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Los Alamos National Laboratory

TA-35 Phase Separator Pit Decommissioning Project

Characterization Report

Phase II - V

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ICF Kaiser Engineers

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LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air filter building
ALARA	As-low-as-reasonably-achievable
Coliwasa	Composite liquid waste sampler
D&D	Decontamination and decommissioning
DAC	Derived air concentration
DEC	DOE Environmental Checklist
DOE	U.S. Department of Energy
dpm	Disintegrations per minute
DQO	Data quality objective
EPA	U.S. Environmental Protection Agency
ESH-1	Operational Health Physics Group, LANL
ESH-17	Air Quality Group, LANL
^{3}H	Tritium
HEPA	High efficiency particulate air
ICPES	Inductively-coupled plasma emission spectroscopy
LANL	Los Alamos National Laboratory
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
PCB	Polychlorinated biphenyl
PPE	Personal protective equipment
PSP	Phase Separator pit
RadCon	Radiological Control
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
SAL	Screening action level
SOP	Standard operating procedure
^{89}Sr	Strontium-89
^{90}Sr	Strontium-90
UST	Underground storage tank
VOL	Volatile organic compounds

1.0 INTRODUCTION

The TA-35 Phase Separator Pit (PSP) Decommissioning Project consists of five phases, each with a specifically defined scope of work from which sample locations were derived. The total number of sample locations and samples taken for analytical purposes varied from phase to phase.

This report discusses the characterization activities for Phases II through V. Characterization activities were performed in accordance with the Characterization Plan for Support of D&D Activities, TA-35 D&D Project, Phase Separator Pit, (ICF Kaiser 1993). Phase I characterization activities have previously been completed, and the results are discussed in the Phase I D&D Activities Characterization Report (ICF Kaiser 1994).

Section 2.0 describes the scope of characterization, the data quality objectives, sample locations for Phase II through V, and the sampling and analysis methodology, respectively.

Section 3.0 describes the analytical results in terms of the type of constituent (i.e., radiological, inorganics, polychlorinated biphenyls [PCB]s, volatile organic compounds, semivolatile organics, and filter swipes, respectively).

Section 4.0 provides discussions regarding regulatory requirements for the D&D project.

Section 5.0 provides references used to establish this characterization report.

2.0 CHARACTERIZATION OBJECTIVES

The following briefly describes the scope of work for Phases II through V of the TA-35 PSP Decommissioning Project:

Phase II activities will include identifying the levels of radioactive contamination within the TA-35-7 flooring, superstructure, and associated internal facility services that will be removed and disposed of.

Phase III activities will include the evaluation and removal of the PSP and three buried underground hold-up tanks (TA-35-4, TA-35-5, TA-35-6) including all piping leading to and from the tanks.

Phase IV activities will include the excavation and removal of the external underground ducts along the south side of TA-35-2. The underground ducts will be cut at the building wall and a permanent cap attached to seal the remaining embedded section of pipe.

Phase V activities will include the excavation and removal of the underground ducts on the north side of TA-35-2 and the removal of Room A-175A. The removal of the room is necessary because it is located over the exhaust ducts to be removed.

2.1 Scope of Characterization

In characterization activities for Phases II through V, surface swipe samples, tank waste samples, soil samples, or a combination thereof were taken in specific locations and analyzed for chemical and radiological constituents.

Soil samples were collected at the ground surface and at 2.5-foot intervals from areas that are expected to be excavated during the D&D activities. Surface samples were collected using a spade and scoop according to LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples (LANL 1993). Subsurface soil samples were collected by hand auger according to LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler (LANL 1993) or by split-spoon according to LANL-ER-SOP-06.24, Sample Collection from Split-Spoon Samplers and Shelby Tube Samplers (LANL 1993). All sample locations are identified in Appendix A.

Soil samples were analyzed for a variety of contaminants, some of which were gross alpha, gross beta, and gross gamma radioactivity; alpha spectroscopy; strontium-89 and -90 (^{89}Sr and ^{90}Sr); tritium (^{3}H); PCBs; cyanide, and total metals by inductively-coupled plasma emission spectroscopy (ICPES). If toxic metals were identified, the sample had a Toxicity Characteristic Leaching Procedure (TCLP) extraction performed to develop additional data. If the gross gamma scan detected gamma radiation, then a gamma spectroscopy was performed. The sample was screened for volatile organic compounds (VOC), and positive results were sent for further analysis.

Samples of liquid and sludge were collected from TA-35-4, TA-35-5, and TA-35-6; from vessels inside the PSP; and from piping, sump pits, and anywhere else that liquid and sludge were encountered. If feasible, samples were collected using a composite liquid-waste sampler (Coliwasa) according to LANL-ER-SOP-06.15, Coliwasa Sampler for Liquids and Slurries (LANL 1993). Alternately, samples were collected using a weighted bottle according to LANL-ER-SOP-06.19, Weighted Bottle Sampler for Liquids and Slurries in Tanks (LANL 1993). If there was inadequate access for either of the previous methods described, it may have been necessary to collect the samples using a perstatic pump and polyethylene tubing. Samples of liquid and sludge were analyzed for gross alpha, gross beta, and gross gamma radioactivity; tritium; gamma spectroscopy; total uranium; isotopic plutonium; strontium and TCLP constituents.

Various types of samples were collected for quality control purposes. These sample types include trip blanks, field blanks, duplicate samples, and equipment blanks. Trip blanks are an organic-free aqueous solution that is prepared by the sample coordination facility and transported with samples. Field blanks are organic-free water that is transferred from one container to another at the sampling location and preserved along with other samples. Duplicate samples are extra samples taken from the same sample location and at the same time. Equipment blanks are samples of equipment decontamination rinse water.

2.2 Data Quality Objectives

The TA-35 PSP D&D characterization plan was developed using the data quality objective (DQO) process, a seven-step process developed by the U.S. Environmental Protection Agency (EPA) for planning effective and efficient data collection programs (EPA 1992). The DQO process is designed to ensure that the right type, amount, and quality of data are collected to support defensible environmental, waste management, and health and safety decisions.

The TA-35 PSP D&D project will require worker handling of contaminated materials, potential environmental exposure to contaminants, and the eventual disposal of the removed material (either onsite at TA-54 or at an off-site facility). To support technical evaluation of potential hazards, a detailed analysis of the contamination present in and on the materials to be disturbed was required. Characterization data was collected to establish the level of worker protection and environmental controls necessary to support the D&D effort and to estimate the expected volume and regulatory status of waste to be disposed of. The following data needs were identified for all phases of the project:

- Radionuclides by isotope and contamination level at each sample location within ductwork and other structures that will be removed during D&D

- Concentrations of radioactive and chemical constituents in soils that will be excavated during D&D

- Concentrations of radioactive and chemical constituents in liquids, sludges, and other materials that will be removed from the PSP and tanks during D&D

- Condition of physical elements that would affect D&D planning for removal, packaging, and final assay

3.0 CHARACTERIZATION ACTIVITIES

The following sections describe the scope of work and associated characterization activities during Phases II through V.

3.1 Phase II

Phase II will include the removal of the contaminated floor and superstructure at TA-35-7, the Air Filter Building (AFB). This will include the associated electrical and mechanical building services and the abandoned waste piping along the northern edge of the facility.

The soils surrounding the TA-35-7 facility, along with core samples taken within the facility, were sampled during characterization. The identified locations were selected to represent the areas of highest suspected contamination in the sample group. Major components to be removed from the facility were individually sampled.

3.1.1 Air Filter Building

TA-35-7, is one of three structures to be removed as part of the TA-35 D&D activities.

The AFB is a single-story, concrete block-wall and metal-roof deck structure. The reinforced-concrete floor received a concrete topping during previous D&D activities. The facility contains a high-efficiency particulate air (HEPA) filter bank and fans for TA-35-2 overhead duct exhaust systems, an electrical power distribution center, and a building heating/ventilation system.

Sampling locations for the AFB were selected to reflect the soil removal required to excavate the foundation and subgrade systems associated with the building and to evaluate the steel structure and existing ventilation system. Sample locations are summarized in Table 3.1-1. Locations for all samples are in Appendix A.

Soil sample sites chosen at two through-the-floor and five building perimeter locations were selected at locations where contamination was likely to be detected (i.e., locations likely to have been affected by facility operations). Soil samples were collected at the surface and at 2.5-foot intervals to depths ranging from 7.5 to 20 feet. The sampling interval was chosen to characterize variations in concentrations with depth. The depth of samples at each location reflected the expected soil volume associated with substructure removal. Facility samples included the steam pipe insulation material and samples of the dust that could have accumulated on the exposed steel beams.

TABLE 3.1-1

Phase II Sample Locations

Building	Sample Location	Description
TA-35-7	37	Exterior soil sample
	38	Exterior soil sample
	39	Exterior soil sample
	40	Interior soil sample
	41	Exterior soil sample
	42	Exterior soil sample
	43	Interior soil sample
	44	Exterior soil sample
	45	Rad survey, swipe, tank sample, inspection
	46	Rad survey, swipe, tank sample, inspection

3.2 Phase III Sample Locations

Phase III will include the evaluation and removal of the PSP, three buried underground storage tanks (UST), and associated piping. Soil sampling locations were selected to minimize disturbances of existing above- and below-grade systems while providing necessary data. A sample interval of 2.5 feet was established to characterize the soil profile and monitor for potential changes in soil contamination with depth. Sample locations are summarized in Table 3.2-1. Locations of all samples collected are shown in Appendix A. Sample locations were selected where the worst contamination would be expected to exist.

This phase will remove the PSP and the three buried underground hold-up tanks (TA-35-4, TA-35-5, and TA-35-6), including all piping that runs to and from the tanks. UST regulations do not apply to this project, which is governed by RCRA corrective action requirements.

The PSP tanks, transfer piping and equipment will be removed in the following manner:

- The PSP tanks, transfer piping, and equipment will be size-reduced, cleaned, and packaged for shipment to a metal recycler. The lead-brick shield walls will be dismantled, and the lead bricks transferred the LANL recycling program.

- Following removal of non-structural items, the soil surrounding the main structure will be excavated to provide working clearance. This excavation is designed to include the three hold-up tanks. The three underground tanks will be excavated and removed as individual units.

- The PSP concrete structure will be demolished and removed as waste.

TABLE 3.2-1
Phase III Samples

Building	Sample Location	Description
TA-35-2	34	Radiological survey, swipe, inspection
PSP	35	Soil sample
	36	Soil sample
	37	Soil sample
	38	Soil sample
TA-35-7	39	Soil sample
	46	Rad survey, swipe, tank/chem sample, inspection
PSP	47	Rad survey, swipe, tank/chem sample, inspection
	48	Rad survey, swipe, tank/chem sample, inspection
	49	Rad survey, swipe, tank/chem sample, inspection
	51	Rad survey, swipe, tank/chem sample, inspection
	53	Rad survey, swipe, tank/chem sample, inspection
	54	Rad survey, swipe, tank/chem sample, inspection
	55	Rad survey, swipe, tank/chem sample, inspection
	57	Rad survey, swipe, tank/chem sample, inspection
	60	Rad survey, swipe, tank/chem sample, inspection
	61	Rad survey, swipe, tank/chem sample, inspection

3.2.1 PSP

The PSP is a large below-grade reinforced concrete structure that contains 10 stainless steel vessels; 7 separators, 1 caustic neutralizer, and 2 HEPA filter banks. The structure is known to contain a significant number of lead shielding bricks. Characterization samples consisted of swipe samples taken from surfaces of structures and vessels inside the PSP, soil samples collected near the PSP, and samples of the contents of PSP vessels.

3.2.2 Hold-up Tanks

Three 1300-gallon stainless steel hold-up tanks (TA-35-4, TA-35-5, and TA-35-6) are buried near the PSP. Original construction drawings show a 3-in. sampling port at finish grade. Each tank was sampled for free liquid and sludge. The exterior surface of the tanks are inaccessible for inspection until excavation during the remediation phase.

3.2.3 Transfer Piping

Transfer piping consists of all the piping leaving the east wall of TA-35-2 and entering the PSP and all lines leaving the PSP to enter TA-35-7 up to the west wall of TA-35-7. No material was present in piping and samples could not be collected.

3.3 Phase IV Sample Locations

This phase will excavate and remove the external underground ducts along the south side of TA-35-2. The underground ducts will be cut at the building wall and a permanent cap attached to seal the remaining embedded section of pipe. Sample locations are summarized in Table 3.3-1. Locations of all samples collected are shown in Appendix A.

The underground exhaust pipe (South Side, TA-35-2) excavation will begin at the east end of the routing, where the pipe is connected with the PSP. As piping to the individual rooms is encountered, the entire room length of spur duct, from the main duct header to the wall connection, will be removed as a unit. Samples were taken to characterize the soil that will be excavated to remove the ductwork and to characterize radioactivity in ductwork.

3.4 Phase V Sample Locations

This phase will excavate and remove the underground ducts on the north side of TA-35-2 and remove Room A-175A. The underground ducts will be cut at the building wall and a permanent cap attached to seal the remaining embedded section of pipe. The removal of Room A-175A is necessary because of its degraded condition and its location over the exhaust ducts to be removed. Sample locations are summarized in Table 3.4-1. Locations of all samples are shown in Appendix A.

3.4.1 Underground Exhaust Piping

The underground exhaust pipe (North Side, TA-35-2) excavation will begin at the east end of the routing, at the connection to the PSP. As piping to the individual rooms is encountered, the entire length of spur duct, from the main duct header to the wall connection, will be removed as a unit.

TABLE 3.3-1

Phase IV Sample Locations

Building	Sample Location	Description
TA-35-2	8	Radiological survey, swipe, inspection
	13	Radiological survey, swipe, inspection
	14	Radiological survey, swipe, inspection
	15	Radiological survey, swipe, inspection
	16	Radiological survey, swipe, inspection
	26	Radiological survey, swipe, inspection
	28	Radiological survey, swipe, inspection
PSP	35	Exterior soil sample
TA-35-2, south side	63	Exterior soil sample
	64	Exterior soil sample
	65	Exterior soil sample
	66	Exterior soil sample

3.4.2 Room A-175A

The foundation for Room A-175A consists of a concrete slab that supports a series of reactor-rod storage tubes originally fitted with depleted uranium caps. The storage tubes were surrounded with concrete for shielding and support. Removal of Room A-175A will require demolition of the roof and block-wall superstructure. All electrical and mechanical systems will be removed from the facility. This will include the roof-mounted HEPA exhaust filter and exhaust ductwork.

3.5 Sampling and Analysis Methodology

Characterization sampling activities for TA-35, PSP D&D, Phases II through V consisted of obtaining soil samples, tank waste samples, swipe samples, and conducting radiological surveys.

Soil characterization sampling consisted of drilling 18 boreholes, from which approximately 120 samples were taken. Boreholes varied in depth from 7.5 to 20 feet. Boring samples were taken at 2.5 ft intervals during drilling operations. An average of 7 samples per boring was provided to characterize potential constituent concentrations at various depths.

Swipe samples were analyzed to determine removable alpha, beta, and gamma radioactivity. Analyses for all swipes included gross alpha, gross beta, gamma spectroscopy, and ^{90}Sr.

Sample operations were completed in accordance the site characterization plan. The analytical results of the samples are presented as "Qualified" or "Unqualified" results. Qualified results are those samples that were analyzed within the EPA guidelines for holding times. Unqualified results are samples that were analyzed after the EPA holding-time limitation and might not provide data as accurate as qualified samples.

TABLE 3.4-1

Phase V Sample Locations

Building	Sample Location	Description
TA-35-2	7	Radiological survey, swipe, inspection
	8	Radiological survey, swipe, inspection
	10	Radiological survey, swipe, inspection
	11	Radiological survey, swipe, inspection
	21	Radiological survey, swipe, inspection
	22	Radiological survey, swipe, inspection
	25	Radiological survey, swipe, inspection
	36	Exterior soil sample
TA-35-2, North Side	67	Exterior soil sample
	68	Exterior soil sample
	69	Exterior soil sample
	70	Exterior soil sample

4.0 CHARACTERIZATION RESULTS

The following sections identify those constituents of concern found during TA-35 PSP characterization activities. Contaminants of concern are constituents that may pose health and safety or radiological protection concerns during D&D, that exceed screening action levels (SALs), or that have regulatory significance. SALs are conservative screening levels for soil and water contamination that were developed using residential exposure scenarios. Constituents present below SALs generally should not require corrective action.

4.1 Radionuclides

4.1.1 Determination of Sample Activity Significance

Radiological sample results from soil samples and ductwork swipes were evaluated for two purposes: to determine if specific physical boundary areas within the area where D&D activities take place should be classified as Airborne Activity Areas and to determine if isotope concentrations in soil exceed LANL SALs.

To make the airborne activity determination, a methodology was developed (Appendix B) using standard resuspension and density factors to arrive at an air concentration that would be expected when personnel are working in a soil contamination area or in contaminated ductwork or other accessible surfaces. The analytical data from soil and swipe samples is converted to an airborne concentration (for a particulate radioisotope) above a contaminated surface. This is called the *calculated air concentration,* **C** (Brodsky 1980):

$$C = S \times K$$

where **C** = Calculated air concentration, $\mu Ci/cm^3$
S = Isotope surface density, $\mu Ci/cm^2$
K = Resuspension factor, 10^{-5} m^{-1}, or 10^{-7} cm^{-1} (Till and Meyer 1983)

This calculation may be used for both swipe sample and soil sample activity. This value for each sample can then readily be compared with DOE Derived Air Concentration (DAC) values to estimate the significance of the sample activities.

In order to compare swipe sample values with DOE surface contamination limits, the activity in pCi/swipe is converted to d/m/100cm^2 as follows:

$$d/m/100cm^2 = \frac{pCi \times 2.2\ d/m/pCi}{swipe}$$

$$= pCi/swipe \times 2.2$$

4.1.1.1 Calculations for Swipe Samples

For calculating air concentration based on swipe sample data, the following assumptions are made:

- The sample is representative of the removable contamination on the surface.
- The deposited material could be resuspended in the air in the vicinity of the surface.
- A worker handling the ductwork or working on the surface will be breathing the air that is in the vicinity of the surfaces.
- Since swipe sample data was obtained only as Gross Alpha activity, the activity was assumed to be ^{239}Pu (worst-case assumption)
- Swipe sample activity was given as pCi/swipe, therefore isotopic surface density, **S**, was calculated by dividing the swipe activity by the area covered by the swipe (100 cm^2) and converting pCi to μCi:

$$S\ (\mu Ci/cm^2) = \frac{pCi/swipe \times 10^{-6}\ \mu Ci/pCi}{100\ cm^2}$$

$$= pCi/swipe \times 1 \times 10^{-8}$$

- Therefore, $C\ (\mu Ci/cm^3) = pCi/swipe \times 1 \times 10^{-8} \times 10^{-7}$

$$= pCi/swipe \times 1 \times 10^{-15}$$

4.1.1.2 Calculations for Soil Samples

Soil samples were analyzed for isotopic activity. The data is given in pCi/g for each isotope detected. The following assumptions are used in calculating the air concentration above the surface of the soil in order to make a comparison with the DAC for each isotope:

- The average soil density is 2 gm/cm^3.
- The radioactivity determined from the sample analysis is evenly distributed throughout each m^2 of soil, in a layer 10^{-4}m thick (Till and Meyer 1983).
- A resuspension factor of 10^{-7} cm^{-1} is applicable for a person walking on the soil, stirring

up dust, and breathing the air (Till and Meyer 1983).

- Isotopic surface density, **S**, was calculated by multiplying the isotope activity of the sample by the soil density, and the surface thickness (10^{-2} cm), and converting pCi to μCi:

$$\mathbf{S}\ (\mu Ci/cm^2) = pCi/g \times 10^{-6}\ \mu Ci/pCi \times 2\ g/cm^3 \times 10^{-2}\ cm$$
$$= pCi/g \times 2 \times 10^{-8}$$

- Therefore, $\mathbf{C}\ (\mu Ci/cm^3) = pCi/g \times 2 \times 10^{-8} \times 10^{-7}\ cm^{-1}$

$$= pCi/g \times 2 \times 10^{-15}$$

4.1.1.3 Comparing Soil and Swipe Sample Data with DACs

The Derived Air Concentration (DAC) is a radioactivity concentration limit in air used to determine worker radiation exposure, and posting and protective measures required in an operation. An "Airborne Activity Area" is defined as a work area with airborne activity levels greater than 0.1 x DAC. As calculated air concentrations begin to approach the 0.1 DAC values, health physics posting and protective measures are considered for the protection of the workers.

Calculated Air Concentrations and DAC values for the highest-activity soil samples and the highest-activity swipe sample are shown in Table 4.1-1. The swipe sample gross alpha result was assumed to be all ^{239}Pu to be conservative. The soil sample isotopic values are for the isotopes shown.

4.1.1.4 Comparing Swipe Sample Data with Surface Contamination Limits

Gross alpha swipe sample analysis results were converted to d/m/100cm^2 values. These results were generally below the DOE surface contamination limit of 20 d/m/100cm^2 for removable plutonium alpha contamination. These are shown in Table 4.1-2.

Table 4.1-3 presents the results of gross beta and ^{90}Sr activity, which are reported together because ^{90}Sr is a beta emitter. Swipe sample results for gross beta radioactivity were generally low (i.e., below the RadCon Manual Table 2-2 value of 200 dpm/100 cm^2 for removable ^{90}Sr beta contamination). Exceptions are also shown in the Table.

Sample 28 (Building 2, room 166, riser duct) indicated the highest beta activity level of 1060 pCi/sample (15,206 dpm/100 cm^2). Strontium results for that same location showed ^{90}Sr levels of 493 pCi/sample (7072 dpm/100 cm^2). This indicates that nearly one-half of the total beta activity in and around the sample location is due to ^{90}Sr.

TABLE 4.1-1
Comparison of Calculated Air Concentrations with the DAC

Radionuclide in Soil Sample *	Calculated Air Concentration ($\mu Ci/cm^3$)	0.1 X DAC ($\mu Ci/cm^3$)
^{241}Am	2.84×10^{-16}	2×10^{-13}
^{140}Ba	3.74×10^{-16}	6×10^{-8}
^{144}Ce	3.04×10^{-16}	1×10^{-9}
^{109}Cd	3.02×10^{-15}	5×10^{-9}
^{60}Co	3.04×10^{-15}	7×10^{-9}
^{137}Cs	5.76×10^{-15}	7×10^{-9}
^{3}H	1.17×10^{-14}	2.5×10^{-4}
^{152}Eu	5.62×10^{-16}	1×10^{-9}
^{22}Na	9×10^{-17}	0.1
^{237}Np	1.892×10^{-15}	2×10^{-13}
^{238}Pu	3.5×10^{-16}	3×10^{-13}
^{239}Pu	8.32×10^{-15}	2×10^{-13}
^{106}Ru	6.04×10^{-16}	2×10^{-9}
^{90}Sr	1.7×10^{-14}	8×10^{-10}
^{234}U	6.432×10^{-15}	3×10^{-11}
^{235}U	2.08×10^{-16}	3×10^{-11}
^{238}U	1.972×10^{-15}	3×10^{-11}
Duct Swipe ^{239}Pu	2.7×10^{-11} **	2×10^{-13}

*The soil isotope concentrations used were the largest concentrations for that individual radionuclide from all individual phases of the TA-35 D&D project.

**The swipe sample value is the highest gross alpha result, sample No. 10.

TABLE 4.1-2

Results of Gross Alpha Analysis of Swipe Samples*

Location	Sample Number	Gross Alpha (pCi/swipe)	Gross Alpha (dpm/100cm^2)
	5	.44	6.3
	6	.79	11.3
	8	1.01	14.4
	9	1.05	15.0
TA-35-2, Room A-137 exhaust duct	10	4.03	57.8
	11	.87	12.5
TA-35-2, Room A-140 exhaust duct	13	2.42	34.7
TA-35-2, Room A-137 exhaust duct	14	3.39	48.6
	15	.25	3.6
	16	.08	1.1
	21	1.12	16.1
	22	.038	.54
	25	.72	10.3
	26	.41	5.8
TA-35-2, Room A-166 riser duct	28	42	602.5
	34	.64	9.2

*Shaded areas are samples above RadCon release limits.

TABLE 4.1-3
Results of Gross Beta and Strontium 90 Analysis of Swipe Samples*

Location	Sample Number	Gross Beta pCi/filter	± pCi/filter	Gross Beta dpm/100cm^2	^{90}Sr	± pCi/Filter
TA-35-2 between Rooms A-134 and A-126 exhaust duct	6	18.09	1.07	259.5	1.47	.23
	8	2.39	.87	34.3	.84	.13
	9	2.82	.96	40.4	.72	.145
	10	9.23	.815	132.4	2.07	.29
TA-35-2 Room A-137 exhaust duct	11	82.43	4.12	1182.4	2.3	.3
TA-35-2 Room A-140 exhaust duct	13	59.59	2.98	854.8	12.15	.895
	14	7.64	.63	109.6	.88	.19
	15	1.06	.835	15.2	1.03	.175
	16	2.13	.685	30.5	3.21	.34
	21	3.73	.595	53.5	3.7	.34
	22	1.96	.76	28.1	.93	.135
TA-35-2 Room A-164 riser duct	25	172.22	8.875	2470.5	28.72	1.75
	26	1.15	.895	16.4	.53	.13
TA-35-2 Room A-166 riser duct	28	1060	100	15,205.9	493	32
	34	2.65	.68	38	.68	.125

* Shaded areas are samples above RadCon release limits.

The following identifies the remaining sample locations that exceed 200 dpm/100cm^2 and compares their values with the ^{90}Sr value at the same locations.

Total Beta vs ^{90}Sr

Sample	Total Beta dpm/100 cm^2	^{90}Sr
6	259.6	21.1 dpm/100 cm^2
11	232.4	32.9 dpm/100 cm^2
13	854.8	174.23 dpm/100 cm^2
25	499.7	411.9 dpm/100 cm ^{2}

Samples 13 and 34 from the comparison between total beta activity and the ^{90}Sr contribution indicates that sample 13 (Building 2, A-140, exhaust duct) total ^{90}Sr contribution is approximately 20 percent of the total beta activity. Sample 25 (Building 2, A-164, riser duct) total ^{90}Sr contribution is approximately 82 percent of the total beta activity.

The results of the gamma spectroscopy analyses generally showed analytical uncertainty to be on the same order as or greater than the reported result. Because of the high uncertainty, these results were not considered indicative of contamination and were not considered as part of the total activity.

4.1.1.5 Screening Action Levels for Soil Samples

Comparing all the soil sample radiological analytical data results with the SALs, only five radionuclides exceeded SAL values. Table 4.1-4 identifies the location of each sample that exceeded the SAL the analytical value and the SAL value.

LANL SALs were established using a DOE-developed model (the computer model RESRAD) for deriving soil criteria, conducting decontamination efforts, and applying the as-low-as-reasonably-achievable (ALARA) process. The RESRAD code is a screening tool used to assess potential doses for the release from DOE properties to members of the public. Analytical values that exceed SALs do not necessarily mean that special precautions need to be taken, especially if the location or land being characterized is not going to be released. Individual constituents that exceed SAL limits need to be re-evaluated on an individual basis to determine what action, if any, needs to be taken.

Table 4.1-4 shows that four contaminant constituents in eight locations exceed SAL values. In addition to the eight locations that do exceed SAL values, two other locations are close to exceeding ^{90}Sr SAL values.

Liquid samples (60) taken from hold-up tank #5 have shown values for Am-241 and Cs-137 of <22 nCi/L and .27 nCi/L, respectively. These values are considerable lower than the SALs for water.

TABLE 4.1-4
List of Soil Sample Radionuclides that Exceed Screening Action Levels

Hole Number	Depth (feet)	Sample Number	Custom ER (AAA Number)	^{60}Co	SAL	^{238}Pu	SAL	^{226}Ra	SAL	^{90}Sr	SAL
				(pCi/g)		(pCi/g)		(pCi/g)		(pCi/g)	
Boring 4, Sample 38	2.5	93.26721	7623					.847	.73		
	5.0	93.26707	7624					.90	.73		
	7.5	93.26709	7625					.881	.73		
Boring 5, Sample 39	0.0	93.26704	7629							47.07	9.9
	5.0	93.26708	7631			54.9	27				
Boring 7, Sample 41	5.0	93.26713	7646	1.52	.90					39.56	9.9
		93.26714	7647							46.73	9.9
V-6, Sample 55		94.01842	7853							493	9.9

4.2 Inorganics

The laboratory results for inorganics indicate that in all samples taken, arsenic and beryllium concentrations levels exceeded the SAL values. The concentrations of arsenic and beryllium in soil, however, were within the range of background concentrations in soil and tuff at LANL (Longmire, et al. 1993). These results, therefore, are not indicative of impacts from facility operations. In a few cases, copper and lead exceeded the SAL values (Table 4.2-1).

TABLE 4.2-1
Lead and Copper Samples Exceeding SAL

Inorganic	Sample #	AAA	Concentration	SAL
Copper	66	7863	19,000 µg/g	3,000 µg/g
Lead	51	6077	178 µg/L	50 µg/L
	55	6080	7100 µg/L	50 µg/L
	55	7863	4850 mg/kg	500 mg/kg
	57	6084	132 µg/L	50 µg/L

Other than these samples, no other inorganic contaminant constituents exceeding SAL were identified. The only inorganic constituent above, or potentially above, TCLP levels was lead. The concentration of lead in the liquid sample from Phase Separator Vessel 5 (sample 6080) was above the TCLP regulatory limit for lead (5000 µg/L). At this level, the liquid would be hazardous or mixed waste. The concentration of lead in the solid sample from Phase Separator Vessel 5 (sample 7863) was greater than 20 times the TCLP regulatory limit for lead (100 mg/kg). At this level, this material could potentially fail the TCLP test and be hazardous or mixed waste. The TCLP test would have to be run on this material to determine if it is hazardous or mixed waste.

4.3 Polychlorinated Biphenyls

PCBs were detected in 14 of 32 samples analyzed. All of the detected values were above SALs. Only one of the results (21.2 mg/kg mixed Aroclors in the sample taken at 2.5 feet in Boring 3) was above EPA's 10 mg/kg soil cleanup level for unrestricted access areas [40 CFR 761.125(c)(4)(v)]. None of the results was above the 50 mg/kg limit for defining PCB wastes regulated under the Toxic Substances Control Act.

4.4 Volatile Organics

The laboratory results of volatile organic contaminant constituents, when compared with the SALs shows that organic constituent concentration values are less than SALs. Appendix D provides the conversion from µg/L to mg/kg. This conversion was conducted to order to compare SAL soil values with comparable laboratory results for residue. Residue mixtures are assumed to be water and sludge. Organics in the residue sample are assumed to be retained in the sludge mixture. Therefore, laboratory results that were in unit of µg/L were converted to mg/kg.

Volatile organics may be of concern for waste management purposes if the constituents detected are constituents of RCRA-listed wastes. For soil samples, the only detected VOC was acetone.

Acetone is a listed waste constituent, but acetone-contaminated soil would only be RCRA-regulated if levels were high enough to be ignitable. The low concentrations of acetone detected should not cause the soil to be ignitable. The only other sample with detectable VOCs was the waste sample from Tank 5. This sample had detectable levels of several VOCs that are constituents of RCRA-listed wastes. This waste could be RCRA-regulated if these constituents are from any of the sources listed in 40 CFR 261 Subpart D

Several VOCs that are TCLP constituents were present above TCLP regulatory levels in the waste sample from Tank 5. These constituents are 1,1-dichlorethene (112,000 μg/L vs. 700 μg/L), carbon tetrachloride (153,000 μg/L vs. 500 μg/L), and 1,2-dichloroethane (2600 μg/L vs. 500 μg/L). At these levels, the liquid waste would be regulated as hazardous or mixed waste.

4.5 Semi-Volatile Organics

Only one semivolatile organic was present at levels above SALs. Bis(2-ethylhexyl)phthalate was present above the SAL for soil in the sample taken from the caustic neutralizer (79.6 mg/kg vs. 50 mg/kg) and above the SAL for water in the liquid sample taken from Phase Separator Vessel 7 (16 μg/L vs. 4 μg/L). Bis(2-ethylhexyl)phthalate is a common plasticizer and is often present in environmental samples. It is unknown whether its presence in these samples is associated with facility operations, or whether it should be considered anthropogenic background. The SALs for some semivolatiles are less than detection limits. For these constituents, it cannot be determined whether they are present above SALs.

5.0 REGULATORY COMPLIANCE

5.1 National Emission Standards for Hazardous Air Pollutants (NESHAP)

Decommissioning activities that could result in release of radionuclides to the environment may require EPA approval under the NESHAP regulations. Several decommissioning activities at TA-35 have the potential for releases.

Information concerning the levels of radioactivity expected in the work area should be submitted to the Air Quality Group (ESH-17) for determination whether NESHAP approval is required for Phase II through V decommissioning activities.

5.2 National Environmental Policy Act (NEPA)

The activities to be performed are within the scope of activities described in the current DOE Environmental Checklist (DEC) for TA-35 decommissioning. Based on this DEC (DEC-91-0009), which was submitted to DOE on February 7, 1992, DOE determined that the Decommissioining activities were subject to a categorical exclusion and that no further NEPA documentation was required. The results of the characterization did not identify any concerns beyond those already identified in the DEC. Therefore, no additional NEPA activities are required.

5.3 Resource Conservation and Recovery Act (RCRA)

Wastes that will be generated during decommissioning activities include ductwork, structures, equipment, soil, personal protective equipment (PPE), and decontamination wastes. Based on knowledge of operations at TA-35-2, some of these wastes could be RCRA-regulated wastes because of the presence of spent solvents, TCLP constituents, and/or perchlorates. Some of the data collected during the characterization were used to determine whether these wastes would be RCRA mixed wastes due to the presence of spent solvents or TCLP constituents. The issue of whether wastes would be mixed wastes due to the presence of perchlorates was previously addressed in the Phase I characterization.

Laboratory operations in TA-35-2 used volatile organic solvents. As a result, decommissioning wastes could contain spent solvents, causing them to be regulated as hazardous or mixed wastes. As described in Section 4.4, volatile organics were detected in some samples. Acetone was detected in some soil samples, but this soil, when excavated, should not be a hazardous or mixed waste because the concentrations are too low to be ignitable. The liquid in Tank 5 contained several VOCs that are constituents of RCRA-listed wastes. If these constituents originated from RCRA-listed sources, which is probable given the activities in Building TA-35-2, this liquid would be hazardous or mixed waste. The source of these constituents will be determined before decommissioning activities are begun.

Operations at TA-35-2 also may have used a variety of constituents that are constituents under the TCLP. The characterization sampling identified three samples having TCLP constituents at levels above, or potentially above, regulatory levels. Liquid samples from Phase Separator Vessel 5 and Tank 5 had lead and VOCs, respectively, above TCLP regulatory levels. The liquid in these vessels would have to be managed as hazardous or mixed wastes. The solid sample from Phase Separator Vessel 5 contained lead at a concentration that could potentially exceed regulatory levels. This material must be tested using the TCLP to determine whether it would have to be managed as hazardous or mixed waste.

Laboratory operations in TA-35-2 may have used perchloric acid in fume hoods, creating the potential for ductwork to contain perchlorates. Testing of ductwork was performed during the Phase I characterization to determine if perchlorates were present at levels that would cause the ductwork to be RCRA-regulated reactive hazardous waste (ICF KE 1994). The results of these tests were negative.

5.4 Health and Safety Requirements

The level of radioactive contamination in the work area was evaluated to identify potential health and safety concerns. LANL HS-1 personnel have conducted a thorough pre-job radiological survey of the work area. the results of this survey confirm that the general area is at NDA (background) levels. The characterization focused investigation on internal contamination of ducts and systems. Removable surface contamination levels were used to estimate a worst-case airborne concentration, which was then compared with the DAC from DOE Order 5480.11, Radiation Protection for Occupational Workers. This conservative analysis indicates that airborne concentrations greater than 10% of the DAC could be generated (Section 4.1). This evaluation is provided in Appendix B.

No safety requirements due to the presence of volatile organic vapors are necessary. Sample locations were field screened for volatile organic vapors, and none were detected. A small amount of mercury has been found in waste piping from abandoned sinks in the fume hoods. The sight specific health and safety plan will provide appropriate guidance.

5.5 Waste Management Requirements

pes and estimated volumes of waste to be generated during TA-35 D&D are presented in Figure 1. Based on the results of the radiological characterization, wastes generated during the completion of the four phases of decommissioning activities will be designated as low-level radioactive wastes per DOE Order 5820.2A, Radioactive Waste Management. Except as noted in Section 5.3, these wastes are not expected to be mixed wastes.

FIGURE 1
TA-35 PSP D&D PROJECT
WASTE VOLUME PROJECTION

Phase II

Metal	712 CF
Concrete Block	5,377 CF
Reinforced Concrete	760 CY
Soil	1,539 CY

Phase III

Metal	673 CF
Reinforced Concrete	400 CY
Soil	600 CY

Phase IV

Metal	1,322 CF
Soil	688 CY

Phase V

Metal	1,500 CF
Concrete Block	1,500 CF
Reinforced Concrete	112 CY
Soil	688 CY

6.0 REFERENCES

, 1992: U.S. Environmental Protection Agency, "The Data Quality Objectives Process for Environmental Decisions", draft, Quality Management Staff, Washington, DC., September 16, 1992

ICF KE 1993: ICF Kaiser Engineers "Los Alamos National Laboratory, TA-35 D&D Project, Phase Separator Pit Characterization Plan for Support of D&D Activities", ICF Kaiser Engineers, Los Alamos, New Mexico, November 17, 1993.

LANL 1993: Los Alamos National Laboratory (LANL), "Installation Work Plan for Environmental Restoration", Revision 3, LA-UR-93-3987, Los Alamos National Laboratory, Los Alamos, New Mexico, November 1993.

ICF KE 1994: ICF Kaiser Engineers, Phase I D&D Activities Characterization Report, 1994.

Longmire, et al. 1993: Longmire, P., C. Duffy, and S. Reneau, 1993. "Preliminary Background Elemental Concentrations in Bandelier Tuff and Selected Soil Series, 1993." unpublished report, Los Alamos National Laboratory, Los Alamos, New Mexico.

Brodsky 1980: Brodsky, "Resuspension Factors and Probabilities of Intake and Materials in Process," Health Physics, 39, 992-1000, 1980.

Till and Meyer 1983: Till and Meyer, "Radiological Assessment," NUREG/CR-3332, U.S. Nuclear Regulatory Commission, 1983.

APPENDIX A

FACILITY LAYOUT AND SAMPLING LOCATIONS

APPENDIX B

JOHN MANN LETTER

APPENDIX B

JOHN MANN LETTER

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8 September 1994

TO: Dennis Basile & Joe English

FROM: John Mann

CORRECTION TO MEMO OF 23 JUNE 1994:
INTERPRETATION OF DATA FROM TA-35 SWIPE SAMPLES ON DRAINS & DUCTS

Assumptions:

- A swipe sample is representative of the removable contamination on the interior of the surface.
- The deposited material could be resuspended in the air in the vicinity of the surface.
- A worker handling the ducts or drains will be breathing the air that is in and around the surfaces.
- The material is ^{239}Pu (worst-case assumption).

Calculations:

- Airborne concentration of particulate plutonium above a contaminated surface is given by:

$$C = S \times K$$

where:
C = Air concentration, $\mu Ci/m^3$
S = Pu surface density, $\mu Ci/m^2$
K = Resuspension Factor, $10^{-5}\ m^{-1}$, or $10^{-7}\ cm^{-1}$ (1)(2)

(In the original memo, a K of 10^{-3} per cm was mistakenly used).

- Using a swipe activity of 2000 d/m/100cm^2 ($9 \times 10^{-6}\ \mu Ci/cm^2$):

$$C = 9 \times 10^{-6} \times 10^{-7}$$
$$= \mathbf{9 \times 10^{-13}\ \mu Ci/cm^3\ of\ Pu.}$$

The Derived Air Concentration (DAC) is a radioactivity concentration used to determine worker exposure, and posting and protective measures required in an operation. An "Airborne Activity Area" is defined as a work area with airborne activity levels greater than 0.1 x DAC. The DAC for plutonium is $2 \times 10^{-12}\ \mu Ci/cm^3$. Comparing these values with the potential airborne activity calculated above, **the airborne**

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(1) Brodsky, "Resuspension Factors and Probabilities of Intake of Materials in Process," *Health Physics* 39, 992-1000, 1980.
(2) Till & Meyer, "Radiological Assessment," U.S. Nuclear Regulatory Commission, NUREG/CR-3332, 1983.

activity would be 4 to 5 times greater than the posting limits for an airborne activity area, or one-half of the DAC value for plutonium. Radiological posting and respiratory protection and other Health Physics protective measures could be required for personnel working with the ductwork/drains.

This analysis is also applicable to an evaluation of airborne activity due to radioactivity in soil:

Assumptions:

- The average soil density is 2 gm/cm^3.
- The average soil activity is 170 pCi/gram.[3]
- This activity is evenly distributed throughout each m^2 of soil, in a layer 10^{-4} m thick[2] This gives a surface density of 3.4 pCi/cm^2 (3.4×10^{-6} µCi/cm^2).
- A resuspension factor of 10^{-7} cm^{-1} is applicable for a person walking on the soil, stirring up dust, and breathing the air[2].
- The airborne concentration of particulate plutonium above the surface of the soil is calculated as before:

$$\begin{aligned} C &= S \times K \\ &= 3.4 \times 10^{-6}\ \mu Ci/cm^2 \times 10^{-7}\ cm^{-1} \\ &= 3.4 \times 10^{-13}\ \mu Ci/cm^3 \text{ of Pu.} \end{aligned}$$

Comparing this concentration with the DAC, as before, it is seen that it is approximately the same as the 0.1DAC value requiring posting as an airborne activity area. In this example, Health Physics protective measures would probably be minimal.

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[3] ERM Program Management Company and Golder Associates, Inc., "Estimated Radionuclide Activities and Hazardous Waste Constituents at the Mixed Waste Disposal Facility (MWDF)," prepared for Los Alamos National Laboratory, Los Alamos, NM (30 June 1993), Table 2.

APPENDIX C

EVALUATION OF VOLATILE ORGANICS

APPENDIX C

EVALUATION OF VOLATILE ORGANICS

Problem: Samples do not specifically identify the type of waste matrix analyzed, i.e., residue; are residues soil, water, or sludge?

Assumption: The units used from the Laboratory Analysis are $\mu g/L$ which would indicate a presence of some liquid. However, organic compounds would most likely be retained in the soil/sludge mixture beneath any sample liquid. Therefore, for the purposes of this evaluation, an assumption is made as to the density of the sludge matrix. Laboratory units will be converted to soil SAL units for comparison. Sludge density = $12 g/cm^3$.

$$\frac{5\mu g}{L} \times \frac{L}{10^3\ cm^3} \times \frac{cm^3}{12g} = .4166\ ng/g \text{ or } .000416\ mg/kg$$

$$\frac{10\ \mu g}{L} \times \frac{L}{10^3\ cm^3} \times \frac{cm^3}{12g} = .833\ ng/g \text{ or } .000833\ mg/kg$$

$$\frac{20\ \mu g}{L} \times \frac{L}{10^3\ cm^3} \times \frac{cm^3}{12g} = 1.67\ ng/g \text{ or } .00167\ mg/kg$$

$$\frac{27\ \mu g}{L} \times \frac{L}{10^3\ cm^3} \times \frac{cm^3}{12g} = 2.26\ ng/g \text{ or } .00225\ mg/kg$$

APPENDIX D

ANALYTICAL RESULTS