). Descriptions of the sample media and notable sample features, similar to a borehole log, are provided on the SCLs in Appendix C. A tabular summary of sample descriptions and comments is included in Appendix G, along with the individual SCLs.

B-5.3 Subsurface Tuff Sampling Methods

Subsurface samples were collected in accordance with approved subcontractor procedures technically equivalent to SOP-06.10, Hand Auger and Thin-Wall Tube Sampler. The use of the power auger allowed the hand auger to reach sampling depths at approximately 20 to 30 ft bgs. The power auger was used to drill down to within 0.5 ft of the sample collection depth. Subsequently, a hand auger was used to collect the sample material at the designated sample depth in a manner equivalent to SOP-06.10. Samples retrieved from the subsurface were field screened for radioactivity and visually inspected.

Samples for VOC analysis were immediately transferred from the auger bucket to the sample container to minimize the loss of subsurface VOCs during the sample collection process. Containers for VOC samples were filled as completely as possible, leaving no or minimal headspace, and sealed with a Teflon-lined cap.

Samples were placed in a stainless-steel bowl, and the material was crushed, if necessary, with a decontaminated rock hammer and stainless-steel spoon to allow the material to fit into the sample containers. The sample collection tools were decontaminated immediately before each sample was collected in accordance with an approved subcontractor procedure technically equivalent to SOP-5061, Field Decontamination of Equipment (see section B-5.7).

B-5.4 Quality Control Samples

Quality control (QC) samples were collected in accordance with an approved subcontractor procedure technically equivalent to SOP-5059, Field Quality Control Samples. The QC samples included field duplicates, field rinsate blanks, and field trip blanks. Field duplicate samples were collected from the same material as the regular investigation samples and submitted for the same analyses. Field duplicate samples were collected at a frequency of at least 1 duplicate sample for every 10 samples.

Field rinsate blanks were collected to evaluate the field decontamination procedures. Rinsate blanks were collected by rinsing sampling equipment (i.e., auger buckets and sampling bowls and spoons) after decontamination with deionized water. The rinsate water was collected in a sample container and submitted to the SMO. Field rinsate blank samples were analyzed for target analyte list metals and were collected from sampling equipment at a frequency of at least 1 rinsate sample for every 10 solid samples.

Field trip blanks were also collected at a frequency of one per day when samples were being collected for VOC analysis. Trip blanks consisted of containers of certified clean sand opened and kept with the other sample containers during the sampling process. Trip blanks were analyzed for VOCs only.

B-5.5 Sample Documentation and Handling

Field personnel completed an SCL and COC form for each sample. Sample containers were sealed with signed custody seals and placed in coolers at approximately 4°C. Samples were handled in accordance with approved subcontractor procedures technically equivalent to SOP-5057, Handling, Packaging, and Transporting Field Samples, and SOP-5056, Sample Containers and Preservation. Swipe samples were collected from the exterior of sample containers and analyzed by the RCT before the sample containers were removed from the site. Samples were transported to the SMO for processing and shipment to off-site contract analytical laboratories. The SMO personnel reviewed and approved the SCLs and COC forms and accepted custody of the samples. The SCLs and COC forms are provided in Appendix C (on DVD).

B-5.6 Borehole Abandonment

Motorized and regular hand-auger sampling locations deeper than 15 ft bgs were abandoned in accordance with an approved subcontractor procedure technically equivalent to SOP-5034, Monitor Well and RFI Borehole Abandonment, by filling the boreholes with bentonite chips up to 2–3 ft from the ground surface. The chips were hydrated and clean soil was placed on top. All cuttings were managed as investigation-derived waste (IDW) as described in Appendix E.

B-5.7 Decontamination of Sampling Equipment

The hand auger barrels and all other sampling equipment that came (or could have come) in contact with sample material were decontaminated after each core was retrieved and logged. Decontamination included wiping the equipment with Fantastik and paper towels. Residual material adhering to equipment was removed using dry decontamination methods such as the use of wire brushes and scrapers. Decontamination activities were performed in accordance with an approved subcontractor procedure technically equivalent to SOP-5061, Field Decontamination of Equipment. Decontaminated equipment was surveyed by an RCT before it was released from the site. Field rinsate blank samples were collected in accordance with an approved procedure technically equivalent to SOP-5059, Field Quality Control Samples.

B-5.8 Site Demobilization and Restoration

Drilling equipment was not used during the 2010–2011 investigation. All temporary fencing and staging areas were dismantled and returned to preinvestigation conditions. All excavations were filled to match surrounding grade, to stabilize for erosion control, and to prevent off-site transport. At Consolidated Unit 21-004(b)-99 and SWMU 21-011(b), the excavations were backfilled to match surrounding site grade. The excavated areas were then seeded with native seed using hydromulch. For the footprints of the former DP East buildings, excavations were backfilled to the surrounding site grade. Base-course material was then applied to match the site condition of the area.

B-6.0 GEODETIC SURVEYING

Geodetic surveys of all sampling locations were performed using a Trimble RTK 5700 differential global-positioning system (DGPS) referenced from published and monumented external Laboratory survey control points in the vicinity. All sampling locations were surveyed in accordance with an approved subcontractor procedure technically equivalent to SOP-5028, Coordinating and Evaluating Geodetic Surveys. Horizontal accuracy of the monumented control points is within 0.1 ft. The DGPS instrument referenced from Laboratory control points is accurate within 0.2 ft. The surveyed coordinates are presented in Table 4.2-1 of the investigation report.

B-7.0 IDW STORAGE AND DISPOSAL

All IDW generated during the field investigation was managed in accordance with an approved subcontractor procedure technically equivalent to SOP-5238, Characterization and Management of Environmental Program Waste. This procedure incorporates the requirements of all applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations, U.S. Department of Energy orders, and Laboratory implementation requirements. IDW was also managed in accordance with the approved waste characterization strategy form. Details of IDW management are presented in Appendix E.

B-8.0 DEVIATIONS FROM THE WORK PLANS

Deviations from the approved investigation work plans (LANL 2009, 108166.9; NMED 2010, 108443; LANL 2010, 110082.4; NMED 2010, 110422) are summarized below. As a deviation from the approved work plan, detailed boring logs are not included in this report. The method used to achieve the depths necessary to meet the sampling objective involved the use of a powered hand auger fitted with a center bit. This method provided greater efficiency during the investigation but did not enable detailed logging because the augering process produces only fine material at the surface, making detailed observations of stratigraphy impracticable. Much of the information that would be expected in a borehole log was included in the SCLs contained in Appendix C. These logs are also included in Appendix G, along with a tabular summary of sample descriptions and comments for boreholes deeper than 5 ft.

Consolidated Unit 21-004(b)-99

- At locations 21-614322, 21-614324, 21-614325, and 21-614328, samples were collected from 0 to 1 ft rather than 0- to 0.5-ft depth to obtain adequate material for analyses.
- At location 21-614326, polychlorinated biphenyls (PCBs) were inadvertently ordered for analysis in the 5- to 6-ft depth interval.

SWMU 21-011(b)

- Because active systems in the vicinity of building 21-257 likely intersect the targeted acid waste line, a portion of the acid waste line was left in place. The acid waste line was removed up to the fence line of building 21-257. The portion of the acid waste line inside the fence surrounding building 21-257 was left in place. The remaining line will be removed and the proposed sampling locations (30-43) will be sampled when building operations have ceased or changed such that active building systems will not interfere with the removal of the line and sampling.
- A section of the acid waste line near building 21-257 was found under a cast-in-place concrete block poured to protect the acid waste line from the overlying active water line that crossed approximately 12 in. above the acid waste line. At the direction of the Laboratory's subcontractor technical representative and in concurrence with the Laboratory's site engineer, an approximately 8-ft section of the acid waste line beneath the concrete block was left in place and isolated with foam sealant. This did not prevent planned sample collection at the site.
- Sump structure 21-223, which extended at least 15 ft belowgrade, was demolished to below 10 ft belowgrade. The remaining lower portion of this cast-in-place sump was poured against competent tuff bedrock. Because of the sump's location on a relatively steep sloping site area, the presence of active fire water lines on parts of two sides of the excavation, and a nearby power pole, the Laboratory's site engineer determined that complete removal of the sump was impracticable; at the direction of the Laboratory's subcontractor technical representative, it was left in place. The remaining portion of the sump was filled with bentonite and soil before the excavation was filled to grade with clean soil. This prevented sampling at planned location 14. However, samples were collected from under the former sump inlet and outlet lines (locations 21-613815, 21-613824, and 21-614319).
- The waste line extending from manhole 21-221 to 21-222 was left in place and partially grouted because of an active fire water line running parallel to, and several feet shallower than, the waste line. The Laboratory's site engineer determined that attempts to excavate the waste line could lead the fire water line breaking and authorized the in-place grouting of the waste line. In attempting to insert plastic tubing to grout the acid waste line between manhole structure 21-221 and manhole structure 21-222, the waste line was found to be blocked. Plastic tubing was

inserted into structure 21-221 and fed approximately 90 ft toward manhole structure 21-222. Approximately 150 gal. of grout was pumped into the industrial waste line, and the line was abandoned. This did not prevent planned sample collection at the site.

- A section of waste line connecting manhole 21-221 to former building 21-209 was encountered during the investigation. This portion of the line was left in place and grouted because it was deeper than 10 ft bgs. This did not prevent planned sample collection at the site.
- An approximately 50-ft section of line from former cooling tower 21-420 to former cooling tower 21-220 (LANL 2009, 108166.9, Figure 2.2-1) was abandoned in place because an active water line was above the cooling system piping. This did not prevent planned sample collection at the site.
- The base of structure 21-223 and manhole structure 21-222 were left in place because they were deeper than 10 ft bgs and were formed in place in excavations into competent Qbt 3 bedrock, making excavation impracticable.
- North of former building 21-155, the southwest piping connecting to manhole structure 21-222 could not be found within approximately 10 ft bgs. Therefore, proposed sampling location 7 (LANL 2009, 108166.9, Figure 4.1-1) was not sampled.
- An approximately 50-ft section of the line on the west side of former building 21-155 was abandoned in place because it was encased in 2 ft of concrete foundation left in place by the decontamination and decommissioning operations. Samples could not be collected at proposed sampling locations 4 and 5 (LANL 2009, 108166.9, Figure 4.1-1).
- Samples from locations 21-613828 and 21-613829 were inadvertently not analyzed for isotopic thorium. However, this does not affect the results because a total of 354 samples were analyzed for isotopic thorium at the sites investigated, with all detections at or below background levels. Therefore, it is unlikely that isotopic thorium would be detected above background at these two locations.

Former Building 21-152

- The sample collected at 8 to 9 ft bgs from location 21-614204 was inadvertently not analyzed for technetium-99. However, this does not affect the results because a total of 341 samples were analyzed for technetium-99 at the sites, with no detections. Therefore, it is unlikely that technetium-99 would be detected at this one location.
- When the vacuum waste line that extended along the east side of former building 21-152 was removed, a deeper waste line running parallel and passing southward under building 21-166 was also was excavated and removed. This waste line, associated with SWMU 21-024(k) and the DP Site Aggregate Area work plan (LANL 2008, 104989), had been left in place for later excavation once the DP East buildings had been removed. Sampling for the vacuum line is sufficient to evaluate the nature and extent of this waste line. It should be noted that a portion of this waste line, which extends under the active south side site access road, remains in place.
- The sample collected at the 5- to 6-ft-depth interval at location 21-614222 was inadvertently analyzed for total petroleum hydrocarbon–diesel range organics by the analytical laboratory.

Former Building 21-155

- Sampling locations 21-613977 and 21-613978 were moved approximately 5 ft west and 5 ft east, respectively, of a water line (LANL 2010, 110082.4, Figure 2.2-1).

- Location 21-614015 (LANL 2010, 110082.4, Figure 2.2-1) was moved 8 ft east of planned sampling location 39 because of the presence of concrete.
- Location 21-614001 (LANL 2010, 110082.4, Figure 2.2-1) was moved 5 ft northwest of planned sampling location 17 because of auger refusal.
- A sample was inadvertently collected at location 21-614023 east of location 21-614024 instead of west of this location. The correct area will be sampled during the Phase II investigation.

Former Building 21-209

- Only one depth was sampled at location 21-612268 (LANL 2010, 110082.4, Figure 2.3-1) because of auger refusal. In addition, the sample collected was not analyzed for radionuclides because the sample size was small. This did not adversely affect the results. The results from samples collected the other floor drains in the area indicate that additional sampling is not necessary at this location.
- Two floor drains were found after all equipment had been removed from the basement. Locations 21-612265 and 21-613173 were added to sample the floor drains.
- The basement was left in place and filled with clean fill and demolition debris. Therefore, the floor drain piping in the basement was not removed. This did not prevent planned sample collection at the site.

B-9.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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LANL (Los Alamos National Laboratory), December 2009. "Investigation Work Plan for Delta Prime Site Aggregate Area Delayed Sites, Revision 1," Los Alamos National Laboratory document LA-UR-09-8180, Los Alamos, New Mexico. (LANL 2009, 108166.9)

LANL (Los Alamos National Laboratory), July 2010. "Delta Prime East Building Footprints Letter Work Plan, Revision 1," Los Alamos National Laboratory document LA-UR-10-4812, Los Alamos, New Mexico. (LANL 2010, 110082.4)

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NMED (New Mexico Environment Department), July 26, 2010. "Approval, Delta Prime East Building Footprints Letter Work Plan for Delta Prime Site Aggregate Area, Technical Area 21," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 110422)