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Date: JAN 14 2011
Refer To: EP2011-0005

James Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of the DP West Building 21-002 Footprint Letter Work Plan

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the DP West Building 21-002 Footprint Letter Work Plan.

If you have any questions, please contact Bruce Wedgeworth at (505) 231-0108 (brucew@lanl.gov) or Woody Woodworth at (505) 665-5820 (lwoodworth@doeal.gov).

Sincerely,

Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

George J. Rael, Manager
Environmental Projects Office
Los Alamos Site Office

34256

MG/GR/PH/BW:sm

Enclosures: Two hard copies with electronic files – DP West Building 21-002 Footprint Letter Work Plan (LA-UR-11-0127)

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LA-UR-11-0127
January 2011
EP2011-0005

DP West
Building 21-002 Footprint
Letter Work Plan

Los Alamos
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EST. 1943

Prepared by the Environmental Programs Directorate

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LA-UR-11-0127
EP2011-0005

DP West Building 21-002 Footprint Letter Work Plan

January 2011

Responsible project manager:

Printed Name	Signature	Title	Organization	Date
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EXECUTIVE SUMMARY

This letter work plan addresses the building 21-002 footprint at DP West at Technical Area 21. Building 21-002 was used for plutonium research starting in the 1940s. This building was connected to various solid waste management units, areas of concern, and consolidated units that are part of the DP Site Aggregate Area at Los Alamos National Laboratory. The investigation of this site is proposed in the "Investigation Work Plan for Delta Prime Site Aggregate Area Delayed Sites."

This letter work plan proposes investigation sampling after the concrete slab (footprint) and subsurface structures removal is complete. Sampling will be coordinated with demolition activities to determine if additional sampling locations are required based on field-screening results and resulting analytical data.

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1.0 INTRODUCTION

The Los Alamos National Laboratory (LANL or the Laboratory) Technical Area 21 (TA-21) Closure Project is investigating DP Site Aggregate Area sites potentially contaminated by past Laboratory operations. In accordance with the approved "Investigation Work Plan for Delta Prime Site Aggregate Area Delayed Sites" (LANL 2009, 107119; NMED 2010, 108443), LANL is submitting this letter work plan outlining the proposed investigation of the building 21-002 footprint area under the concrete building slab and utility tunnels following the removal of remaining surface (i.e., concrete slab) and subsurface (e.g., piping and sumps) structures. Building 21-002 is located on DP Mesa within TA-21 at DP West (DPW) complex (Figure 1.0-1).

2.0 BACKGROUND AND SCOPE OF ACTIVITIES

The operational history, previous investigations, and/or field activities for building 21-002 are presented below. The work will be conducted in accordance with the field methods outlined in the approved investigation work plan (LANL 2009, 107119, section 8.0; NMED 2010, 108443).

2.1 Building 21-002 Operational History

Building 21-002 of the TA-21 DPW complex was originally a laboratory for plutonium research, processing, and production. Between 1945 and 1978, operations conducted in building 21-002 included plutonium dissolution, plutonium recovery, and americium waste storage (Garde et al. 1982, 006399). Acids and caustics were used to isolate and concentrate uranium and plutonium (LANL 2006, 111467, p. 3). Early ether extraction operations were also conducted in this building (McGehee and Garcia 1999, 087442, p. 143). Figure 2.1-1 shows the main waste process lines and work areas throughout building 21-002.

In 1978, plutonium operations at DPW were transferred to the new plutonium facility at TA-55. Following in 1978–1981, the building was decontaminated to a level to allow continued occupancy for non-plutonium research activities. The building most recently housed offices, storage rooms, and wet chemistry laboratories and was operated under strict use limitations (Maraman 1979, 006464; LANL 2006, 111467, p. 4). In 2010, building 21-002 aboveground structures were demolished during decontamination and decommissioning (D&D) activities. Currently, only the concrete building footprint, utility tunnels with some associated piping, and concrete-filled troughs remain. Provided below are descriptions of potential building contamination sources and building processes over time. Room locations throughout the building (excluding mezzanine-level structures) are indicated in Figures 2.1-1 and 2.1-2 (LASL 1962, 111451; LASL 1972, 111442; LANL 1984, 111434).

Building 21-002 was constructed in 1945 and had a rectangular foundation footprint (LASL 1945, 111432) consisting of a reinforced elevated concrete slab, stem walls, and footings (McGehee and Garcia 1999, 087442, p. 144). The building had a north and south wing divided by a main east-west corridor (personnel corridor) that connected to other buildings. Piping dropped from laboratories into approximately 1.6-ft-deep, 2-ft-wide floor troughs (or trenches) that traversed the rooms west to east. The troughs connected to 4-ft x 4-ft utility tunnels that extended around the entire perimeter of the building (LASL 1945, 111432; Christensen 1981, 095841, pp. 12 and 13; Garde et al. 1982, 006399, p. 9). Piping in the utility tunnels included industrial-waste sewer lines; supply and return lines for steam, water (including chilled and hot), and acid and caustic solutions; helium; argon; and air (Garde et al. 1982, 006399, p. 9). The utility tunnels also contained the main service process pipes, waste lines (including the acid waste line), and possibly electrical wiring (LANL 2006, 111467, p. 3). Related D&D activities are described in section 2.2.

The floor area of building 21-002 is approximately 13,500 ft^2 (LANL 2006, 111467, p. 4). The original floor was 6-in.-thick concrete and a 4-in. layer of concrete was later poured over the original floor to contain and shield radioactive contaminants. Building 21-002 had 14 floor troughs where liquid wastes, spills, and floor washings collected and drained into the acid waste line running in the tunnel along the east perimeter of the building (LANL 2006, 111467, p. 3). These pipe troughs were filled with concrete after pipe removal and decontamination (Garde et al. 1982, 006399). A raffinate line, which likely carried americium waste, extends from the south end of building 21-002 (room 213, Figure 2.1-1) through the east perimeter utility tunnel and into the acid-waste sump structure 21-81 located near the northeast corner of building 21-002 (Figure 2.1-1, LASL 1952, 024480). The prior removal of this sump is discussed in section 2.2.

Building 21-002 was remodeled several times, including significant room additions described below.

In 1945, equipment room 2B was added to the original building 21-002 footprint at the southeast corner of building 21-002 adjacent to and southeast of room 213 (LASL 1945, 111437; LASL 1945, 111439). Room 2B housed the steam, compressed air, and hot and cold water supply systems for the building. The addition had two levels; the basement floor is 6 ft below the main floor of building 21-002. A pit and sump are located in the southwest corner of the basement (LASL 1945, 111437; LASL 1952, 111450). The pit is approximately 8 ft by 16 ft and 5 ft deep (LANL 2006, 111467, p. C-9; LASL 1945, 111439; LASL 1945, 111437). The sump is 18 in. by 18 in. and 2 ft deep and was classified as solid waste management unit (SWMU) 21-022(i). This SWMU is part of Consolidated Unit 21-022(h)-99 and site history is provided in the investigation report (LANL 2008, 102760). SWMU 21-022(i) will be sampled and removed as part of this work plan. Three drains and associated lines in this room drained toward the pit. A 2-in. drainline extended north from the pit into the east tunnel of building 21-002 where it connects to the acid waste line that drains to acid-waste sump structure 21-81 (Figure 2.1-1).

Also in 1945, pipes were installed connecting the south ends of buildings 21-002 and 21-003 (LASL 1945, 111438; Christensen 1981, 095841, pp. 12 and 14). A total of five pipes ran through this area, including a nitric acid line, tracer lines, and ether extraction lines. Some of these lines eventually corroded and disintegrated, contaminating the area (see section 2.2). Subsequently, a new nitric acid line was installed farther south (Figures 2.1-1; Christensen 1981, 095841, p. 14).

An engineering drawing (LASL 1945, 111441) shows that during the 1940s room 212 contained a vacuum system with pumps, tanks, and associated lines and valves, and a steam condensate line among other indistinguishable features. Figures 2.1-2 and 2.1-3 indicate that room 212 (and perhaps including rooms 209, 210, and 211) was designated office space in 1968.

During the early 1950s, room 218 was added to the west side of the south wing (LASL 1950, 111447; LASL 1950, 111448). This room included three floor drains, which were connected by a pipe to a floor drain in room 213 (also newly installed in 1950). This line appears to tie into a floor trough in room 213 and then eventually drained to the acid-waste sump structure 21-81 (LASL 1950, 111447). Equipment room 2A was added around the same time adjacent to and south of room 218 (LASL 1950, 111448). An air-conditioning system was installed in equipment room 2A (LASL 1952, 111450). Also around 1950, room 213 was redesigned to construct a solvent extraction plant (LASL 1950, 111446). The solvent extraction plant included three dissolver pits (north, central, and south) constructed in room 219 and a room (217) within room 213 along the west wall, east of room 218 (Figures 2.1-1 and 2.1-2; LASL 1950, 111446; LASL 1962, 111451; LASL 1961, 111436). The dissolver pits are approximately 4 ft wide, 6 ft long, and 4 ft deep (LASL 1961, 111436). Additionally, process tanks were located in rooms 213 and 218 (LASL 1951, 111443).

In 1952, room 201 was subdivided into four small rooms with a scrap incinerator located in the northeasternmost room (Figure 2.1-1) (LASL 1952, 111449; McGehee and Garcia 1999, 087442, p. 146). Explosions in the incinerator room occurred in 1959 and 1960 (Blackwell 1980, 036476). A sanitary sewer drainline carried sanitary sewer waste from two sump pumps in room 201 and compressed air blowoff from room 206 (LANL 1996, 111440). This line ran north and south between rooms 201 and the personnel corridor (room 3137) along the west side of the building (Figure 2.1-1). Room 2 was identified as an emergency battery room (LASL 1962, 111451), and later as a janitorial storage space (Figure 2.1-2; LASL 1972, 111442; LANL 1984, 111434). The contaminated-waste drainage system sampling device enclosure (room 220, Figure 2.1-2) was added to the northeast corner of building 21-002 (Figure 2.1-1; LASL 1952, 024480). A floor drain was located in the center of this sampling room and a 2-in. drainline extended east-southeast from this room to acid-waste sump structure 21-81.

In 1956, a concrete pad approximately 12-ft by 35-ft was added to an existing narrow pad north of room 218 (Figure 2.1-1; LASL 1955, 111444). It was reported that a spill from room 213 flowed into room 218 and outside onto this loading area. A transport tank also overflowed onto this loading area (LANL 2006, 111467, p. 25). The radionuclide contaminants from the spill and/or overflow included americium-241 and plutonium isotopes.

In 1958, a criticality accident occurred in the south wing of building 21-002, which likely affected rooms 213 and 218 (McGehee and Garcia 1999, 087442, p. 145; Blackwell 1980, 036476, p. 4). Subsequently in 1959, room 216 (later designated room 3121) was constructed to serve as a monitoring laboratory (Figure 2.1-2; LASL 1962, 111451; LASL 1972, 111442). In this room, the polychlorinated biphenyl–(PCB-) containing transformer substation 21-312 was replaced in 1992 by a new dry-type transformer (LANL 1992, 111430).

In 1960, a chemical storage room (room 215-A) was added to the northwest side of building 21-002 adjacent to rooms 201 and 215 (McGehee and Garcia 1999, 087442, p. 147). It was constructed with a single centrally located floor drain that connected to a subsurface pipe run extending east to the utility tunnel (LASL 1960, 024521). The line in the utility tunnel runs north from room 215-A and then east along the northern perimeter of building 21-002, terminating by connecting to existing waste lines near acid-waste sump structure 21-81 (Figure 2.1-1; LASL 1960, 024522). The original northwesternmost tunnel access was bricked in and the access pit filled with compacted sand and covered by the room 215A concrete floor (LASL 1960, 024521; McGehee and Garcia 1999, 087442, p. 147). This tunnel access was relocated south of room 207, which was a vault adjacent to the corridor west of room 202 (LASL 1972, 111442). The two vaults (rooms 207 and 214, Figure 2.1-2; LANL 1984, 111434) located on the west side of building 21-002 were used to store plutonium solutions until recovery processes were developed (Herbert 2006, 096638, p. 4).

Designed in 1961, the chemical solution preparation room (room 224) was added north of the personnel corridor and east of room 206 (LASL 1961, 111429) and included a floor drain and a tunnel access, noted as a valve pit (Figures 2.1-1 and 2.1-2). Before 1978, while crafts prepared to seal this entrance to the perimeter tunnel, plutonium contamination was released into room 224 and circulated into room 206 by an exhaust fan (LANL 1982, 105809, p. 1). Subsequently, this area was decontaminated and the tunnel entrance was sealed.

In 1970, service equipment (air, hot and cold water, vacuum, heater, steam, and condensate transfer systems, and caustic solution lines) were relocated to rooms 3134, 3135, and 3136 on the east side of building 21-002 south of the personnel corridor (Figure 2.1-2). Among other features, these rooms contained pumps, a flash tank, heaters, a heat exchanger, and air receivers (LASL 1970, 024695; LANL 2006, 111467, p. C-12). Room 3136 had three floor drains (LANL 2006, 111467, p. C-13). The location of

one of these floor drains and a floor drain in room 3134 (LASL 1970, 024695) are indicated in Figure 2.1-1. Caustic solution lines were also indicated in rooms 3134 and 3136 (LASL 1970, 111431).

Interim upgrading occurred between 1971 and 1972, including installation of a nitric acid storage tank exterior to the north wall of room 218 adjacent to and west of the ramp (LASL 1971, 111433; McGehee and Garcia 1999, 087442, p. 147). The tank was situated within a concrete enclosure and had a vent trap elevated aboveground with a drainline to the south along the north wall of room 218. The drain discharged to an asphalt surface that sloped downward to an existing ditch. The nitric acid tank line exited building 21-002 near the tank drainline discharge area and connected to the south side of building 21-003 (nitric acid line, Figure 2.1-1).

Following D&D activities from 1978 to1981, room 201 and the second floor mezzanine level were remodeled to provide wet chemistry laboratory facilities for the Environmental Studies Group of the Laboratory Life Sciences Division (McGehee and Garcia 1999, 087442). A sewer line that received acid waste from drains in the laboratories ran south to north along the middle of building 21-002 in or beneath room 201, extending 14 ft north of building 21-002, then east to the main acid waste line (LANL 1982, 111435).

2.2 Previous Investigations

Subsurface sampling has not been completed to address the building 21-002 footprint. However, the following summarizes relevant previous radiological surveys and D&D work.

Between 1945 and 1973, hazardous chemical and radionuclide releases occurred in rooms 201, 205, 208, 209, 212, 213, and 218, mainly from transferring solutions from room-to-room and from glovebox-to-glovebox (Blackwell 1980, 036476; LANL 2006, 111467 p. 27; Garde et al. 1982, 006399, p. 15). The Group H-1 “Final Condition Report, Building 2, DPW, TA-21” (LANL 1982, 105809) was supplemented by an internal Group H-1 office memorandum (Blackwell 1980, 036476) that noted a search of records of releases from November 1946 to October 1973. Table 2.2-1 summarizes by room number documented release descriptions and room features (LANL 2006, 111467; Blackwell 1980, 036476). Releases included americium-241, acidic solutions, caustic solutions, nitrates, plutonium isotopes, uranium isotopes, and spills of unknown contaminants.

Walls, ceilings, and floors were decontaminated from 1978 to 1981 during the Los Alamos DP West plutonium facility decontamination project (Garde et al. 1982, 006399). The remaining process utility lines and the process air exhaust lines were also removed to the basement tunnels and capped. Pipes in the troughs were removed and all surfaces were cleaned, painted, and filled with concrete. After cleaning, all of the floors received an overlay of concrete. The utility tunnel was sprayed with asphalt to fix the contamination to the surfaces. Most entrances to the tunnels were sealed with concrete, leaving access to the tunnels through two points at the north and south ends of the building. The process equipment (i.e., gloveboxes, pumps, and tanks) was removed. Some of the internally-contaminated lines were also removed from utility tunnels and attics, but were not specifically identified in the associated report. All other lines in the utility tunnel were isolated, sealed, and abandoned in place because the tunnels could not have been totally decontaminated without destroying the integrity of the building.

As part of the decontamination project, the ground adjacent to building 21-002 was monitored. Where radiation levels were found to be significantly higher than background, material was dug out and replaced with new material (Blackwell 1980, 036476). Field notes dated March 1980 depict an excavation area 20-ft wide (length or depth not indicated) near the end of the discharge pipe exiting room 218 (Figure 2.1-1;LANL 1980, 105952).

Also in March 1980, the dissolver pits (Figure 2.1-1) were surveyed for radiation. Readings at the south pit were up to 2600 times background. The center pit had readings up to 1300 times background, although the north pit had readings up to 300 times background (LANL 1980, 105952). These pits may have been filled with concrete and were likely part of the 1978 to 1981 D&D activities, although not specifically mentioned in the summary report (Garde et al. 1982, 006399).

The report summarizing the D&D activities notes these additional findings at building 21-002 (Garde et al. 1982, 006399).

- The section of utility tunnel between rooms 213 and 218 was known to be highly contaminated. The tunnel was entered from above and approximately 17.3 ft^3 of soil containing approximately 13 g of plutonium-239 and americium-241 was removed. Remaining contamination was fixed as well as possible by spray application of a water-based asphalt (p. 16).
- Sump 21-81 was removed. This sump structure was approximately 15 ft deep and 5 ft in diameter and was constructed of brick with a stainless-steel liner. After removal of the sump, contaminated soil was removed to the extent practical in anticipation of further removal at a later date when the waste lines would be decommissioned. The contaminated pit walls were sprayed with asphalt to delineate the pit boundaries and backfilled with clean soil (p. 17).
- Records indicated that considerable contamination existed southeast of building 21-002 under the asphalt covering in an abandoned line between buildings 21-002 and 21-003. Two-thousand eight-hundred and twenty-five cubic feet of soil and 43.3-linear ft of pipe were removed and the area was resurfaced with asphalt (p. 17). This abandoned line may have run through the utility pipe tunnel that extends from the southeast corner of room 213 to building 21-003 (Figure 2.1-1; LASL 1945, 111438). Another source notes that an area between the south ends of buildings 21-002 and 21-003 contained ether extraction lines thought to be very contaminated (Figure 2.1-1; Christensen 1981, 095841, p. 3).

In 1993, the Department of Energy (DOE) Los Alamos Area Office established a team that reviewed historical facility documents and performed a walk-through of building 21-002 (DOE 1993, 021244, p. 1). Their assessment concluded that piping degradation was present and that the tunnel conditions were “severe” with levels of contamination in the range of 200,000 disintegrations per minute (dpm). Subsequent investigation identified that soil in the utility tunnel associated with building 21-002 had an average plutonium contamination of 240 nCi/g with a high of 1,650 nCi/g (DOE 1993, 021244, p. 6). The team reported that conditions in the tunnel would present a significant challenge during the D&D process and that the potential for migration of contaminants exists because the tunnel floors are soil and lines still run through the tunnels.

In 2006, the reconnaissance-level characterization plan (LANL 2006, 111467) focused primarily on defining the physical, radiological, and chemical condition of the facilities that could affect future D&D activities. According to the subsequent “Report on Characterization of Above-Grade Delta Prime West Structures at Technical Area 21,” subsurface spaces were not inspected due to potential exposure risks posed by radioactively-contaminated surfaces in these spaces (LANL 2006, 094351, pp. 6 and 25). Additionally, three samples (two surface and one volumetric) were collected from equipment room 2B pumps, piping, and sump [SWMU 21-022(i)], analyzed for PCBs (LANL 2006, 094351, p. 31), and classified as not PCB-contaminated (LANL 2006, 094351, p. 17). FIDLER low-energy photon radiation detectors were used to determine the distribution of low-energy photons emitted by radionuclides in or beneath the accessible floor areas (Figure 2.2-1), particularly the contribution of anomalies caused by decaying americium-241 and plutonium isotopes. Elevated counts in rooms 206, 213, and 219 (located

along the east side of room 213) were attributed to uncontrolled releases of radioactive liquids into the pipe troughs and utility tunnels (LANL 2006, 094351, p. 22).

Two waste lines (acid waste and sewer) that connected to the east side of building 21-002 were removed and investigated as part of the DP Site Aggregate Area investigation activities in 2007 [Figure 2.1-1, pipes labeled Consolidated Units 21-006(c)-99 and 21-023(a)-99; LANL 2008, 102760].

2.3 Scope of Activities for Building 21-002

The proposed sampling locations for the building 21-002 footprint and associated-structure footprints are shown in Figure 2.3-1. Table 2.3-1 provides a summary of the proposed sampling objectives, number of samples, sample locations and depths, and analytical suites.

Sampling outlined in this plan will occur after removal of the building concrete pad (footprint) is completed. The excavation area dimensions and areas with elevated radiological field-screening results will be recorded and used by the field teams performing the work outlined in this plan to finalize sampling locations and depths. Preliminary analytical results received from the laboratory may be used to direct further sampling or excavation. Any additional piping or structures encountered (not specified below) will be removed under this work plan. During pipe removal activities, excavation of soil, fill, and/or tuff (including any stained areas) will proceed until media with elevated levels of radionuclide and/or organic vapors based on field-screening results have been removed to a maximum depth of 10 ft below ground surface (bgs). Excavating to 10 ft bgs is technically practicable for the excavation equipment.

All samples will be analyzed for target analyte list (TAL) metals, cyanide, nitrate, perchlorates, volatile organic chemicals (VOCs), semivolatile organic chemicals (SVOCs), radionuclides (americium-241, isotopic plutonium, isotopic thorium [to detect actinium-227], isotopic uranium, strontium-90, tritium, and by gamma spectroscopy), moisture, and pH. In addition, at least 20% of all samples will be analyzed for an extended suite consisting of dioxins/furans, explosives compounds, and PCBs as directed in the approved investigation work plan (LANL 2009, 107119; NMED 2010, 108443). The locations selected for extended-suite analysis are areas where contaminants had the most potential to be released to the environment (e.g., sumps, floor drains, pits; Table 2.3-1). Where field-screening results from organic chemical and radionuclide detectors identify locations with higher readings than locations already selected for extended-suite analyses (to exclude equipment rooms or the incinerator areas, locations 8-13 and 63–67), these locations will be sampled instead and analyzed for an extended suite. Where elevated field-screening results are recorded in the deepest sampling depth for a location, samples will be collected in 5-ft-depth intervals at that location until field-screening results indicate no contamination is present above background values. Additional lateral-extent samples may also be collected based on elevated field-screening results, staining, and increasing result trends after the data have been received and reviewed.

The investigation of the building 21-002 footprint will consist of the following activities (Table 2.3-1).

- *Under-the-floor drains*. Samples will be collected from under each floor drain (Figure 2.3-1, locations 1–13), at 0 to 1.0 ft and 2.0 to 3.0 ft below the floor drains. Floor drains are located in: sampling room (220) for former sump 21-81 and rooms 215A, 218, 224, 3134, 3136, and equipment room 2B, which includes releases from the sump located in this room, SWMU 21-022(i). Locations 8–13 will also be analyzed for the extended suite because these floor drains were located in equipment rooms. Sample locations may be adjusted and/or added based on field-screening results and visual inspection performed during foundation removal activities. Zero depth is defined as immediately below the excavated floor drain.

- *Under the process and waste lines within the pipe tunnel around the perimeter of building 21-002.* These pipes (some of which received waste from laboratory floor troughs, drains, and sinks) were suspended in a 4-ft-wide, 4-ft-bgs pipe tunnel with a dirt floor. Over time, building processes and piping installed in the tunnel changed. These pipes include a raffinate (likely americium-241 waste) line and acid waste lines that drained into the former structure 21-81 acid-waste sump. In addition, several process lines from rooms 201, 213, and 215 are in this tunnel as well as the sanitary sewer line (Figures 2.1-1 and 2.1-2). After piping removal, samples will be collected from the former pipe tunnel at the north-end corners, the south-end corners, and adjacent to the pipe floor troughs at the east and west sides (Figure 2.3-1, locations 14–43). At these locations, samples will be collected at 4.0 to 5.0 ft bgs and 6.0 to 7.0 ft bgs (the pipe tunnel floor is currently approximately 4 ft bgs). Samples will be analyzed for asbestos in addition to the suites listed at the start of this section. Sample locations may be adjusted and/or added based on field-screening results and visual inspection performed during foundation removal activities. Zero depth is defined as ground surface.
- *Under the center of building 21-002 laboratories.* Samples will be collected along the center of former building 21-002 under the pipe troughs (Figure 2.3-1, locations 44–56) at 0 to 1.0 ft and 2.0 to 3.0 ft below the excavated pipe troughs. Sample locations may be adjusted and/or added based on field-screening results and visual inspection performed during foundation removal activities. Zero depth is defined as immediately below the excavated pipe troughs, approximately 1.5 ft bgs.
- *Under the pit areas, vaults, and incinerator.* The pit areas in room 219 were used as dissolver pits as part of the solvent extraction plant. Samples will be collected from under each pit (Figure 2.3-1, locations 57–59) at 0 to 1.0 ft, 2.0 to 3.0 ft, and 4.0 to 5.0 ft below the excavated pits. There is also a pit valve area in room 224 that will be sampled (Figure 2.3-1, location 60) at 0 to 1.0 ft bgs and 2.0 to 3.0 ft bgs. The vault rooms 207 and 214 were used for concentrated plutonium solution storage. One location will be sampled from under each of the vaults (Figure 2.3-1, locations 61 and 62) at 0 to 1.0 ft, 2.0 to 3.0 ft, and 4.0 to 5.0 ft under the floor of the vault. One location will be sampled from under the former incinerator in room 201 (Figure 2.3-1, location 63) at 0 to 1.0 ft and 2.0 to 3.0 ft under the floor. The incinerator samples will be analyzed for extended-suite analyses to include asbestos. Sample locations may be adjusted and/or added based on field-screening results and visual inspection performed during foundation removal activities. Zero depth is defined as immediately below the floor of the excavated pits/vaults and under the concrete of room 201 where the incinerator was located.
- *Under central-corridor equipment rooms (rooms 3121 and 3122), emergency battery room 2, and equipment room 2A.* Samples will be collected from under each room (Figure 2.3-1, locations 64-67) at 0 to 1.0 ft and 2.0 to 3.0 ft under the room concrete. At these locations, samples will be analyzed for an extended suite in addition to the suites listed at the start of this section due to the potential for PCBs and dioxin/furans in these equipment areas. Sample locations may be adjusted and/or added based on field-screening results and visual inspection performed during foundation removal activities. Zero depth is defined as immediately below the floor of the rooms.
- *Additional locations addressing radiological survey data*. To address photon survey results from 2006 (Figure 2.1-4; LANL 2006, 094351), samples will be collected at 0 to 1.0 ft and 2.0 to 3.0 ft directly under each of the following rooms: from west of the eastern pipe tunnel under room 201 (Figure 2.3-1, location 68), under the pipe tunnel under the firewall north of room 205 (Figure 2.3-1, location 69), in room 206 west of the valve pit (Figure 2.3-1, location 70), and the south end of room 213 north of location 28 (Figure 2.3-1, location 71). Elevated counts measured during the 2006 photon survey in room 219 (along the west side of room 213) are addressed by sample locations 57 through 59 (refer to fourth sampling bullet above). Sample locations may be

adjusted and/or added based on field-screening results and visual inspection performed during foundation removal activities. For location 68, zero depth is defined as the bottom of the excavated pipe tunnel. For locations 69–71, zero depth is defined as immediately below the concrete floor slab of the rooms.

- *Under the drain outside room 218 and pipe discharge outside the building.* Samples will be collected from under the exterior drain serving the nitric acid tank at the northwest corner of room 218 (Figure 2.3-1, location 72). At this location, samples will be collected at 0 to 1.0 ft and 2.0 to 3.0 ft below the drain. Zero depth is defined as immediately below the excavated drain. A location will also be sampled just west of this location where this drain discharged at 0 to 1.0 ft, 2.0 to 3.0 ft, and 5 to 6 ft under the excavated asphalt/concrete (Figure 2.3-1, location 73). The deepest depth is to also address the nitric acid line buried approximately 3 ft under the tank discharge area. Zero depth is defined as immediately under any asphalt/concrete present in this area. Sample locations may be adjusted and/or added based on field-screening results and visual inspection performed during footprint removal activities.
- *Under the lines running outside the 21-002 building area.* These lines include ether extraction lines, tracer lines, and a nitric acid line that connected buildings 21-002 and 21-003 along the south end. These lines were removed previously (Christensen 1981, 095841). To verify removal, trenching in the area of the lines will be completed until native soil is encountered or a total of 5 ft bgs has been excavated. Also included are three lines: two along the north side of the building, one of which connects to the acid-waste piping from room 201 and the other that connected building 21-002 to the acid-waste sump structure 21-81, and a nitric acid line running south of building 21-002 that connected to former building 21-003. After line removal, samples will be collected from the former piping locations at 0 to 1.0 ft and 2.0 to 3.0 ft under the pipe trench (Figure 2.3-1, locations 74–83). At locations 74 and 75, asbestos will also be analyzed for in addition to the suites listed at the start of this section. Sample locations may be adjusted and/or added based on field-screening results and visual inspection performed during foundation removal activities. Zero depth is defined as immediately below the excavated piping at the bottom of the pipe trench.
- *Under the concrete outside the building between rooms 3121 and 218.* Samples will be collected from under the concrete slab at four locations to characterize a spill and a transport tank overflow in this area (Figure 2.3-1, locations 84–87). Samples will be collected at 0 to 1.0 ft and 2.0 to 3.0 ft under the removed concrete. Zero depth is defined as immediately under any concrete present in this area. Sample locations may be adjusted and/or added based on field-screening results and visual inspection performed during foundation removal activities.

3.0 SCHEDULE

The D&D of building 21-002 is completed. Only the concrete pad (footprint) and subsurface structures currently remain. The sampling outlined in this work plan will be completed in accordance with the schedule provided in the approved “Investigation Work Plan for Delta Prime Site Aggregate Area Delayed Sites” (LANL 2009, 107119; NMED 2010, 108443). The results from this letter work plan investigation will be included in the June 2014 investigation report for Consolidated Unit 21-022(b)-99, MDA T, and DP West building footprints.

4.0 REFERENCES AND MAP DATA SOURCES

4.1 References

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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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4.2 Map Data Sources

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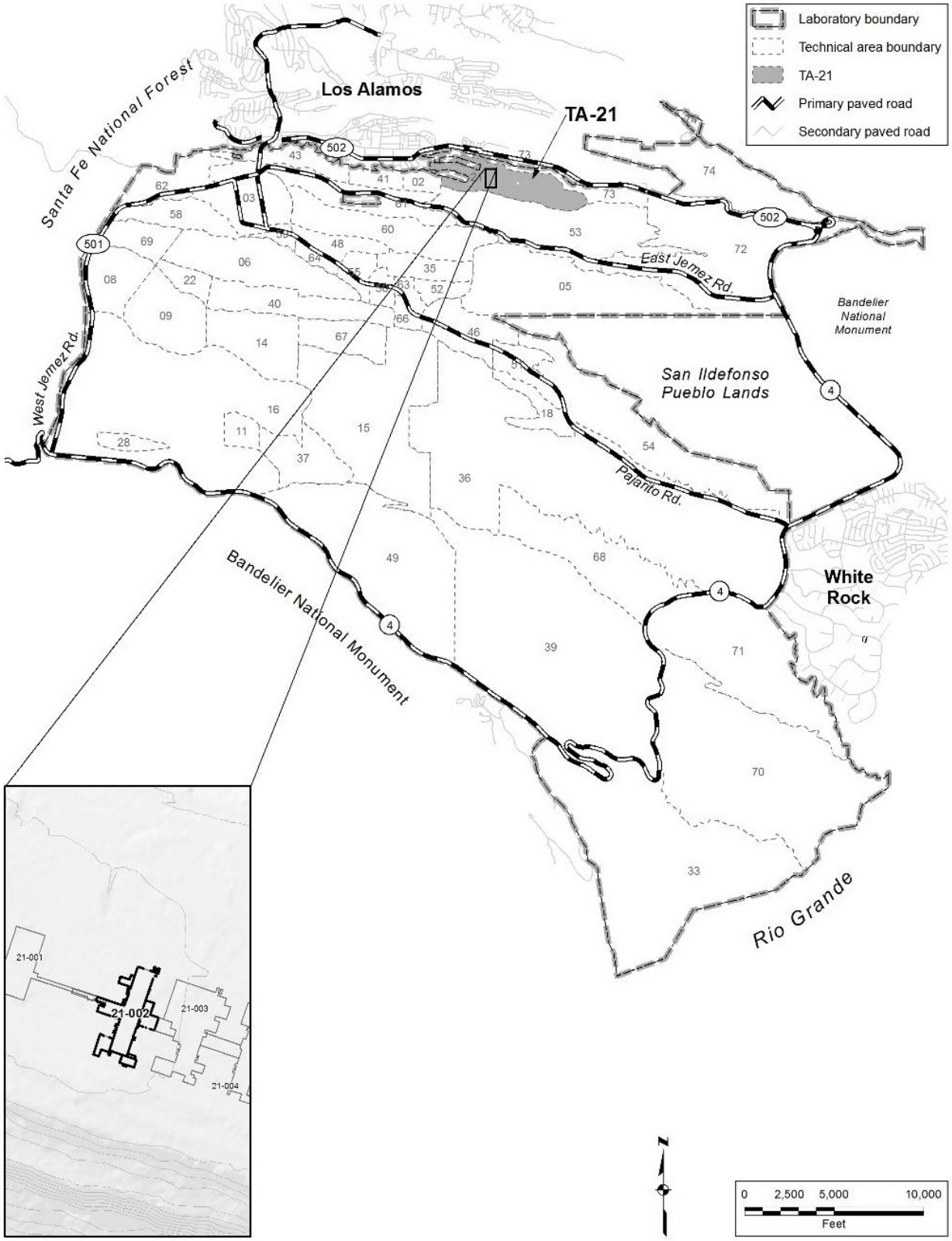
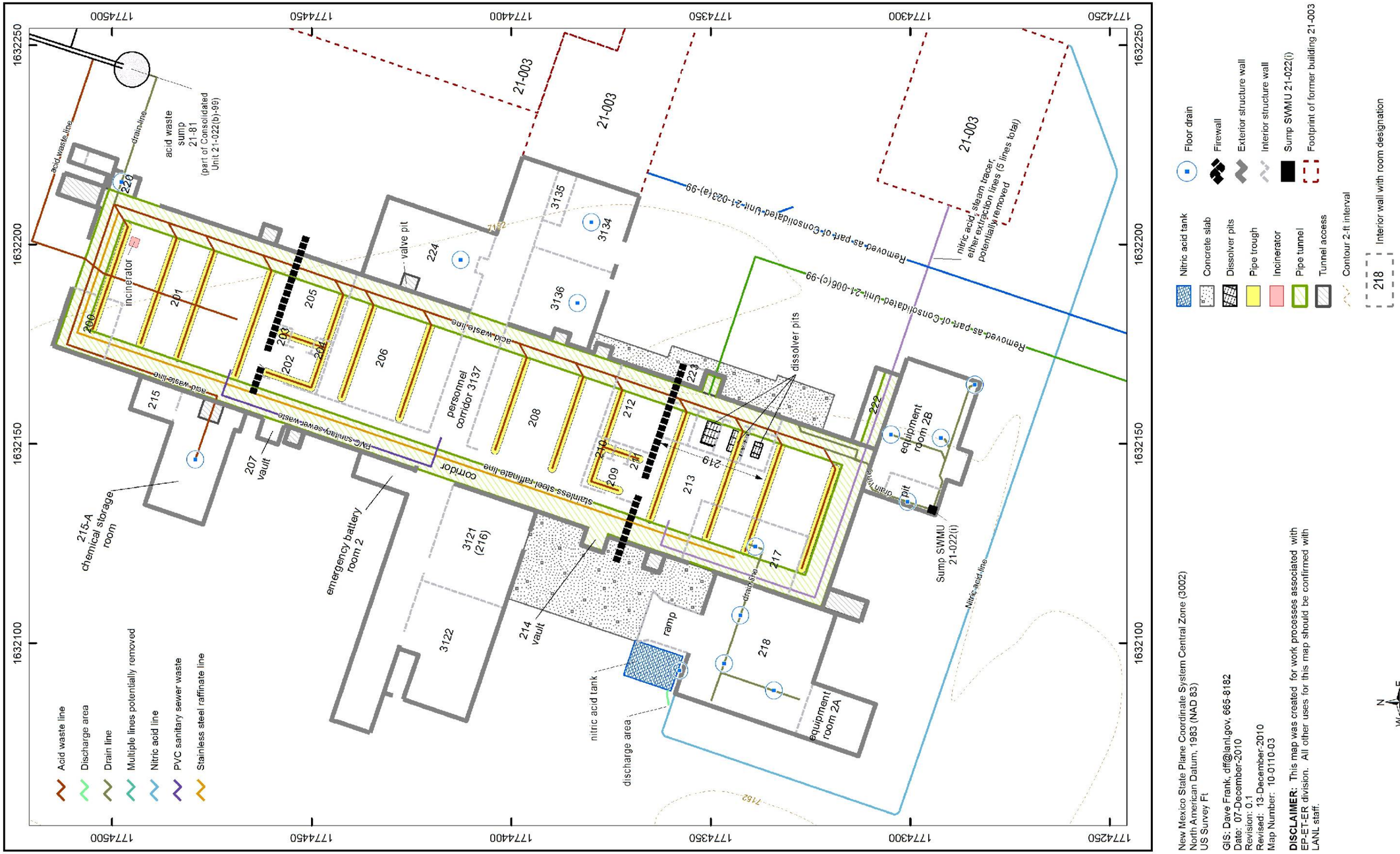


Figure 1.0-1 Location of building 21-002 within DP West at TA-21



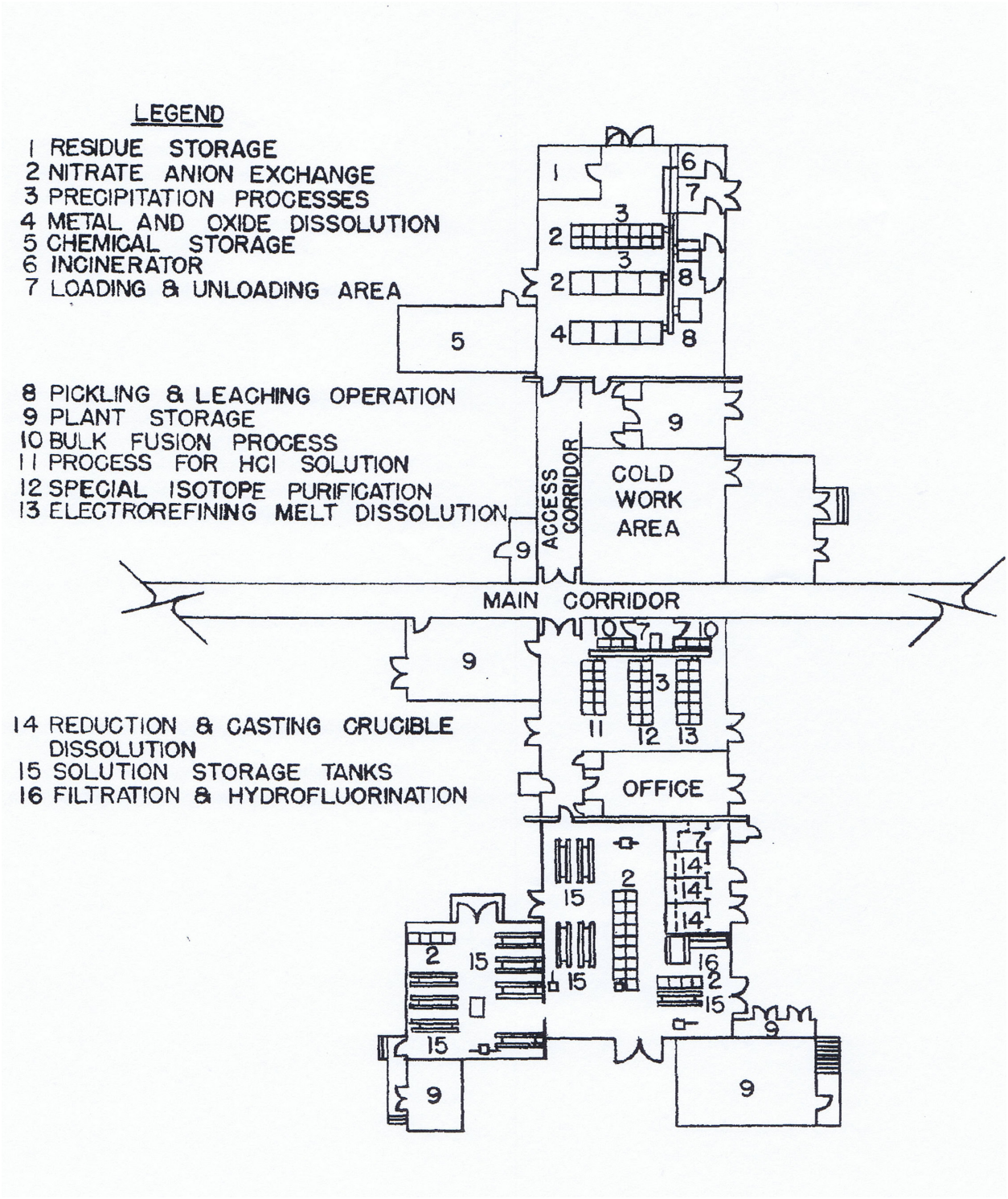
New Mexico State Plane Coordinate System Central Zone (3002)
North American Datum, 1983 (NAD 83)
US Survey Ft

GIS: Dave Frank, dff@lanl.gov, 665-8182
Date: 07-December-2010
Revision: 0.1
Revised: 13-December-2010
Map Number: 10-0110-03

DISCLAIMER: This map was created for work processes associated with EP-ET-ER division. All other uses for this map should be confirmed with LANL staff.

Figure 2.1-1 Site map for building 21-002 features

Figure 2.1-2 Building 21-002 room numbers and site utilities



Source: Mc Gehee and Garcia 1999, 087442, Figure 19.

Figure 2.1-3 General building 21-002 process locations

Source: (LANL 2006, 094351).

Figure 2.2-1 Low-energy photon distribution measured over DP West building floors

New Mexico State Plane Coordinate System Central Zone (3002)
North American Datum, 1983 (NAD 83)
US Survey Ft

GIS: Dave Frank, dff@lanl.gov, 665-8182
Date: 07-December-2010
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Map Number: 10-0110-03

DISCLAIMER: This map was created for work processes associated with EP-ET-ER division. All other uses for this map should be confirmed with LANL staff.

0 5 10 15 20 25 50 Feet

Figure 2.3-1 Proposed sampling locations at building 21-002

Table 2.2-1
Building 21-002 Processes, Waste Structures, Documented Release, and Contamination Information by Room

Room[a]	Known Historical Use[b]	Associated Processes and Waste Structures[c]	General Location[d]	Description of Documented Release[e]	Documented Radiological Survey Data[f]
2	Emergency battery room Janitorial storage	n/a[g]	Across main personnel corridor (room 3137) from room 3121	n/a	n/a
2A	Equipment room	Cooling system	SW of room 218	n/a	n/a
2B	Equipment room	Floor drains All connect to acid waste line in tunnel then to building 21-002 acid-waste sump (21-81) Pumps for building 21-002 main steam, compressed air, and hot and cold water supply systems	SE of room 213	n/a	n/a
		Pit ~8 ft x 16 ft x 5 ft deep with 18-in. x 18-in. x 2-ft-deep sump in SW corner [SWMU 21-022(i)] Pump(s)	Basement level; SWMU 21-022(i)	n/a	n/a
200 201	Incinerator, nitrate anion exchange, precipitation processes, metal and oxide dissolution, pickling and leaching operations, and residue storage	Pipe troughs	North end of building 21-002	Spills documented during 1946–1969	Spills/releases measured >80 k dpm on floor every month of 1963 and 1968 Low-energy photon measured (Figure 2.1-4): • 9 k–14 k counts per minute (cpm) entire room • 14 k–19k cpm in SE corner of room and into tunnel at firewall where >19 k cpm • >19 k cpm near middle two troughs at junctures with east tunnel

Table 2.2-1 (continued)

Room[a]	Known Historical Use[b]	Associated Processes and Waste Structures[c]	General Location[d]	Description of Documented Release[e]	Documented Radiological Survey Data[f]
		Incinerator	NE area	Explosions (1959 and 1960)	Spills/releases measured >80 k dpm on floor Remaining floor contamination after hot-spot decontamination was <25,000 dpm/100 cm^2
		Acid-waste line	Running south to north along the middle of building 21-002, then north of building 21-002 14 ft and east to the main acid-waste line	n/a	n/a
		Sump pumps	Unknown—connected to sanitary drainline in tunnel west of rooms 202 and 206	n/a	n/a
		Sanitary drainline served two sump pumps in room 201 and compressed air blow-off drain in room 206	Runs through corridor west of rooms 202 and 206	n/a	Remaining floor contamination in corridor after hot-spot decontamination was <10,000 dpm/100 cm^2
202[h] 203 204 205	Laboratory function	Pipe trough with two branches to north	Traverses all these rooms	n/a	n/a
		n/a	Room 203	n/a	Remaining floor contamination after hot-spot decontamination was <12,000 dpm/100 cm^2
	Plant (maintenance) storage	Large Trane refrigeration unit (LANL 2006, 111467)	Room 205	Spills of unknowns documented during 1952–1968	Spills/releases measured >80 k dpm on floor every month of 1963 and 1968 Remaining floor contamination after hot-spot decontamination was <8000 dpm/100 cm^2

Table 2.2-1 (continued)

Room[a]	Known Historical Use[b]	Associated Processes and Waste Structures[c]	General Location[d]	Description of Documented Release[e]	Documented Radiological Survey Data[f]
206	Cold work area	Pipe troughs	Room 206	n/a	Low-energy photon measured (Figure 2.1-4): • 9 k–14 k cpm entire room • >19 k in NE quadrant of room 206 into east tunnel
207 214	Chemical solutions storage	Vaults Sprinkler fire protection piping and electrical components present (LANL 2006, 111467)	West side of building 21-002 along perimeter wall	n/a	Low-energy photon not measured Room 207 remaining floor contamination after hot-spot decontamination was <10,000 dpm/100 cm^2
208	Bulk fusion process, precipitation process, process for hydrogen chloride solution, electro-refining melt dissolution, and special isotope purification	Pipe troughs	Just south of personnel corridor	Spills (including plutonium solutions) documented during 1946–1970 Molten uranium spill in 1950	Spills/releases measured >80 k dpm on floor every month of 1968; molten uranium spill Remaining floor contamination after hot-spot decontamination was <4000 dpm/100 cm^2 Low-energy photon not measured
209[h] 210 211 212	Laboratory function (pre-1968) Office (1968)	Pipe trough - with two branches to south	Traverses all these rooms	n/a	Low-energy photon not measured
			Room 209	1964 liquid plutonium solution spill on floor	Spills/releases measured >80 k dpm on floor
			Room 212	Spills documented during 1946–1967	

Table 2.2-1 (continued)

Room[a]	Known Historical Use[b]	Associated Processes and Waste Structures[c]	General Location[d]	Description of Documented Release[e]	Documented Radiological Survey Data[f]
213[i] 217 219	Rooms collectively known as the solvent extraction plant Room 213: Nitrate anion exchange, solution storage tanks, filtration, and hydrofluorination Room 219: reduction and casting crucible dissolution	Floor drain and drainline Tanks	South end of building 21-002	Spills documented during 1946–1973 1958 criticality accident that also affected room 218 1958 bottle of plutonium nitrate exploded Americium-241 spills Caustic solution spill	Spills/releases measured >80 k dpm on floor, including spills every month of 1962 and 1963 Remaining floor contamination after hot-spot decontamination east side room 213 (which actually may have been room 219) was <20,000 dpm/100 cm^2 Low-energy photon measured (Figure 2.1-4): • 9 k–14 k cpm in both rooms except SE and most of SW areas of room 213, which was not measured • >19 k cpm: Room 219 where two middle pipe troughs in room 213 connect to east tunnel Near center of room 213 and south wall
213[i] 217 219		Pipe troughs	Northernmost two troughs traverse room 219 continuing west through room 213; middle two troughs traverse from room 213 west into room 217; southernmost trough traverses only room 213	n/a	n/a
		Dissolver pits	Room 219	n/a	n/a

Table 2.2-1 (continued)

Room[a]	Known Historical Use[b]	Associated Processes and Waste Structures[c]	General Location[d]	Description of Documented Release[e]	Documented Radiological Survey Data[f]
		Raffinate tank and subfloor drainline	Room 213; line runs to west tunnel north to north tunnel, then east to building 21-002 acid-waste sump (21-81)	n/a	n/a
		Nitric acid, steam tracer, ether extraction lines	Southeast corner of building 21-002	n/a	n/a
		Large nitric acid tank	Room 213 exterior	n/a	n/a
215-A	Chemical storage	Floor drain, drainline Tunnel access pit	Drain in center of room with line traversing east to tunnel, then north to north end of building 21-002, then east to acid-waste sump (21-81)	n/a	n/a
218	Nitrate anion exchange, solution storage tanks	Floor drains and drainlines Tanks	Room 218	Affected by criticality accident in 1958 in room 213 Spills of americium and plutonium	Spills/releases measured >80 k dpm on floor Remaining floor contamination after hot-spot decontamination south side was <1,000,000 dpm/100 cm^2 Nearly entire room low-energy photon measured 9 k–14 k cpm (Figure 2.1-4) Highest observable alpha surface contamination at DPW, 300/dpm/100 cm^2 (LANL 2006, 094351, p. 21)
		Drainline to nitric acid tank	Exterior NW corner	n/a	n/a
		Nitric acid line	Travels south beyond building 21-002, then east to connect to the SE corner of building 21-003 equipment room 3A	n/a	n/a

Table 2.2-1 (continued)

Room[a]	Known Historical Use[b]	Associated Processes and Waste Structures[c]	General Location[d]	Description of Documented Release[e]	Documented Radiological Survey Data[f]
		Ramp loading area and concrete pad	North of room 218	Spill from room 213 into room 218 that also spilled onto outside loading area Overflow of transport tank onto loading area	n/a
220	Contaminated waste drainage system—sampling device enclosure	Floor drain Drainline to "existing cistern," which was likely the building 21-002 acid-waste sump (21-81)	Room center; NE corner of building 21-003	n/a	n/a
224	Chemical solution preparation (1961–1962) Cold lab (1972)	Floor drain Tunnel access pit	Room 224	n/a	Entire room low-energy photon measured 9 k–14 k cpm (Figure 2.1-4)
3121 3122 3123	Monitoring lab (room 3121, constructed in 1959) Plant (maintenance) storage (later years)	Transformer substation (room 3121) Numerous breaker boxes Mercoid thermostat	Rooms 3121, 3122, 3123	n/a	n/a
3134 3135 3136	Mechanical service equipment	Floor drain Flash tank Heaters Pumps Mercoid switch	Room 3134	n/a	n/a
		Tank Pump	Room 3135	n/a	n/a

Table 2.2-1 (continued)

Room[a]	Known Historical Use[b]	Associated Processes and Waste Structures[c]	General Location[d]	Description of Documented Release[e]	Documented Radiological Survey Data[f]
		Tunnel access Floor drains Caustic solution lines (sodium and potassium hydroxide) Transformer cabinet Numerous pumps, heat exchanger, vacuum system, mercoid switches, heaters	Room 3136	n/a	n/a
3137	Personnel corridor—east-to-west	n/a	Middle of building	n/a	Entire corridor low-energy photon measured 9 k–14 k cpm (Figure 2.1-4)

[a] See Figure 2.1-2.

[b] Primary sources: Refer to Figure 2.1-3 (McGehee and Garcia 1999, 087442, Figure 19) and to sections 2.1 and 2.2.

[c] Refer to text for details and references.

[d] See Figure 2.1-1.

[e] Sources: LANL (1980, 036476; 2006, 111467).

[f] Sources: LANL (1980, 036476) and/or Figure 2.2-1, as noted.

[g] n/a = Not applicable.

[h] These rooms are grouped because they share the same branched pipe trough.

[i] Some reports and diagrams do not distinguish rooms 217 and 219 (dissolver pits area) from room 213, so these three rooms are combined with distinctions noted.

Table 2.3-1
Proposed Sampling for Building 21-002 Footprint

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination under floor drain piping, sampling room 220 connecting to sump 21-81	1	Under floor drain in sampling room 220	0.0–1.0 2.0–3.0	X[b] X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	—[c] —	X X
Vertical extent of contamination under floor drains in room 215-A	2	Under floor drain in room 215-A	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	X X
Vertical extent of contamination under floor drains in room 218	3	Under floor drain in room 218	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under floor drains in room 218	4	Under floor drain in room 218	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under floor drains in room 218	5	Under floor drain in room 218	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under floor drains in room 213 connected to floor drainpipe from 218	6	Under floor drain in room 213	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under floor drains in room 224	7	Under floor drain in room 224	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —

Table 2.3-1 (continued)

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination under floor drains in room 3134	8	Under floor drain in room 3134	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	X X
Vertical extent of contamination under floor drains in room 3136	9	Under floor drain in room 3136	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	X X
Vertical extent of contamination under floor drains in equipment room 2B	10	Under floor drain in equipment room 2B	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	X X
Vertical extent of contamination under floor drains in equipment room 2B	11	Under floor drain in equipment room 2B	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	X X
Vertical extent of contamination under floor drains in equipment room 2B	12	Under floor drain in equipment room 2B	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	X X
Vertical extent of contamination under floor drains in equipment room 2B	13	Under floor drain in equipment room 2B	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	X X
Vertical extent of contamination under pipe tunnel	14	Under pipe tunnel	4.0–5.0 6.0–7.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X
Vertical extent of contamination under pipe tunnel	15	Under pipe tunnel	4.0–5.0 6.0–7.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —
Vertical extent of contamination under pipe tunnel	16	Under pipe tunnel	4.0–5.0 6.0–7.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —
Vertical extent of contamination under pipe tunnel	17	Under pipe tunnel	4.0–5.0 6.0–7.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —

Table 2.3-1 (continued)

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination under pipe tunnel	18	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	19	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	20	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	21	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	20	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	21	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	22	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	23	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	24	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	25	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	26	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	27	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 2.3-1 (continued)

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination under pipe tunnel	28	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	29	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vertical extent of contamination under pipe tunnel	30	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	31	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	32	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	33	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	34	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	35	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	36	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	37	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	38	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
Vertical extent of contamination under pipe tunnel	39	Under pipe tunnel	4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—
			6.0–7.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—

Table 2.3-1 (continued)

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination under pipe tunnel	40	Under pipe tunnel	4.0–5.0 6.0–7.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —
Vertical extent of contamination under pipe tunnel	41	Under pipe tunnel	4.0–5.0 6.0–7.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —
Vertical extent of contamination under pipe tunnel	42	Under pipe tunnel	4.0–5.0 6.0–7.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —
Vertical extent of contamination under pipe tunnel	43	Under pipe tunnel	4.0–5.0 6.0–7.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —
Vertical extent of contamination under pipe trough along center of building	44	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	45	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	46	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	47	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	48	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	49	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —

Table 2.3-1 (continued)

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination under pipe trough along center of building	50	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	51	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	52	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	53	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	54	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	55	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pipe trough along center of building	56	Under pipe trough	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under pit in room 219	57	Under pit	0.0–1.0 2.0–3.0 4.0–5.0	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	— — —	— — —

Table 2.3-1 (continued)

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination under pit in room 219	58	Under pit	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
			4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
Vertical extent of contamination under pit in room 219	59	Under pit	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
			4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
Vertical extent of contamination under valves valve pit in room 224	60	Under pit	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X
Vertical extent of contamination under vault 207	61	Under vault 207	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
			4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
Vertical extent of contamination under vault 214	62	Under vault 214	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
			4.0–5.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	—
Vertical extent of contamination under incinerator	63	Under incinerator	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vertical extent of contamination under room 3121	64	Under room 3121	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X
Vertical extent of contamination under room 3122	65	Under room 3122	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X
Vertical extent of contamination under battery room 2	66	Under battery room 2	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X
Vertical extent of contamination under equipment room 2A	67	Under equipment room 2A	0.0–1.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X
			2.0–3.0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	—	X

Table 2.3-1 (continued)

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination west of eastern pipe tunnel in room 201 (survey results)	68	Under room 201	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination in the pipe tunnel under the firewall north of room 205	69	Under room 205	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination west of pit valve in room 206	70	Under room 206	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination south end of room 213 north of location 28	71	Under room 213	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination at nitric acid room 218 drain	72	Under drain outside room 218	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination at nitric acid room 218 drain discharge area	73	At outfall discharge	0.0–1.0 2.0–3.0 5.0–6.0	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	— —	X X X
Vertical extent of contamination under pipe tunnel connecting to building 21-003	74	Under pipe trench	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —
Vertical extent of contamination under pipe tunnel connecting to building 21-003	75	Under pipe tunnel	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —
Vertical extent of contamination under piping north of building from room 200	76	Under pipe	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —

Table 2.3-1 (continued)

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination under piping north of building from room 200	77	Under pipe	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under piping connecting to sump 21-81	78	Under pipe	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under nitric acid piping south of building 21-002	79	Under nitric acid pipe at 90-degree bend to the east	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under nitric acid piping south of building 21-002	80	Under nitric acid pipe 50 ft from location 79	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under nitric acid piping south of building 21-002	81	Under nitric acid pipe 50 ft from location 80	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under nitric acid piping south of building 21-002	82	Under nitric acid pipe at bend to former building 21-003	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under nitric acid piping south of building 21-002	83	Under nitric acid pipe at connection to former building 21-003	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —

Table 2.3-1 (continued)

Objective Addressed	Location Number	Location	Sample Depths (ft)	VOCs	SVOCs	TAL Metals	Cyanide	Nitrate	Perchlorates	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Technetium-99	Tritium	pH	Asbestos	Dioxins, Furans, Explosives Compounds, PCBs[a]
Vertical extent of contamination under concrete between rooms 3121 and 218	84	Under concrete	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under concrete between rooms 3121 and 218	85	Under concrete	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under concrete between rooms 3121 and 218	86	Under concrete	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —
Vertical extent of contamination under concrete between rooms 3121 and 218	87	Under concrete	0.0–1.0 2.0–3.0	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— —	— —

[a] At least 20% of the total samples will be analyzed for dioxins, furans, explosives compounds, and PCBs (extended suite). If field-screening results identify locations with higher readings than those already selected for extended-suite analyses (to exclude equipment rooms or the incinerator areas, locations 8—13 and 63—67), these locations will be sampled instead and analyzed for an extended suite.

[b] X = Analyzed for.

[c] — = Not analyzed for.