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Title: *Fast-Turnaround RCRA Site Characterization of Former TA-42 at Los Alamos National Laboratory*

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TABLE OF CONTENTS

LIST OF FIGURES ii

LIST OF TABLES iii

1.0 INTRODUCTION 1

2.0 PREVIOUS DATA 1

2.1 Environmental Surveillance Group Study 2
2.2 Environmental Protection Group Reconnaissance Study 2

3.0 OU 1129 SAMPLING ACTIVITIES 3

3.1 Sampling Techniques 3
3.2 Sampling Locations 11

4.0 RESULTS 12

4.1 Stratigrapny of the Site 12
4.2 Screening 12
4.3 Field Monitoring 12
4.4 Isotope and Nuclear Chemistry Group Analysis 17
4.5 Energy Dispersive X-Ray Fluorescence Screening 19
4.6 Contract Laboratory Analytical Results 21

5.0 DATA ANALYSIS: INTERPRETATION, MODELS, AND PARAMETERS 24

5.1 Two-Dimensional Modeling: Concentration or Activity Isopleths 27

6.0 QUALITY ASSURANCE AND QUALITY CONTROL 27

7.0 CONCLUSIONS 33

8.0 REFERENCES 34

APPENDIX A SAMPLE PREPARATION BY THE ISOTOPE AND NUCLEAR CHEMISTRY GROUP 37

APPENDIX B ROCKWORKS PARAMETER DOCUMENTATION 39

APPENDIX C ACKNOWLEDGMENTS 61

LIST OF FIGURES

Number	Title	Page
Figure 1	Nuclear Safeguards Technology Laboratory (proposed) with reconnaissance sample locations and cross sections.	6
Figure 2	Cross section through former TA-42 site showing existing grade and finished grade after the proposed NSTL building is completed. (A) north view, (B) east view, and (C) east view.	7
Figure 3	Potential release sites and sampling locations at former TA-42.	9
Figure 4	Geological log of Borehole No. B6.	13
Figure 5	Geological log of Borehole No. B7.	14
Figure 6	Geological log of Borehole No. B8.	15
Figure 7	Geological log of Borehole No. B9.	16
Figure 8	Predicted distribution of lead TCLP concentration isopleths based on reconnaissance sampling data. Kriging interpolation technique was used.	20
Figure 9	Data summary for former TA-42.	25
Figure 10	Predicted activity isopleths for ^{241}Am at former TA-42.	28
Figure 11	Predicted activity isopleths for ^{238}Pu at former TA-42.	29
Figure 12	Predicted activity isopleths for ^{239,240}Pu at former TA-42.	30
Figure 13	Predicted concentration isopleths for lead at former TA-42.	31

LIST OF TABLES

Number	Title	Page
Table 1	Results of Environmental Surveillance Group Study After D&D	2
Table 2	1991 Reconnaissance Results for Near-Surface Sampling at Former TA-42	3
Table 3	Analytical Results from EM-8 Reconnaissance Sampling at Former TA-42	4–5
Table 4	Summary of OU 1129 Samples Collected at Former TA-42	8
Table 5	Results from High-Volume Air Samplers	17
Table 6	INC-12 Analytical Results of Sampling at Former TA-42	18
Table 7	EDXRF Analysis Results of Lead Investigation at Former TA-42	21
Table 8	Contract Laboratory Analytical Results	22–23
Table 9	Comparison of Screening Action Levels with Contaminants of Concern at Former TA-42	24
Table 10	Descriptive Statistics for Former TA-42 Data	26
Table 11	Results of Quality Control Samples	32
Table 12	Results of Spike and Blind Quality Control Samples	33

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1.0 INTRODUCTION

This report describes the results of an accelerated characterization to evaluate contamination at the site of former Technical Area (TA) -42. This accelerated characterization supported the construction validation for the Nuclear Safeguards Technology Laboratory (NSTL), which will be constructed at the site. All activities described herein were conducted for and funded by the NSTL program sponsors, the former Nuclear Technology and Engineering (N) Division, and the former Facilities Engineering (ENG) Division. The Department of Energy Albuquerque Operations Office (DOE/AL) used the results of this characterization for construction validation. The results will be incorporated into a Resource Conservation and Recovery Act Facility Investigation (RFI) characterization report for Operable Unit (OU) 1129.

Sampling activities were conducted under the guidelines described in the *RFI Work Plan for Operable Unit 1129* (LANL 1992, 7666) (hereafter referred to as the Work Plan). The environmental setting is described in Chapter 2 of the Work Plan; the potential release sites (PRSs) at former TA-42 are described in Chapter 3, Section 3.4; the conceptual model is detailed in Chapter 4; and the technical approach is detailed in Chapter 5. The sampling and analysis plan (SAP), which describes the approach used in this characterization, was revised and is included as Appendix E of the Work Plan.

TA-42 was the site of a radioactive waste incinerator facility that operated from 1951 to 1952. From 1956 to 1969 the incinerator facility was used to store and decontaminate equipment. The facilities were decommissioned and the site was decontaminated in 1978. The following PRSs, which resulted from operations at the site, were included in this characterization:

- 42-001(a), former location of an incinerator;
- 42-001(b and c), former location of two ash storage tanks;
- 42-002(a), former location of a building used as an indoor storage and decontamination area;
- 42-002(b), former outdoor decontamination area; and
- 42-003, former location of a septic tank and tile drain field.

2.0 PREVIOUS DATA

Data collected at the site before this accelerated characterization came from two sources: a study performed in 1978 by the former Environmental Surveillance Group after decontamination and decommissioning (D&D) activities and a reconnaissance study performed in 1991 by the former Environmental Protection Group (EM-8). These data were used to develop the revised SAP.

2.1 Environmental Surveillance Group Study

Final gross-alpha activity in soil samples taken after the D&D activities in 1978 (Harper and Garde 1981, 6286) are shown in Table 1.

TABLE 1

RESULTS OF ENVIRONMENTAL SURVEILLANCE GROUP STUDY AFTER D&D

Location	Number of Samples with Gross-Alpha Activity Less than 25 pCi/g	Values (pCi/g) for Samples with Gross-Alpha Activity Greater than 25 pCi/g
Former building area	60	29
Septic tank area	Unknown	None
Tile field	12	31 35 44 99 45
Excavation under the tile field drain	3	65 78 87 310 418
Canyon wall below the tile field outfall	14	29 36 40

Harper and Garde (1981, 6286) report that "Because of the low levels of contamination and the safety hazards associated with any further excavation, the Environmental Surveillance Group considered the area decontaminated to as low as reasonably achievable (ALARA). After concurrence from the Laboratory's Health Division Office and the Los Alamos, New Mexico, Area Office of the U.S. Department of Energy the area was contoured and revegetated to minimize erosion."

2.2 Environmental Protection Group Reconnaissance Study

At the request of the construction leader from the former Project Management Group (ENG-1), EM-8 performed a reconnaissance study in January 1991. The OU 1129 technical team used the analytical results from EM-8 as Phase I results to design the SAP for this accelerated characterization. Table 2 contains the levels of ^{238}Pu, $^{239,240}Pu$, and toxicity characteristic leaching procedure (TCLP) lead in the near-surface samples (surface to 5-ft depth). The near-surface fill materials and soils were important because construction activities would impact them and because, if contamination were found, the path to receptors would originate there. Table 3 contains the analytical results for all samples (near-surface and

subsurface) that EM-8 investigated. Figure 1 shows the location of the reconnaissance samples, which have the prefix "PF," and Figure 2 shows the corresponding cross section.

TABLE 2

1991 RECONNAISSANCE RESULTS FOR NEAR-SURFACE SAMPLING AT FORMER TA-42

Borehole	Sample Depth (feet)	^{238}Pu (pCi/g)	Unc[a]	$^{239,240}Pu$ (pCi/g)	Unc	Pb TCLP[b] (mg/L)	Unc
PF-IB1	0–5	0.0004	0.0009	0.015	0.026	11.4	1.1
PF-IB2	0–5	0.003	0.001	0.0554	0.0047	0.05	0.01
PF-HT2	0–5	0.002	0.002	0.0179	0.0033	< 0.01	
PF-HT3	0–5	0.0012	0.0007	0.0205	0.0031	0.04	0.01
PF-CDA	0–5	0.0036	0.0009	0.0014	0.0006	0.17	0.02
PF-PLN	0–5	0.0012	0.0008	0.006	0.001	0.01	0.01
PF-PLM	0–5	0.009	0.002	0.0148	0.0021	< 0.01	
PF-PLS	0–5	0.006	0.001	0.0151	0.0018	0.34	0.03

a. Unc = uncertainty
b. TCLP = toxicity characteristic leaching procedure

3.0 OU 1129 SAMPLING ACTIVITIES

The OU 1129 field team used three methods to collect fill material, soil, and nonwelded tuff for sampling. They used a hand auger from the surface to a depth of 6 ft, a power-assisted hand auger for depths from 5 ft to 11 ft, and a hollow-stem auger for depths to 30 ft. Table 4 lists the samples and the depths at which they were collected. Figure 3 shows the locations of both the samples taken during the reconnaissance study (designated by the prefix "PF") and the samples collected by the field team (designated by the prefix "B" or "C").

3.1 Sampling Techniques

The field team collected near-surface samples with a hand auger. They used the auger to collect unconsolidated materials in 6- to 12-in. intervals. They pulled the auger when it was full and placed the samples in a decontaminated pan. Augering continued until the top 3 ft of soil was collected or until the soil-tuff interface was encountered (Table 4 shows the actual sample depths). When they reached the soil-tuff interface, the field team collected samples, homogenized the samples, and divided the composite material into portions (called splits) for analysis by the former Isotope and Nuclear Chemistry Group (INC-12)

TABLE 3

ANALYTICAL RESULTS FROM EM-8 RECONNAISSANCE SAMPLING AT FORMER TA-42

Sample No.[a, b]	PCBs[c] (µg/g)	Unc[d]	Pb[e] (mg/L)	Unc	VOCs[f]	SVOCs[f]
PF-IB1-0	< 0.05		11.4	1.1	NTCF[f]	NTCF
PF-IB1-5	< 0.05		0.29	0.03	NTCF	NTCF
PF-IB2-0	< 0.05		0.05	0.01	NTCF	NTCF
PF-IB2-5	< 0.05		0.03	0.01	NTCF	NTCF
PF-HT2-0	1.02	0.2	< 0.01		NTCF	NTCF
PF-HT-2-5	0.4	0.08	0.04	0.01	NTCF	NTCF
PF-HT2-10	< 0.05		< 0.01		NTCF	NTCF
PF-HT3-0	0.08	0.02	0.04	0.01	NTCF	NTCF
PF-HT3-5	0.11	0.02	< 0.01		NTCF	NTCF
PF-HT3-10	< 0.05		0.04	0.01	NTCF	NTCF
PF-CDA-0	< 0.05		0.17	0.02	NTCF	NTCF
PF-ST-10	< 0.05		2.2	0.2	NTCF	NTCF
PF-ST-15	< 0.05		0.45	0.04	NTCF	(see note g)
PF-ST-20	< 0.05		< 0.01		NTCF	NTCF
PF-ST-25	< 0.05		< 0.01		NTCF	NTCF
PF-PLN-0	0.52	0.1	0.01	0.01	NTCF	(see note h)
PF-PLM-0	0.12	0.02	< 0.01		NTCF	NTCF
PF-PLS-0	< 0.05		0.34	0.03	NTCF	NTCF

a. Last digit on sample number indicates the depth of sampling in feet.

b. PF = Philip Fresquez (sample collector), IB = incinerator building, HT = holding tank, CDA = canyon disposal area, ST = septic tank, PLN = parking lot north, PLM = parking lot middle, PLS = parking lot south

c. Action level for polychlorinated biphenyls (PCBs) is 50 mg/g (or ppm) (EPA 1990, 39994).

d. Unc = uncertainty

e. Toxicity characteristic leaching procedure (TCLP) metals analyzed for included Hg, As, Se, Ag, Ba, Cd, Cr, and Pb. All other TCLP metals were below action levels except for a sample that contained Pb above action levels; therefore, only Pb results are shown.

f. VOCs = volatile organic compounds, SVOCs = semivolatile organic compounds, NTCF = no target compound found

g. Eight SVOCs were detected in this sample. Seven of the eight were polycyclic aromatic hydrocarbons (PAHs). Although these hydrocarbon compounds are carcinogen hazards in volatile forms (Sax and Lewis 1987, 34770), they are all common constituents in paving (asphalt) and roofing tar (coal tar pitch) materials (Windholz 1983, 34771). The soil sample collected at the 15-ft level was fill material, thus the PAHs detected in this soil sample were probably from a piece of asphalt or paving tar, a nonhazardous material (nonsoluble and nonvolatile) in its present form. The other SVOC detected is bis-2-ethyl-hexylphthalate, but at trace amounts (400 ppb).

h. This sample contained a trace amount of bis-2-ethyl-hexylphthalate (400 ppb). This amount is below the Environmental Protection Agency action-level guideline of 83 ppm.

TABLE 3 (continued)

ANALYTICAL RESULTS FROM EM-8 RECONNAISSANCE SAMPLING AT FORMER TA-42

Sample No.[a, b]	^{238}Pu (pCi/g)	Unc[c]	^{239}Pu (pCi/g)	Unc	Total U (µg/g)	Unc	^{137}Cs (pCi/g)	Unc
PF-IB1-0	0.0004	0.0009	0.015	0.026	3.58	0.4	0.0883	0.0996
PF-IB1-5	0.007	0.001	0.0002	0.0004	3.44	0.3	0.176	0.151
PF-IB2-0	0.003	0.001	0.0554	0.0047	3.5	0.3	0.0944	0.0941
PF-IB2-5	0.0003	0.0006	0.000	0.0005	3.76	0.4	0.193	0.171
PF-HT2-0	0.002	0.002	0.0179	0.0033	3.85	0.4	0.169	0.111
PF-HT-2-5	0.009	0.004	0.0628	0.0085	3.76	0.4	0.0643	0.16
PF-HT2-10	0.0006	0.0004	0.0013	0.0006	3.7	0.4	0.236	0.111
PF-HT3-0	0.0012	0.0007	0.0205	0.0031	3.65	0.4	0.245	0.143
PF-HT3-5	0.0035	0.0009	0.0086	0.0014	3.13	0.3	0.241	0.109
PF-HT3-10	0.0016	0.0006	0.0292	0.0027	3.6	0.4	0.238	0.152
PF-CDA-0	0.0036	0.0009	0.0014	0.0006	1.86	0.2	0.0643	0.156
PF-ST-10	0.015	0.002	0.151	0.0077	4.17	0.4	0.143	0.104
PF-ST-15	2.48	0.15	4.77	0.26	5.2	0.5	0.0579	0.17
PF-ST-20	0.155	0.016	0.40	0.03	3.34	0.3	0.0239	0.101
PF-ST-25	0.016	0.002	0.0032	0.0008	3.9	0.4	0.463	0.173
PF-PLN-0	0.0012	0.0008	0.006	0.001	3.7	0.4	0.0662	0.106
PF-PLM-0	0.009	0.002	0.0148	0.0021	3.44	0.3	0.272	0.146
PF-PLS-0	0.006	0.001	0.0151	0.0018	2.47	0.2	0.16	0.109

a. Last digit on sample number indicates the depth of sampling in feet.

b. PF = Philip Fresquez (sample collector), IB = incinerator building, HT = holding tank, CDA = canyon disposal area, ST = septic tank, PLN = parking lot north, PLM = parking lot middle, PLS = parking lot south

c. Unc = uncertainty

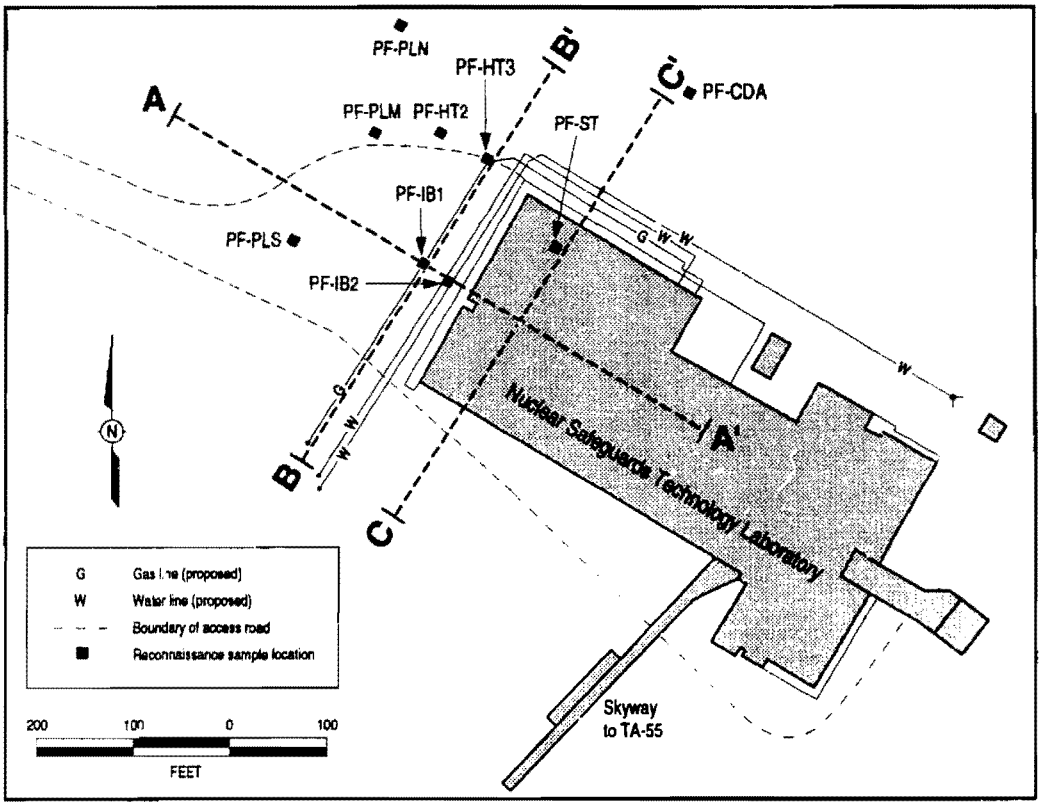


FIG 01 / TA-42 FINAL RPT / 081994

Figure 1. Nuclear Safeguards Technology Laboratory (proposed) with reconnaissance sample locations and cross sections.

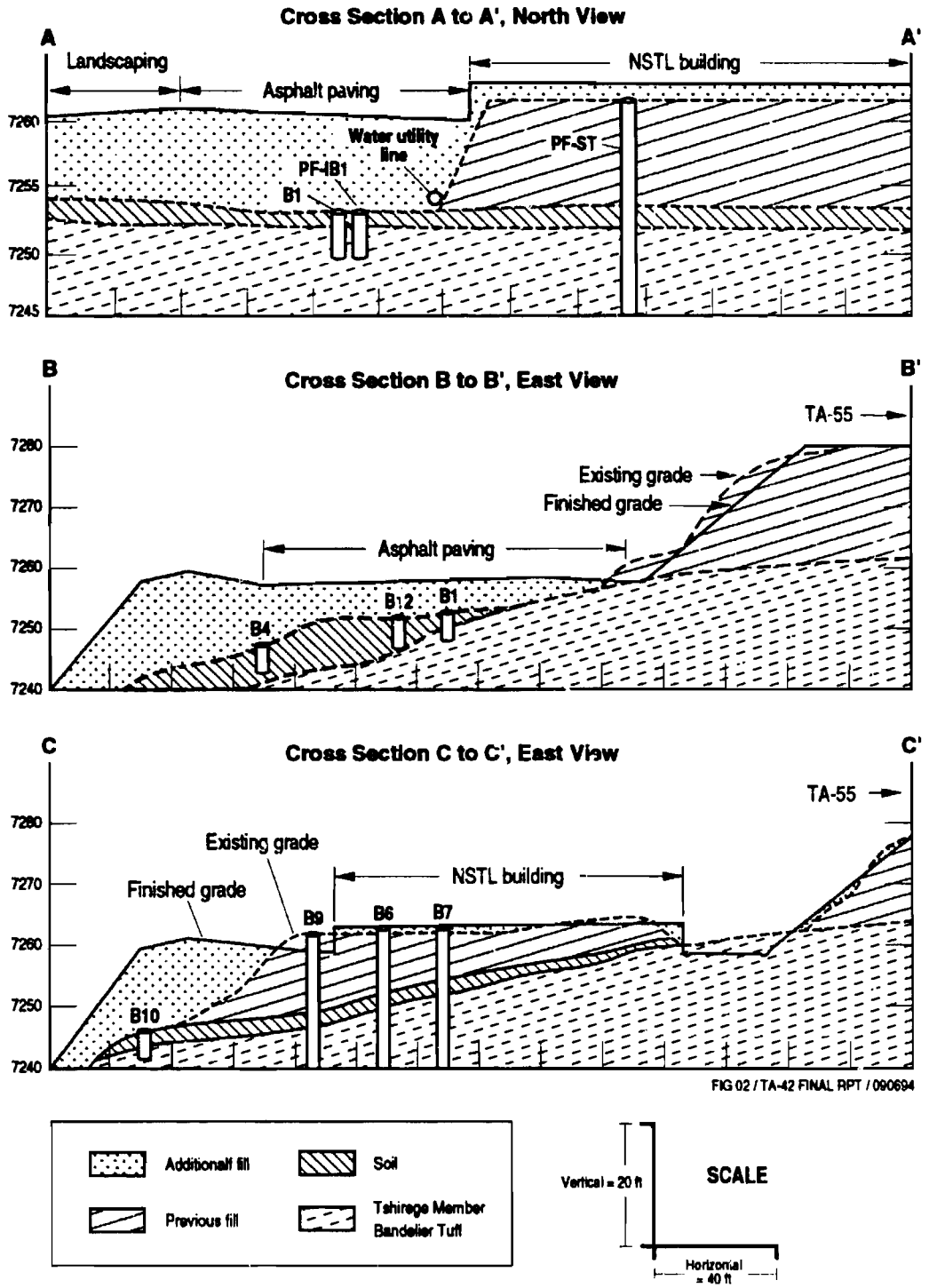
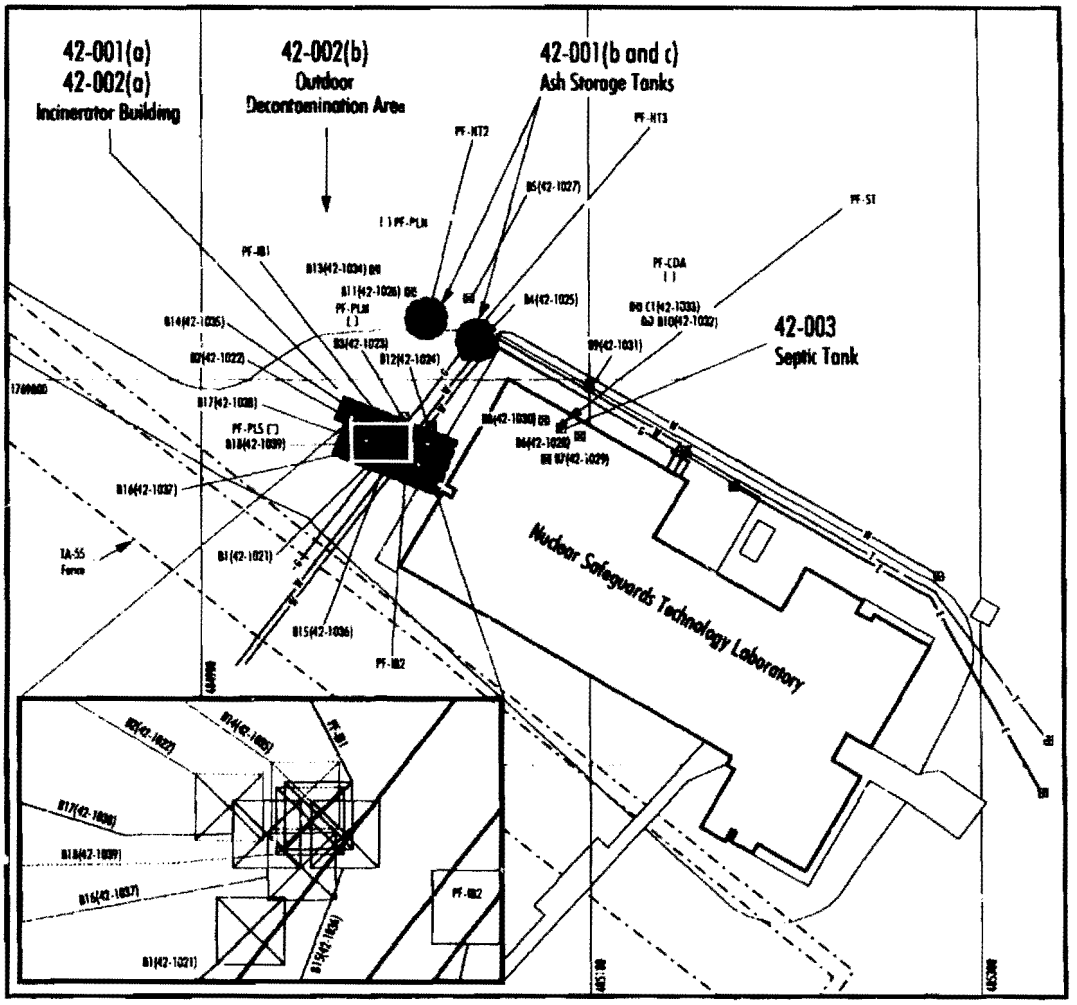


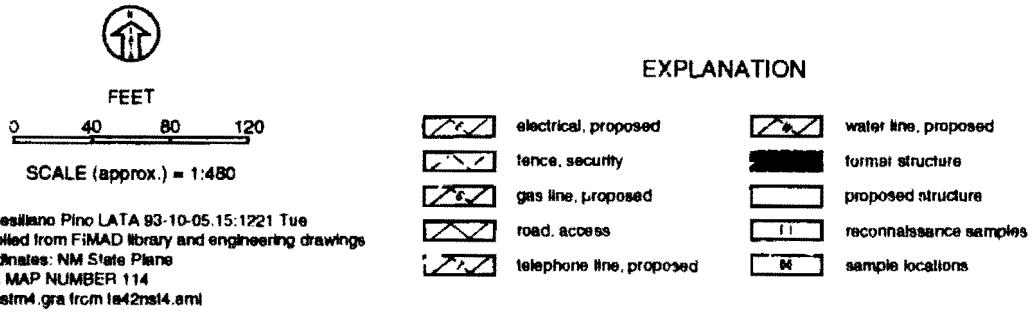
Figure 2. Cross section through former TA-42 site showing existing grade and finished grade after the proposed NSTL building is completed. (A) north view, (B) east view, and (C) east view.

TABLE 4

SUMMARY OF OU 1129 SAMPLES COLLECTED AT FORMER TA-42

Borehole Number	Location ID	Sample Number	Sample Interval (ft)
B1	42-1021	B-1-1	0–1.5
		B-1-2	1.5–2.4
B2	42-1022	B-2-1	0–2.6
		B-2-2	2.6–3.5
B3	42-1023	B-3-1	0–3
		B-3-2	3–4.75
B4	42-1025	B-4-1	0–2.2
		B-4-2	2.2–5.25
B5	42-1027	B-5-1	0–3
		B-5-2	3–6
B6	42-1028	B-6-1	10–15
		B-6-1D	10–15
		B-6-2	15–20
		B-6-3	20–25
		B-6-C-2	25–28
B7	42-1029	B-7-1	10–15
		B-7-2	15–20
		B-7-3	20–25
B8	42-1030	B-8-1	10–15
		B-8-1D	10–15
		B-8-2	15–20
		B-8-3	20–25
		B-8 C-3	25–28
B9	42-1031	B-9-1	10–17
		B-9-2	17–22
		B-9-3	22–27
B10	42-1032	B-10-1	0–5
		B-10-2	5–7
		B-10-3	7–11
B11	42-1026	B-11-1	0–3
		B-11-2	3–6
B12	42-1024	B-12-1	0–3
		B-12-2	3–6
B13	42-1034	B-13-1	0–3
		B-13-2	3–6
B14	42-1035	B-14-1	0–1
		B-14-2	1–2
		B-14-3	2–3
B15	42-1036	B-15-1	0–1
		B-15-2	1–2
		B-15-3	2–3
B16	42-1037	B-16-1	0–1
		B-16-2	1–2
		B-16-3	2–3
B17	42-1038	B-17-1	0–1
		B-17-2	1–2
		B-17-3	2–3
B18	42-1039	B-18-1	0–1
		B-18-2	1–2
		B-18-3	2–3
C1	42-1033	C-1-1	0–3.5





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Compiled from FiMAD library and engineering drawings
Coordinates: NM State Plane
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ta42nstm4.gra from ta42nst4.aml

NOTICE: Building information on this map is provisional and has not been checked for accuracy

Figure 3. Potential realease sites and sampling locations at former TA-42.

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(125 g); for alpha, beta, and gamma screening by the former Health and Environmental Chemistry Group (EM-9 now CST-9) mobile laboratory (500 g); and for EM-9 analysis (125 g). For each sample collected, OU 1129 personnel completed the Chain of Custody/Request for Analysis form. affixed a label to the sample container, and entered a complete description of the sample on the Sample Collection Log.

The field team also used a hand auger to collect subsurface samples in the interval below the soil-tuff interface. After they encountered the interface and collected the near-surface samples, the field team decontaminated the equipment. They continued augering in the nonwelded tuff below the interface until they could no longer turn the auger or until they collected samples from a 3-ft interval. They handled these samples in the same manner as the near-surface samples.

The field team used a power-assisted hand auger to collect samples near the tile drain field. The targeted depths were 0 to 5 ft, 5 ft to 10 ft, and 10 ft to 15 ft; however, the actual depths were 0 to 5 ft, 5 ft to 7 ft, and 7 ft to 11 ft. The field team collected samples from the first 5-ft interval with a hand auger. They attempted to drill the second interval with the hand auger, but when they reached the depth of 7 ft, they could no longer turn the hand auger. They collected samples from that 2-ft interval before using the power-assisted hand auger to collect samples from the 7- to 11-ft interval. By turning the auger bit, they brought the samples up to the surface for collection.

The field team used a hollow-stem auger and a split spoon to collect subsurface samples between 10 ft and 30 ft. The split spoon is a 5-ft core barrel that can be opened to remove the sample. The field team did not sample the top 10 ft of fill material. They started sampling at a depth of 10 ft and collected samples at every 5-ft interval.

3.2 Sampling Locations

Sampling locations were selected to bound the extent of contaminants detected during the reconnaissance study and to include locations where construction activities might impact residual contamination around the NSTL structures or utility lines (Figure 3). Sample locations were surveyed after the samples were collected so that the exact coordinates (XYZ) would be documented.

Sample No. B-10 was moved from the original location that was designated in the SAP because the tile drain field was not found. A second hole was augered to find the location of the former structure. The soil from the abandoned auger hole was collected as a contingency sample (Sample No. C-1) (Figure 3).

4.0 RESULTS

4.1 Stratigraphy of the Site

Schematic cross sections were constructed using the information collected during drilling that also show the finished grade after the proposed NSTL is constructed (Figure 2). Figure 1 shows the location of the cross sections. In addition, detailed geological logs of samples collected using a hollow-stem auger are shown in Figures 4 through 7. These logs include a detailed lithologic description of each core, sections of core not recovered, qualitative moisture content, and the analyses requested for each interval.

4.2 Screening

The EM-9 mobile laboratory performed alpha, beta, and gamma screening of all samples before they were analyzed. The minimum detectable activity (MDA) in a soil matrix is 63 pCi/g for alpha screening, 24 pCi/g for beta screening, and 4 pCi/g for gamma screening. Gross-alpha, -beta, and -gamma radiation above MDA was not detected in any of the samples collected.

4.3 Field Monitoring

Radiation and organic screening were conducted concurrently with the sampling effort. The auger holes and the breathing zones around the sample locations were tested for organic vapors every time the auger advanced an interval. Organic screening was performed with a Century OVA 128 GC and an HNu photoionizing detector. The following materials were monitored for radiation: the soil removed by the hand augers, the drill rig cuttings, the cores after the split spoons were opened, and the equipment after the auger or drill rig advanced an interval. In addition, shoes and coveralls were checked before personnel left the site. Beta and gamma radiation were monitored with an Eberline ESP; alpha radiation was monitored with an Alpha Instrument Model 139.

No radiation above background was detected by the monitoring instruments during sampling. Organic vapors were detected up to 2 ppm in the borehole and in several sections in the split-spoon sampler for the auger drill, but the vapors were not detected in the breathing zone. The industrial hygienist indicated that the reading was probably the result of the high moisture content of the sample or fumes from the drill rig. The samples were high in moisture content but were not saturated.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	42	SAP:	Aggregate J	Date Logged:	07-21-92
Borehole:	B6	Collar Elevation:	7262 ft	Page:	1 of 1
Location ID:	42-1028	Total Depth:	28 ft	Field Team Leader:	Gabriela Gainer
Core Size:	2-1/2 in.	Coordinates:	N 1769770.86 E 485077.53	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. Hollow-Stem Auger				

NOTE: Borehole is located 10 ft northeast of the septic tank

Depth in Feet	Sample Interval	Analysis Requested: Gross-α, β, γ	Isotopic Pu	Am-241	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0											Sandy soil/tuff pebbles mix; gray; depth 0 to 2 ft
											Soil/clay/tuff mix; gray to reddish brown; depth 2 to 3 ft
											No recovery between 3 and 4.5 ft
5											Soil/tuff mix; tan to gray; depth 4 to 6 ft
											Soil/clay/tuff; moderate clay horizon; dark brown; depth 6 to 8 ft
											No recovery between 8 and 8.5 ft
											Soil/tuff mix; trace to moderate clay; tan to brown; depth 8.5 to 10 ft
10											Tuff contact in this zone; difficult to identify actual contact; soft; depth 10 to 12 ft
		X		X	B-6-1 B-6-1D						Clay and roots; orange; depth 12 to 12.5 ft
											Tuff, soft; tan to brown; depth 12.5 to 15 ft (no competence at 12.5 and 13 ft)
15											Clay, reddish brown with ≤30% tuff (soft gray to brown); depth 15 to 18 ft; 1/4-in. root running down axis of core barrel in clay zone; white clay at contact with tuff
		X	X	X	B-6-2						Clay, same as above but without organics; depth 18 to 20 ft.
20											50% clay and 50% soft tuff; tuff is drying out but is still very soft and fragile; clay is very moist at contact with tuff; depth 20 to 22 ft
		X		X	B-6-3						Tuff, fragile; pumice is visible; gray; depth 22 to 23 ft
25											Tuff, edges are dusty; beginning to be competent and welded; up to 1-in. pumice crystals; gray; depth 23 to 28 ft
		X		X	B-6-C-2						
30											Total depth: 28 ft

NOTE: No dust was visible at collar or during drilling; interval from 23 to 28 ft was dry; small amount of dust was visible during trip out; fill material from approximately 0 to 11 ft.

FIG 04 / TA-42 FINAL RPT / 090694

Figure 4. Geological log of Borehole No. B6.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log
RCRA Site Characterization

Technical Area:	42	SA P:	Aggregate J	Date Logged:	07-21-92
Borehole:	B7	Collar Elevation:	7263 ft	Page:	1 of 1
Location ID:	42-1029	Total Depth:	28.5 ft	Field Team Leader:	Gabriela Gainer
Core Size:	2-1/2 in.	Cordinates:	N 1769759.13 E 485077.53	Geologist:	Jeff Wallerschek
Method:	6-1/2-in. Hollow-Stem Auger				

NOTE: Borehole is located at the septic line cleanout 15 ft south of the septic tank

Depth in Feet	Sample Interval	Analysis Requested: Gross-α, β, γ	Isotopic Pu	Am-241	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0											Tuff/soil mix (60% tuff gravels, 40% silty sand of tuff origin); gray to brown; trace of clay; depth 0 to 3.5 ft
											No recovery between 3.5 and 4.5 ft
5											Tuff/soil mix as noted in 0 to 3.5-ft depth; slight increase in brown clay; depth 4.5 to 6.5 ft
											Clayey soil; brown; depth 6.5 to 8.5 ft
											Clay with weathered tuff gravels and soils; brown; depth 8.5 to 10 ft (NOTE: Tuff contact at 10 ft)
10		X	X	X	B-7-1						Tuff, weathered but firm core; pumice is evident; "rocky"; gray; depth 10 to 13.5 ft
15		X	X	X	B-7-2						Tuff, competent; not quite dusty, but getting very dry with depth; gray; pumice and quartz crystals; depth 13.5 to 18.5 ft (NOTE: Possible PID hit at approximate depth of 14.0 to 16.0 ft)
20		X	X	X	B-7-3						Tuff, competent; gray; drying out with depth; depth 18.5 to 23.5 ft
											Tuff, competent; gray; depth 23.5 to 25.0 ft
25											Tuff, competent; gray; dusty; depth 26 to 28.5 ft (NOTE: Sample not taken between 25 and 28 ft)
30											Total depth: 28.5 ft

NOTE: The interval from 14 to 28.5 ft contained competent tuff; wind was blowing 10 to 15 mph and swirling around vehicles; dust was also blowing off auger during trip out; fill material from approximately 0 to 10 ft.

FIG 05 / TA-42 FINAL RPT / 08/594

Figure 5. Geological log of Borehole No. B7.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log
RCRA Site Characterization

Technical Area:	42	SAP:	Aggregate J	Date Logged:	07-21-92
Borehole:	B8	Collar Elevation:	7262 ft	Page:	1 of 1
Location ID:	42-1030	Total Depth:	28 ft	Field Team Leader:	Gabriela Gainer
Core Size:	2-1/2 in.	Coordinates:	N 1769778.96 E 485076.86	Geologist:	Jeff Walterschaid
Method:	6-1/2-in. Hollow-Stem Auger				

NOTE: Borehole is located 10 ft northwest of the septic tank

Depth in Feet	Sample Interval	Analysis Requested: Gross-α, β, γ	Isotopic Pu	Am-241	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0											Fill, soil/tuff mix predominantly fine to medium silty sand with tuff gravels; trace clay, gray; depth 0 to 2 ft
											Clayey soil with tuff gravels; brown; depth 2 to 3 ft
											No recovery between 3 and 4 ft
5											70% clay 30% purple tuff gravels with pumice; brown; pieces of asphalt (small pebbles) found at 5.5 ft; depth 4 to 8 ft
											Soil/tuff mix; depth 8 to 10 ft
10											Brown clay zone at tuff contact; depth 10 to 11.5 ft
		X	X	X	B-8-1 B-8-1D						Tuff, weathered, not competent, visible pumice; gray; depth 11.5 to 13 ft.
											Tuff, rocky, not quite competent; gray to tan; depth 13 to 15 ft
15											Tuff, competent, almost dusty but still holding moisture; pumice evident; gray to tan; depth 15 to 18 ft
		X	X	X	B-8-2						
20											Tuff, competent, drying out with depth; gray to tan; depth 18 to 23 ft
		X	X	X	B-8-3						
											Tuff, same as above; depth 23 to 24 ft
25											Tuff, competent, dusty, lightly welded; gray; depth 24 to 28 ft
		X	X	X	B-8-C-3						
30											

Total depth: 28 ft

NOTE: No dust was visible during drilling; swirling winds were blowing 10 to 15 mph; dust was blowing during trip out; fill material from approximately 0 to 11 ft.

FIG 06 / TA-42 FINAL RPT / 081994

Figure 6. Geological log of Borehole No. B8.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log
RCRA Site Characterization

Technical Area:	42	SAP:	Aggregate J	Date Logged:	07-21-92
Borehole:	B9	Collar Elevation:	7260 ft	Page:	1 of 1
Location ID:	42-1031	Total Depth:	27 ft	Field Team Leader:	Gabriela Gainer
Core Size:	2-1/2 in.	Cordinates:	N 1769796.48 E 485100.34	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. Hollow-Stem Auger				

NOTE: Collared hole at northwest edge of antihelicopter pad where proposed utility lines will run. Will also check the tile field. Pad consists of 70% soil (tuff orgin) and 30% tuff blocks (pebbles to 6-in. diameter). Light gray to brown, dusty at surface.

Depth in Feet	Sample Interval	Analysis Requested: Gross-α, β, γ	Isotopic Pu	Am-241	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0											Tuff/soil mix; gray; no dust during clearing; depth 0 to 1 ft
											Tan block of tuff; depth 1 to 2 ft
5											Soil (70%)/tuff (30%) mix; increase in brown clay visible with depth; gray to reddish-brown with increase in clay content, moisture increasing with clay content; depth 2 to 6 ft
											No recovery between 6 and 7 ft
											Clayey soil; reddish brown; tuff pebbles smaller and less prevalent; high moisture content in clay; depth 7 to 12 ft
10											(NOTE: Zone of asphalt rubble evident between 10.3 ft and 10.5 ft; it is included in the first sample)
		X	X	X	B-9-1						No recovery between 12 and 15 ft
15											100% recovery; tuff contact at approximately 16 ft (actual contact is unknown because of recovery problems between 12 and 15 ft); strong clay horizon at contact; soft weathered tuff very moist; light brown to gray; pumice evident; depth 15 to 17 ft
											Tuff continues; depth 17 to 18 ft
		X	X	X	B-9-2						Reddish brown clay seam at a depth of 19 to 20 ft
20											Soft tuff; gray; depth 20 to 21 ft
											Clay seam at a depth of 21 to 21.5 ft
											Nonwelded tuff; gray; drier as tuff turns from gray to flesh color; depth 21.5 to 22 ft
											Same as above; 22–22.5-ft depth
		X	X	X	B-9-3						Reddish brown clay fracture fill (50% tuff, 50% clay); gray tuff; depth 22.5 to 23 ft
25											Nonwelded tuff; very fragile; noncohesive; light gray to flesh color; increase in pumice content; depth 23 to 27 ft
											(NOTE: Tuff will probably be dry within the next 10 ft)
30											

Total depth: 27 ft

NOTE: No dust was visible during drilling or trip out; fill material from approximately 0 to 16 ft.

FIG 07 / TA-42 FINAL RPT / 082594

Figure 7. Geological log of borehole No. B9.

Field monitoring of fugitive dust at the site was conducted in conjunction with the drilling operation. Two high-volume air samplers (HVAS) were set up at the site, one upwind and one downwind from the drill rig. The filter samples were submitted to CST-9 for analysis of gross-alpha, -beta, and -gamma activity; $^{239,240}Pu$; and ^{241}Am. Results from the HVAS are shown in Table 5. Negative values are a result of counting statistics; activity in those filters was at background levels.

TABLE 5

RESULTS FROM HIGH-VOLUME AIR SAMPLERS

Analyte	Upwind HVAS (pCi/filter)		Downwind HVAS (pCi/filter)	
	Analytical Result	Analytical Unc*	Analytical Result	Analytical Unc*
Alpha	0.9	0.2	0.8	0.2
Beta	1.9	0.3	2.0	0.3
Gamma	–80	80	–100	80
^{238}Pu	0.002	0.011	0.015	0.016
$^{239,240}Pu$	0.006	0.01	0.026	0.016
^{241}Am	0.0	0.23	–0.01	0.04

* Unc = uncertainty

The concentrations of ^{238}Pu and $^{239,240}Pu$ in air filter samples collected downwind from the drilling operation were higher than those collected upwind. However, because of uncertainty in the analytical results, no statistical difference exists between upwind and downwindsamples collected. The ^{241}Am concentrations in air filter samples collected downwind from the drilling operation were similar to those collected upwind.

4.4 Isotope and Nuclear Chemistry Group Analysis

The former INC-12 provided the necessary quick-turnaround analysis of samples. The INC-12 analyses were used to make decisions about the need for remediation at the site. INC-12 provided ^{238}Pu, $^{239,240}Pu$, and lead analyses for a selected suite of samples (Table 6). The suite of samples to be analyzed was selected based on knowledge gained from the results of the reconnaissance study and on construction project plans. Samples were collected from the area of the incinerator and the ash storage tanks, critical depths at the septic tank, locations of planned excavations for utility lines, and the outdoor decontamination area. Because the INC-12 analyses are not Contract Laboratory Program Level III or higher, and because procedures approved by the Environmental Protection Agency were not followed, a description of the sample preparation, analyses, and limits of detection is included as Appendix A.

TABLE 5

INC-12 ANALYTICAL RESULTS OF SAMPLING AT FORMER TA-42

Sample Number	Sample Depth (feet)	^{238}Pu (pCi/g)	Error %	$^{239,240}Pu$ (pCi/g)	Error %	Total Pb (ppm)	TCLP[a] Equivalent (mg/L)
B-1-1	0-1.5	0.036	8	1.28	6.5	17	0.85
B-2-1	0-2.6	< 0.02	12	0.094	15	< 5	< 0.25
B-2-2	2.6-3.5	< 0.004	1	0.044	11	< 5	< 0.25
B-3-2	3-4.75	0.016	25	1.05	4.8	< 5	< 0.25
B-4-1	0-2.2	0.0067	24	0.110	20	NM[b]	NA[c]
B-4-2	2.2-5.25	< 0.002	2	0.144	0.9	NM	NA
B-5-2	3-6	< 0.004	9	0.165	13	NM	NA
B-6-2	15-20	< 0.06	17	< 0.406	18	NM	NA
B-6-C-2	25-28	< 0.06	9	< 0.29	79	NM	NA
B-7-2	15-20	< 0.01	6	< 0.006	45	NM	NA
B-8-2	15-20	0.067	7	< 0.002	28	NM	NA
B-8-C-3	25-28	< 0.03	9	< 0.17	13	NM	NA
B-9-1	10-17	0.010	20	0.176	12	NM	NA
B-9-2	17-22	< 0.01	3	< 0.003	28	NM	NA
B-10-1	0-5	0.022	19	0.639	14	NM	NA
B-10-3	7-11	0.009	44	< 0.006	24	NM	NA
B-11-1	0-3	0.012	30	0.149	2.9	NM	NA
B-12-1	0-3	< 0.003	5	0.043	11	NM	NA
B-12-2	3-5	0.029	18	0.877	3.0	NM	NA
B-13-1	0-3	< 0.01	2	< 0.002	23	NM	NA

a. TCLP = toxicity characteristic leaching procedure
b. NM = not measured
c. NA = not applicable

Results of the INC-12 analyses are presented in Table 6. The error percentages for the plutonium values reflect the counting errors. Results are given by sample number for each depth sampled. Values reported as "less than" (<) are below the detection level of the instrument. The value provided in these cases is based only on counting statistics for radiochemistry results. TCLP equivalents were calculated using a worst-case scenario in which all of the lead present is assumed to be leachable. The purpose of this calculation is only to compare the INC-12 results with those from the EM-8 reconnaissance study.

These preliminary INC-12 data showed that the levels of contaminants of concern (COCs) were below screening action levels. Figure 3 shows that most of the NSTL building foundation would not overlap the footprint of the former incinerator facility; the parking lot of the proposed NSTL would be the only structure covering the former incinerator facility and associated structures. Therefore, if other data (such as the final

contract laboratory analysis) showed elevated concentrations of COCs, remediation could still be conducted because only the parking lot would need to be removed. With this preliminary information, DOE/AL gave ENG Division and N Division approval for construction validation in October 1992. (A complete package of final contract laboratory analysis was not received until November 1993.)

4.5 Energy Dispersive X-Ray Fluorescence Screening

The results of the INC-12 analyses for lead (highest value was 0.85 mg/L equivalent TCLP) were inconsistent with the level of lead in Sample No. PF-IB1 (11.4 mg/L by TCLP), which was collected during the reconnaissance study (Table 3). Therefore, more information was needed to assess the extent of lead at the site of the former incinerator. Energy dispersive x-ray fluorescence (EDXRF) screening was conducted. Figure 8 shows the predicted distribution of lead concentrations using the interpolation technique kriging, and then plotting the predicted concentrations using the SURFER software package. The model calculated an area approximately 5 ft in diameter around Sample No. PF-IB1 (Figure 1) in which TCLP concentrations of lead could be as high as 7.5 mg/L.

Lead screening and sampling was conducted inside the 7.5-mg/L contour predicted by the model. Figures 3 and 8 show the sample locations that were selected inside this circumference to test the model. Four locations (Nos. B14 through B17) were sampled 2 ft from Sample No. PF-IB1, in cardinal directions (N, S, E, and W). In addition, one location (No. B18) was sampled immediately adjacent to Sample No. PF-IB1 to determine if the 11.4 mg/L (TCLP) lead in Sample No. PF-IB1 was due to a point source of contamination.

The samples were analyzed with a portable EDXRF instrument. The instrument is a Spectrace 9000 that provides portable field EDXRF analysis. Splits were collected from each 1-ft interval, placed in special 32-mm sample cups, and sealed with 4-µm polypropylene x-ray film windows. Total lead results are shown in Table 7. TCLP equivalent concentrations were calculated from the total lead analyses and are also included in Table 7. The calculation assumes that lead is 100% leachable from the soil. If TCLP analyses for lead were performed on these samples, the values would be less than the calculated maximum. The calculation is based on the analytical methodology given in 40 CFR 261, Appendix II, Method 1311 (EPA 1993, 40099), in which the solid phase is extracted with an amount of extraction fluid equal to 20 times the weight of the solid phase.

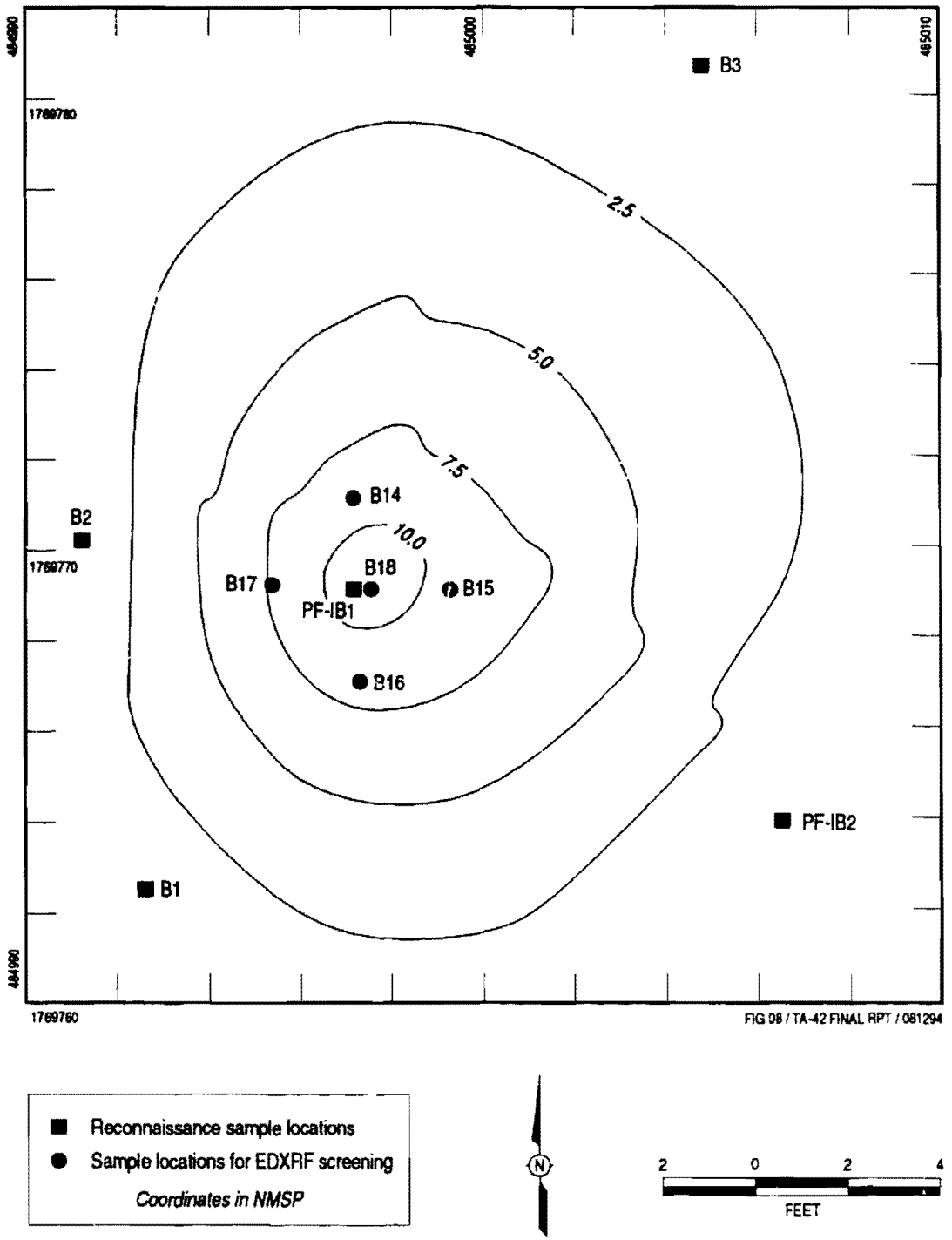

Figure 8. Predicted distribution of lead TCLP concentration isopleths based on reconnaissance sampling data. Kriging interpolation technique was used.

TABLE 7

EDXRF ANALYSIS RESULTS OF LEAD INVESTIGATION AT FORMER TA-42

Sample Number	Total Pb by EDXRF[a] (ppm)	TCLP[b] Equivalent[c] (ppm)	Contract Laboratory Total Pb (ppm)
B-14-1	8	0.4	
B-14-2	19	0.95	
B-14-3	19	0.95	
B-15-1	12	0.6	
B-15-2	6	0.3	
B-15-3	10	0.5	
B-16-1	12	0.6	
B-16-2	25	1.25	10.4
B-16-3	19	0.95	
B-17-1	19	0.95	
B-17-2	7	0.35	
B-17-3	16	0.8	
B-18-1	19	0.95	12.5
B-18-2	15	0.75	15.3
B-18-2R	15	0.75	17.1
B-18-3	13	0.65	12.4

a. EDXRF = energy dispersive x-ray fluorescence
b. TCLP = toxicity characteristic leaching procedure
c. Equivalent from EDXRF analyses, 40 CFR 261, Appendix II, Method 1311 (EPA 1993, 40099)

EDXRF analyses did not show lead concentrations equivalent to or greater than 5 mg/L (TCLP); therefore, only five of the splits collected from each 1-ft interval were submitted to CST-9 for confirmatory contract laboratory analyses. The results of the confirmatory analyses are also shown in Table 7 for comparison. The results of the EDXRF analysis were very close to the analyses conducted by the contract laboratory using inductively coupled plasma emission spectroscopy, making the fast-turnaround technique of EDXRF a good alternative technique for lead analysis.

The most plausible explanation for the 11.4-mg/L (TCLP) analytical result for lead is that the contamination detected in Sample No. PF-IB1 was due to either a very localized point source or an analytical error.

4.6 Contract Laboratory Analytical Results

An aliquot of samples collected was submitted to CST-9 for confirmatory contract laboratory analysis. Only 5 of the 16 samples collected for lead analysis were submitted. Not all samples were analyzed for all

TABLE 8

CONTRACT LABORATORY ANALYTICAL RESULTS

Sample Number	^{238}Pu (pCi/g)	Unc[a]	^{239}Pu (pCi/g)	Unc	Pb (mg/kg)	Unc	^{241}Am (pCi/g)	Unc
B-1-1	0.0739	0.0244	0.0523	0.0208	14.4	2.88	0.0491	0.0352
B-1-1D					14.5	2.9		
B-1-2	0.2	0.062	0.0839	0.0395	4.3	0.86	0.0657	0.0568
B-2-1	0.02	0.02	0.11	0.03	12.	2.4	0.17	0.03
B-2-2	0.01	0.02	0.03	0.02	6.6	1.32	0.02	0.025
B-3-1	0.0	0.025	0.0	0.015	11.7	2.34	0.02	0.015
B-3-2	1.75	0.24	2.24	0.31	28.1	5.62	0.332	0.107
B-4-1	0.438	0.149	0.125	0.08			0.121	0.055
B-4-2	0.289	0.107	0.231	0.096			0.0818	0.0477
B-5-1	0.36	0.146	0.216	0.112			0.0958	0.0558
B-5-2	0.139	0.075	0.511	0.155			0.138	0.061
B-6-1	0.101	0.096	0.151	0.114			0.061	0.211
B-6-1D	0.36	0.153	0.565	0.0712			0.0249	0.0499
B-6-2	0.0319	0.0371	0.0212	0.0302			0.0862	0.0529
B-6-3	0.052	0.0606	0.0	0.0028			0.138	0.062
B-6-C-2	0.136	0.09	0.0964	0.0743			0.135	0.057
B-7-1	0.0	0.0018	0.0722	0.0599			0.0707	0.0584
B-7-2	0.168	0.09	0.0112	0.0225			0.0388	0.0778
B-7-3	0.0393	0.0788	0.0	0.06			0.0413	0.034
B-8-1	1.95	0.44	10.3	1.7			0.152	0.074
B-8-1D	0.565	0.2	1.46	0.36			0.292	0.107
B-8-2	0.0836	0.0727	0.0119	0.024			0.327	0.098
B-8-3	0.269	0.105	0.0179	0.0254			0.358	0.112
B-8-C-3	0.147	0.09	0.0793	0.061			0.332	0.097
B-9-1	0.0492	0.0738	0.312	0.159			0.463	0.116
B-9-1D	0.132	0.07	0.29	0.111			0.749	0.171
B-9-2	0.0238	0.0424	0.0189	0.0378			0.529	0.127
B-9-3	0.332	0.144	0.0553	0.0559			0.342	0.102
B-10-1	0.377	0.171	0.298	0.151			0.103	0.046
B-10-1D	0.0973	0.0783	0.401	0.152			0.209	0.069
B-10-2	0.0992	0.0765	0.0142	0.0491			0.157	0.075
B-10-3	0.0806	0.062	0.229	0.125			0.057	0.114
B-11-1	0.389	0.165	0.135	0.102			0.107	0.055
B-11-2	0.214	0.108	0.465	0.167			0.227	0.071
B-12-1	0.154	0.091	0.0441	0.0543			0.0804	0.0455
B-12-2	0.07	0.0504	0.963	0.225			0.38	0.12
B-13-1	0.0827	0.0719	0.0591	0.0535			0.933	0.194
B-13-2	0.0771	0.07	0.0	0.0024			0.309	0.09
B-16-2					10.4	NR[b]		
B-18-1					12.5	NR		
B-18-2					15.3	NR		
B-18-2R					17.1	NR		
B-18-3					12.4	NR		
C-1-1	0.156	0.102	0.29[c]	0.144			0.105	0.052

a. Unc = uncertainty
b. NR = not reported

TABLE 8 (continued)

CONTRACT LABORATORY ANALYTICAL RESULTS

Sample Number	^{228}Th (pCi/g)	Unc[a]	^{230}Th (pCi/g)	Unc	^{232}Th (pCi/g)	Unc	^{234}U (pCi/g)	Unc	^{235}U (pCi/g)	Unc	^{238}U (pCi/g)	Unc
B-1-1												
B-1-1D												
B-1-2												
B-2-1												
B-2-2												
B-3-1												
B-3-2												
B-4-1												
B-4-2												
B-5-1												
B-5-2	1.9	0.49	1.55	0.41	1.53	0.41	0.819	0.28	0.0999	0.0901	0.779	0.226
B-6-1												
B-6-1D												
B-6-2												
B-6-3												
B-6-C-2												
B-7-1												
B-7-2												
B-7-3												
B-8-1												
B-8-1D												
B-8-2												
B-8-3												
B-8-C-3												
B-9-1												
B-9-1D												
B-9-2												
B-9-3												
B-10-1												
B-10-1D												
B-10-2												
B-10-3												
B-11-1	1.27	0.29	1.1	0.26	1.39	0.3	1.	0.43	0.0	0.105	0.815	0.365
B-11-2												
B-12-1												
B-12-2												
B-13-1	2.59	0.81	1.52	0.55	0.91	0.395						
B-13-2	1.83	0.69	1.1	0.44	1.46	0.53						
B-16-2												
B-18-1												
B-18-2												
B-18-2R												
B-18-3												
C-1-1												

a. Unc = uncertainty

COCs because some COCs are present only at certain PRSs. Table 8 lists which COCs the contract laboratory analyzed for and shows the results and uncertainty values. Blank spaces under some analytes indicate that the samples were not analyzed for that particular COC.

5.0 DATA ANALYSIS: INTERPRETATION, MODELS, AND PARAMETERS

All analytical results (such as reconnaissance, INC-12, contract laboratory, and EDXRF) were compared with the Environmental Restoration (ER) Program derived screening action levels (LANL 1993, 26077; LANL 1993, 26078). Table 9 shows the screening action levels for COCs compared with the highest concentrations measured at the site (independent of facility or method used). None of the samples contained concentrations above the screening action level; in fact, all concentrations were at least an order of magnitude below the screening action level except for ^{232}Th. The screening action level for ^{232}Th is 0.88 pCi/g; however, the generic limit set in DOE Order 5400.5 (DOE 1990, 0080) is 5 pCi/g averaged over the first 15 cm of soil and 15 pCi/g averaged over each additional 15-cm interval. The sample that contained 1.53 pCi/g of ^{232}Th was collected at the interval between 3 ft and 6 ft. Even though this value is above the screening action level published in the Installation Work Plan (LANL 1993, 26077; LANL 1993, 26078), it is an order of magnitude below the limit set by DOE.

TABLE 9

COMPARISON OF SCREENING ACTION LEVELS WITH CONTAMINANTS OF CONCERN AT FORMER TA-42

Chemical	Soil Screening Action Level [a]	Maximum Result at TA-42
Pb	500.0 mg/kg	28.1 mg/kg
^{241}Am	22.0 pCi/g	0.933 pCi/g
^{238}Pu	27.0 pCi/g	2.48 pCi/g
^{239,240}Pu	24.0 pCi/g	10.3 pCi/g
^{230}Th	10.0 pCi/g	1.55 pCi/g
^{232}Th	0.88 pCi/g[b]	1.53 pCi/g
^{234}U	86.0 pCi/g	1. pCi/g
^{235}U	18.0 pCi/g	0.0999 pCi/g
^{238}U	59.0 pCi/g	0.815 pCi/g

a. Installation Work Plan (LANL 1993, 26077; LANL 1993, 26078)

b. Generic limits for ^{232}Th are set in DOE Order 5400.5 (DOE 1990, 0080) at 5 pCi/g averaged over the first 15 cm of soil and 15 pCi/g averaged over each additional 15-cm interval. The more conservative derived screening action levels should be used for screening purposes only.

Table 10 contains descriptive statistics for the data from former TA-42. All data available for COCs were used to create the descriptive statistics except the uranium data collected during the reconnaissance study. The samples collected during the reconnaissance study were analyzed for total uranium instead of isotopic uranium; therefore, comparisons cannot be made. The background level for uranium is 3.4 µg/g (Environmental Protection Group 1992, 7004). Samples collected during the reconnaissance study had concentrations near background levels (see Table 3) and therefore do not present a concern. In addition, isotopic uranium activity measured during the characterization effort is below the screening action levels. The data shown in Table 10 were used to construct Figure 9, which shows the screening action level with respect to the data range for each COC. The data were also modeled using gridding software to better illustrate the distribution of the COCs at the site. The ROCKWORKS software system was used to construct concentration or activity isopleths.

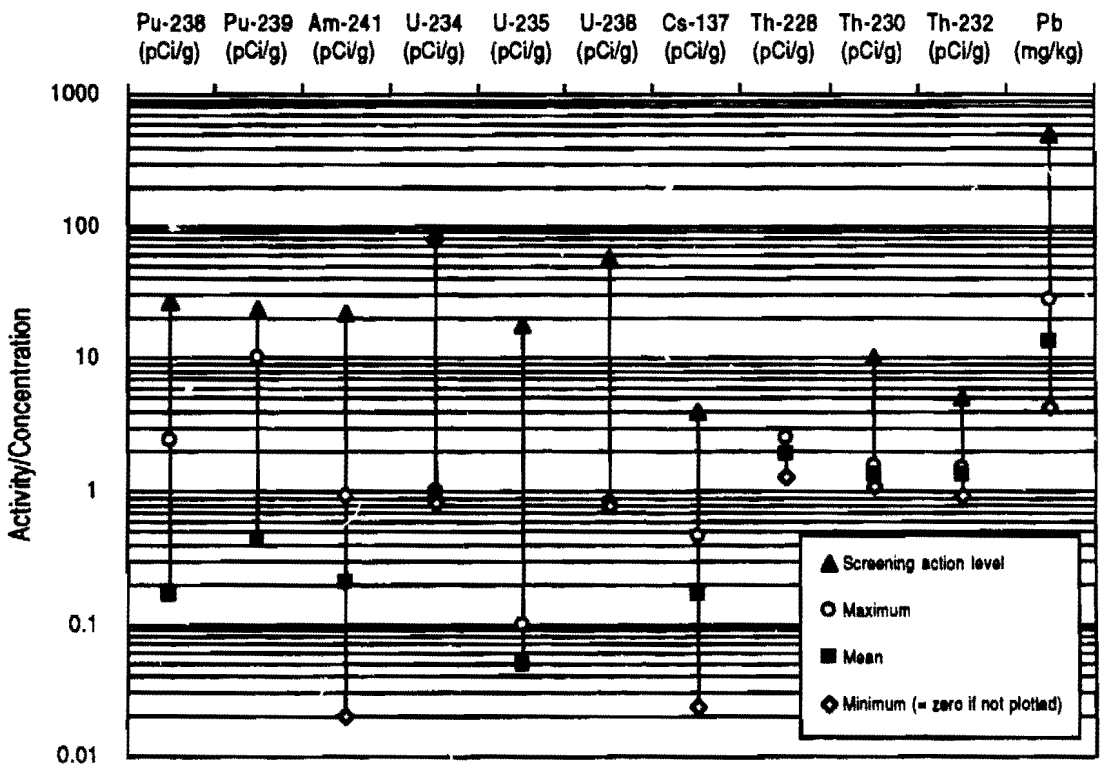

Figure 9. Data summary for former TA-42.

TABLE 10

DESCRIPTIVE STATISTICS FOR FORMER TA-42 DATA

	^{238}Pu (pCi/g)	^{239}Pu (pCi/g)	Pb (mg/kg)	^{241}Am (pCi/g)	^{137}Cs (pCi/g)
Screening Action Level*	27	24	500	22	4
Maximum	2.48	10.3	28.1	0.933	0.463
Mean	0.170	0.419	13.291	0.208	0.166
Minimum	0	0	4.3	0.02	0.024
Standard Error	0.048	0.155	1.028	0.033	0.025
Median	0.034	0.076	12.75	0.137	0.165
Mode	0.01	0	19	0.02	0.064
Standard Deviation	0.415	1.335	5.815	0.202	0.108
Sample Variance	0.172	1.782	33.817	0.041	0.012
Kurtosis	19.391	43.271	0.137	4.159	1.982
Skewness	4.314	6.231	0.409	1.903	1.104
Range	2.48	10.3	23.8	0.913	0.439
Sum	12.584	31.019	425.3	7.901	2.995
Number of Samples	74	74	32	38	18
Confidence Level (95.000%)	0.094	0.304	2.015	0.064	0.050

	^{228}Th (pCi/g)	^{230}Th (pCi/g)	^{232}Th (pCi/g)	^{234}U (pCi/g)	^{235}U (pCi/g)	^{238}U (pCi/g)
Screening Action Level*		10	5	86	18	59
Maximum	2.59	1.55	1.53	1	0.0999	0.815
Mean	1.898	1.318	1.323	0.910	0.050	0.797
Minimum	1.27	1.1	0.91	0.819	0	0.779
Standard Error	0.270	0.126	0.140	0.091	0.050	0.018
Median	1.865	1.31	1.425	0.910	0.050	0.797
Mode	N/A	1.1	N/A	N/A	N/A	N/A
Standard Deviation	0.541	0.251	0.281	0.128	0.071	0.025
Sample Variance	0.293	0.063	0.079	0.016	0.005	0.001
Kurtosis	1.489	-5.929	3.202	N/A	N/A	N/A
Skewness	0.357	0.012	-1.755	N/A	N/A	N/A
Range	1.32	0.45	0.62	0.181	0.100	0.036
Sum	7.59	5.27	5.29	1.819	0.100	1.594
Number of Samples	4	4	4	2	2	2
Confidence Level (95.000%)	0.530	0.246	0.275	0.177	0.098	0.035

* Installation Work Plan (LANL 1993, 26077; LANL 1993, 26078)

5.1 Two-Dimensional Modeling: Concentration or Activity Isopleths

The GRIDZO software package was used to construct grids and fit the data using an algorithm for inverse-distance weighing without radial searching. The data were then contoured to create isopleths of concentrations or activities for each COC. The inverse-distance-weighing algorithm accommodates clustered data points and will not exaggerate its extrapolations beyond the given data points. This algorithm was chosen because of the nature of the PRSs. The potential contamination associated with each PRS is independent of the others, so an algorithm that would restrict influences from other clusters of data was the ideal one to use. Appendix B contains tables showing the parameters that were chosen to construct the isopleth maps.

The data chosen to construct the two-dimensional isopleth maps were the highest concentration or activity measured for each particular COC at each unique XY coordinate (sampling location). That is, if four samples were taken at different depth intervals at a unique XY coordinate, the highest concentration or activity measured for each COC in any of those samples was selected to construct the contour map. Figures 10 through 13 show isopleth maps constructed for ^{241}Am, ^{238}Pu, ^{239,240}Pu, and lead.

The highest ^{241}Am activity was found in the northern-most section of the outdoor decontamination area (0.9 pCi/g) and in the sample intersecting the line that connects the tile drain field with the septic tank (0.75 pCi/g) (see Figure 10). Figures 11 and 12 show that ^{238}Pu and ^{239,240}Pu have elevated and lower activities in the same areas on the isopleth maps. Elevated activities for ^{238}Pu and ^{239,240}Pu were found in the former location of the incinerator. Lead is distributed somewhat uniformly throughout the site (Figure 13), with values ranging from 4.3 mg/kg to 28.1 mg/kg. These values for lead are at background levels when compared with the values determined by a reconnaissance study in 1990 (Environmental Protection Group 1992, 7004). Values of lead in samples collected from canyons throughout the Laboratory ranged from 20 mg/kg to 28 mg/kg.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

Activities described in this report were conducted in accordance with ER Program administrative procedures (APs) and standard operating procedures (SOPs). The procedures listed below were followed.

- LANL-ER-AP-02.1, "Procedure for LANL ER Records Management"
- LANL-ER-SOP-01.01, "General Instructions for Field Investigations"
- LANL-ER-SOP-01.02, "Sample Containers and Preservation"
- LANL-ER-SOP-01.03, "Handling, Packaging, and Shipping of Samples"

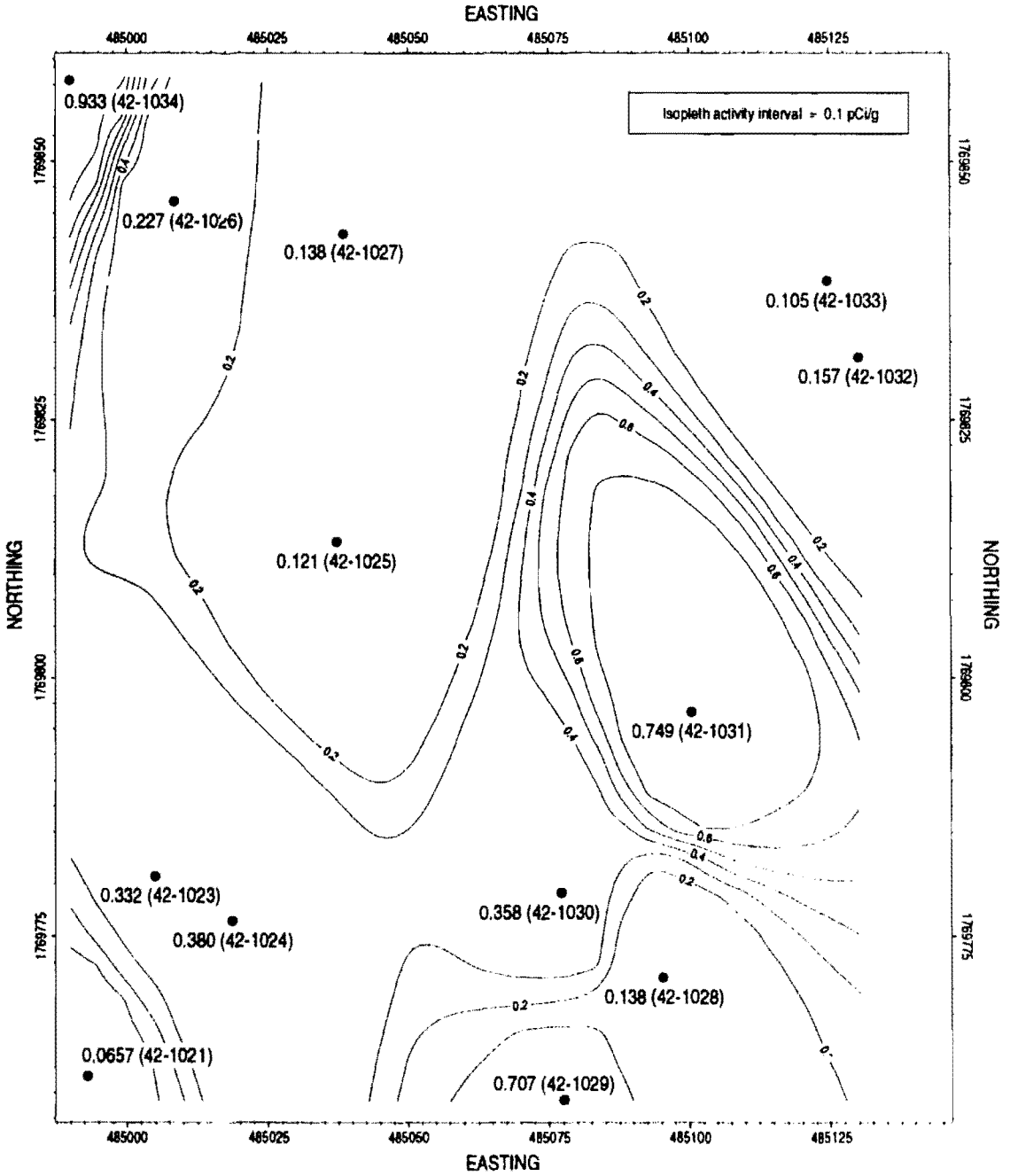

FIG 10 / TA-42 FINAL RPT / 081794

Figure 10. Predicted activity isopleths for ^{241}Am at former TA-42.

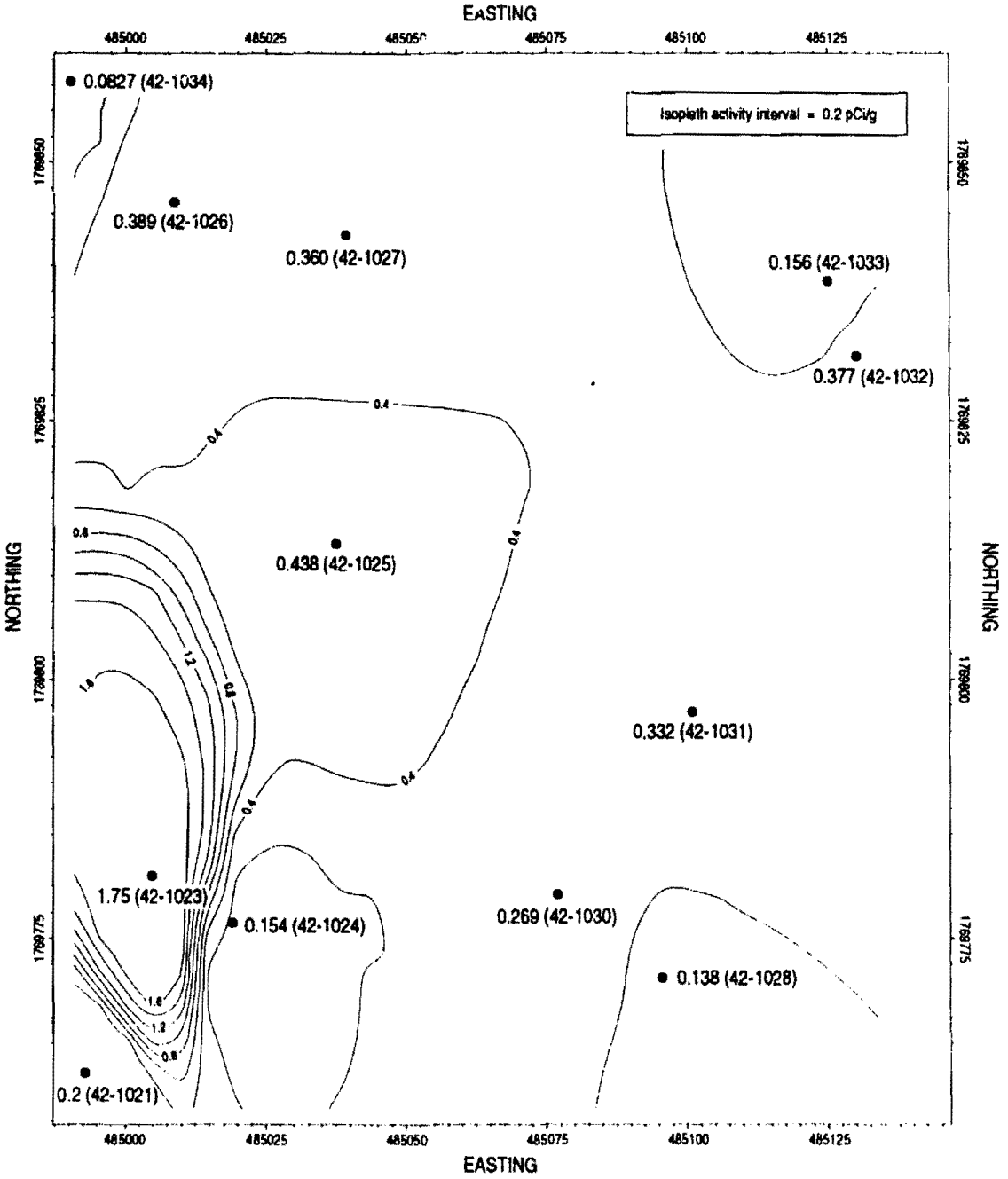

FIG 11 / TA-42 FINAL RPT / 090794

Figure 11. Predicted activity isopleths for ^{238}Pu at former TA-42.

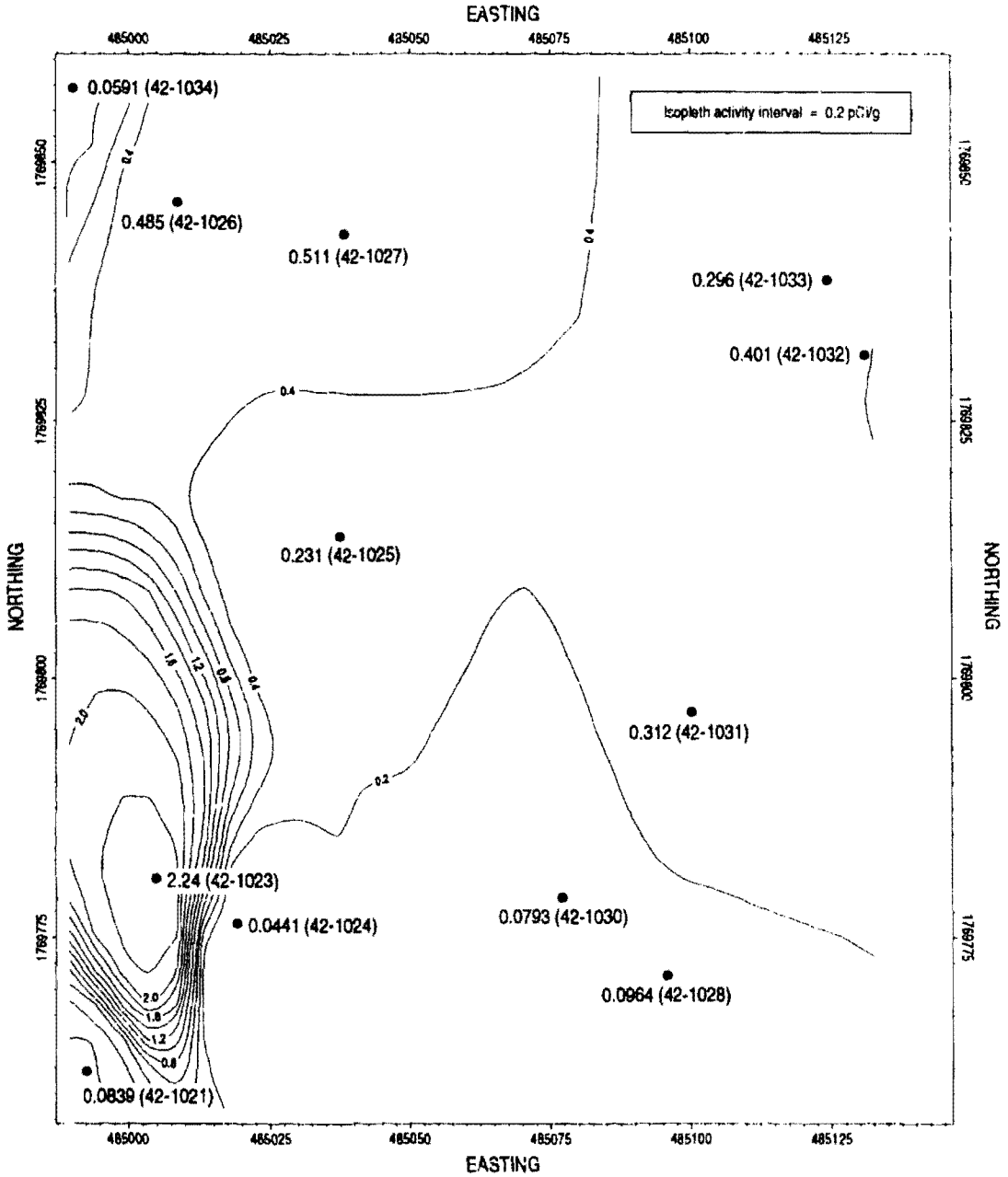

FIG 12 / TA-42 FINAL RPT / 081794

Figure 12. Predicted activity isopleths for $^{239,240}Pu$ at former TA-42.

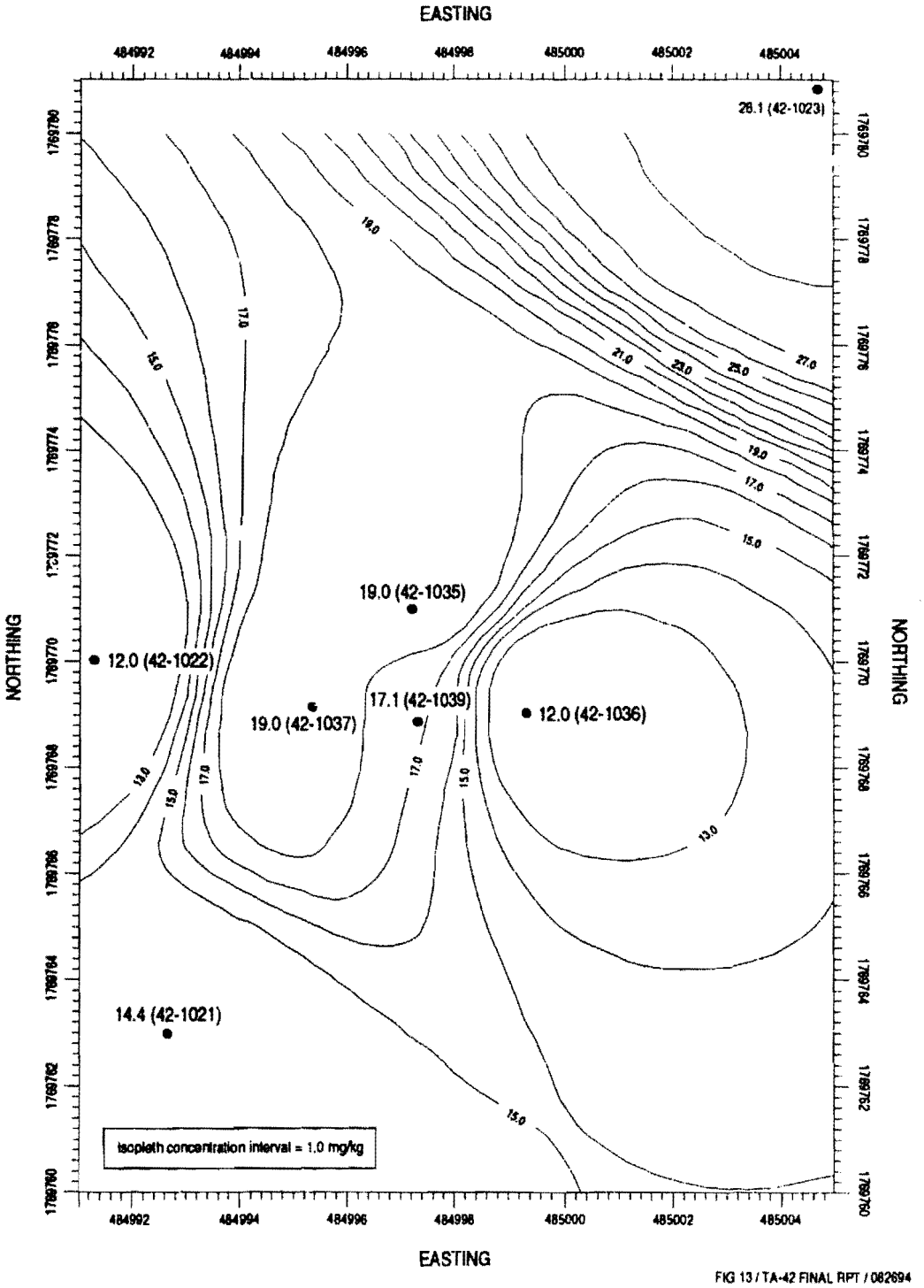

Figure 13. Predicted concentration isopleths for lead at former TA-42.

- LANL-ER-SOP-01.04, "Sample Control and Field Documentation"
- LANL-ER-SOP-01.05, "Field Quality Control Samples"
- LANL-ER-SOP-01.06, "Management of RFI-Generated Waste"
- LANL-ER-SOP-06.10, "Hand Auger and Thin-Wall Tube Sampler"

A function of quality control (QC) is to check the operation of the analytical laboratory and to measure the quality of the data generated. Field duplicate samples were collected to evaluate the reproducibility of the sampling technique. To evaluate analytical procedures, spike and blind samples were included with the samples to be analyzed, and replicate analyses were performed by the contract laboratory. One equipment rinsate blank and one bottle (or field) blank were collected and submitted for every 20 samples or for each sampling event (one day of sampling). These blanks were collected to evaluate decontamination and other sample-handling procedures. Results of the QC samples are shown in Table 11, and results of spike and blind QC samples are shown in Table 12. All results were used in the decision-making process, even though the analysis of one of the blind QC samples for ^{238}Pu resulted in a warning, and two blind QC samples for ^{241}Am were not measured because of insufficient amounts of sample material (see Table 12). The results were used because all measurements were well below the screening action levels (see Table 10).

TABLE 11

RESULTS OF QUALITY CONTROL SAMPLES

Sample Number	^{238}Pu (pCi/L)	Unc[a]	^{239}Pu (pCi/L)	Unc	Pb (µg/L)	Unc	^{241}Am (pCi/L)	Unc
B-12-2-bb[b]	1.8	1.18	0.969	0.846			0.264	0.325
B-12-2-erb[c]	5.63	1.66	2.68	1.1			1.09	0.56
B-9-3-bb	0.465	0.471	0.0	0.0181			0.199	0.298
B-9-3-erb	0.852	0.815	0.142	0.492			0.135	0.27
B-18-3-erb					5.3	NR[d]		
B-3-2-bb					4.2	0.42		
B-3-2-erb					3.7	0.37		
QC-1					<1			
QC-2					17.6	1		

a. Unc = uncertainty
b. bb = bottle blank
c. erb = equipment rinsate blank
d. NR = not reported

TABLE 12

RESULTS OF SPIKE AND BLIND QUALITY CONTROL SAMPLES

Sample Type	Analysis	Amt. Spiked (mg/kg)	Amount Recovered	Anal. Result	Anal. Unc[a]	QC[b] Value	QC Unc	Units	Comment
Spike	Pb	2.31	38.%						
Spike	Pb	2.31	39.%						
Open QC	Pb			<0.3		0.0		mg/kg	Under control
Blind QC	Pb			11.4	1.14	12.5	0.5	mg/L	Under control
Spike	Pb	2.31	122.2%						
Spike	Pb	2.31	115.7%						
Open QC	Pb			<1.				mg/L	Under control
Blind QC	Pb			17.6		16.	1.	mg/L	Under control
Blind QC	^{238}Pu			0.297	0.119	0.0045	0.0005	mg/L	Warning 2–3 sig
Blind QC	^{239}Pu			0.307	0.118	0.217	0.016	pCi/g	Under control
Blind QC	^{238}Pu			0.284	0.112	0.34	0.02	pCi/g	Under control
Blind QC	^{239}Pu			0.696	0.186	0.79	0.01	pCi/g	Under control
Blind QC	^{238}Pu			0.401	0.175	0.34	0.02	pCi/g	Under control
Blind QC	^{239}Pu			0.0309	0.0439	0.0		pCi/g	Under control
Blind QC	^{238}Pu			0.0505	0.0539	0.002		pCi/g	Under control
Blind QC	^{239}Pu			0.0202	0.0287	0.038	0.003	pCi/g	Under control
Blind QC	^{241}Am			0.0		0.32	0.01	pCi/g	Insufficient sample
Blind QC	^{241}Am			0.0		0.65	0.01	pCi/g	Insufficient sample

a. Unc = uncertainty
b. QC = quality control

7.0 CONCLUSIONS

This report presents the results of the site characterization activities at former TA-42. The characterization included the following PRSs:

- 42-001(a), former location of an incinerator;
- 42-001(b and c), former location of two ash storage tanks;
- 42-002(a), former location of a building used as an indoor storage and decontamination area;

- 42-002(b), former outdoor decontamination area; and
- 42-003, former location of a septic tank and tile drain field.

None of the samples collected at the PRSs contained COCs above screening action levels; in fact, all measurements were at least an order of magnitude below the screening action levels. Therefore, no risk to human health or the environment exists. Based on these results, OU 1129 personnel recommended to DOE/AL that no remedial actions be required before construction of the NSTL. These PRSs will also be recommended for no further action.

8.0 REFERENCES

DOE (US Department of Energy), June 5, 1990. "Radiation Protection of the Public and the Environment," DOE Order 5400.5 (Change 1), Washington, DC. **(DOE 1990, 0080)**

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EPA (US Environmental Protection Agency), July 1993. "Identification and Listing of Hazardous Waste," *Code of Federal Regulations, Protection of Environment*, Title 40, Part 261, Appendix II, Method 1311, Washington, DC. **(EPA 1993 ER ID Number 40099)**

EPA (US Environmental Protection Agency), July 1990. "PCB Spill Cleanup Policy," *Code of Federal Regulations, Protection of Environment*, Title 40, Part 761, Subpart G, Washington, DC. **(EPA 1990 ER ID Number 39994)**

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LANL (Los Alamos National Laboratory), May 1992. "RFI Work Plan for Operable Unit 1129," Los Alamos National Laboratory Report LA-UR-92-800, Los Alamos, New Mexico. **(LANL 1992, ER ID Number 7666)**

LANL (Los Alamos National Laboratory), November 1993. "Installation Work Plan for Environmental Restoration," Revision 3, Vol. I, Los Alamos National Laboratory Report LA-UR-93-3987, Los Alamos, New Mexico. **(LANL 1993, ER ID Number 26077)**

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APPENDIX A

SAMPLE PREPARATION BY THE ISOTOPE AND NUCLEAR CHEMISTRY GROUP

Personnel from the former Isotope and Nuclear Chemistry Group (INC-12) prepared the samples for plutonium analysis. The samples were air dried, pulverized, and placed in a plastic vial from which 0.3- to 5-g samples were weighed. A ^{236}Pu tracer was added to each sample. The samples were completely dissolved with mineral acids and taken to near dryness. The plutonium analysis consisted of a lanthanum fluoride precipitation and two ion-exchange cleanup steps. The purified plutonium fractions were electroplated onto platinum discs and submitted for counting on solid-state detectors. The counting length was set for 20 hours, and the samples were counted three times. The error percentages for the plutonium values (Table 6) reflect the counting errors.

A reagent blank was run with each set of three to five soil samples to establish the detection limit. The average value for the blank is 0.150 pCi (61%) of $^{239,240}Pu$, which probably reflects the plutonium contribution from Room 415 at INC-12. No ^{238}Pu was noted on the process blanks. The criterion used for setting the limit of detection is the average value (counting or process blank activity) plus three sigma. Actual sample values must be greater than this value (99% level) to be reported. For ^{238}Pu, this value is based on the counting statistics only. Only one of six counters showed any background activity in the ^{238}Pu alpha region. The detection limit for ^{238}Pu is estimated at ~0.04 pCi for this counter. For the remaining five counters the activity observed was assumed to be ^{238}Pu. For $^{239,240}Pu$, no activity was observed at this alpha range in the process blanks. The limit of detection is based on the average of five process blanks and is ~0.42 pCi.

INC-12 personnel also prepared samples for lead analysis. The samples (~0.5 g) were dissolved in mineral acids. They were taken to near dryness and then diluted to volume. The samples were analyzed using ion coupled plasma-mass spectroscopy. A process blank was also run through the procedure in which a contribution from lead was measured and subtracted from the sample values. Method detection limits for lead are estimated at ~5 ppm.

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APPENDIX B

ROCKWORKS PARAMETER DOCUMENTATION

This appendix consists of four sections that document the parameters chosen and data used to construct the activity isopleths shown in Figures 10 through 12 and the concentration isopleths shown in Figure 13. Each section documents one of the following contaminants of concern: ^{241}Am, ^{238}Pu, $^{239,240}Pu$, and lead. The isopleths were constructed using the "Configure," "makeGrid," and "conTour" options in the GRIDZO gridding and contouring software package, which is one of the components of the ROCKWORKS software system.

The first part of each section documents the "Configure" option. The column labeled "Menu Item" lists the various parameters that are available. The column labeled "Default Setting" describes the default setting for each menu item. The column labeled "Setting Choices" lists the choices that are available for changing the default setting or customizing the output. The setting that was selected for each menu item is printed in boldface type. The column labeled "Value Entered" lists the value(s) that were used to calculate some of the parameters.

The next two parts of each section document the "makeGrid" and "conTour" options. The columns labeled "Prompt" show the commands that are displayed on the computer screen. The columns labeled "Information Entered" list the data that were entered into the program.

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PARAMETER DOCUMENTATION FOR ^{241}Am

Subject of Documentation: Figure 10. Predicted activity isopleths for ^{241}Am at former TA-42.

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Filtering	*** Inactive: All control points used when gridding**	Activate: Ignore control points outside user-specified "window"	
		Deactivate: Include all control points when generating maps and grids	
Gridding	**Inverse distance/Nonradial**		
Algorithm	**Inverse-distance/without radial searching**	Inverse distance weighting exponent	7
		Number of data points to use when interpolating values	3
Auto-Size	Active: Based on constants	**Constant: Compute dimensions by dividing range by constant**	
		Horizontal (X) cell spacing	30
		Vertical (Y) cell spacing	30
		Distance: Multiple of average distances between control points	
		Deactivate: Do not modify grid dimensions from previous session	
Check-Duplicates	**Inactive: No duplicate checking**	Activate: Check for duplicate control points	
		Deactivate: Do not check for duplicate control points	
Average-Clusters	**Inactive: Do not average clustered points**	Activate: Average clustered points	
		Deactivate: Do not average clustered control points	
Polyenhancement	**Inactive: Do not calculate regional polynomial (3)**	Automatic: Automatically determine polynomial order	
		Manual: Manually specify polynomial order	
		Deactivate: Do not add regional polynomial to surface	

* The default setting or the setting that was selected is printed in **boldface** type.

PARAMETER DOCUMENTATION FOR ^{241}Am (continued)

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Contouring	*** Low-Fi 2x regular-spacing without masking**		
Fidelity	**Inactive: Contours not forced to honor control points**	Activate: Force contours to honor control points	
		Deactivate: Do not force contours to honor control points	
Smoothing	Activated: Contours will be smoothed 2x	**Activate: Smooth contours**	3
		Deactivate: Do not smooth contours	
Intervals	**Regular: Contour intervals are regularly spaced**	Regular: Contour intervals are equally spaced	
		Irregular: Irregularly spaced (defined within an ASCII file)	
Masking	**Inactive: All contour segments plotted**	Activate: Erase/modify contours that are far from control points	
		Deactivate: All contour segments will be plotted	
		"Proven" (solid) cutoff distance 1	
		"Probable" (dashed) cutoff distance 2	
		"Inferred" (dotted) cutoff distance 3	
Clipping	**Inactive: Plot all contours within gri del**	Activate: Erase contours outside control area	
		Deactivate: Plot all contours within grid model	
Labeling	Activated size = 0.100 Dist = 5.000 Normal		
Status	**Activated: Label contours**	Activate: Label contours	
		Deactivate: Do not label contours	
Dimensions	Medium (0.10000)	Small, Medium, **Large**, Other	
Spacing	Medium (5.00000)	Close, **Medium**, Far, Other	
Type	Normal	**Normal**, Framed	

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR ^{241}Am (continued)

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Decimals	Decimal places to be included with labels = 0		1
Point-Maps	With labels		
Symbol Number			16
Symbol Width			0.1500
Symbol Height			0.1500
Plot Labels			Yes
Label Width			0.1500
Label Height			0.1500
Label X-offset			0.0000
Label Y-offset			0.0000
Label Decimals			0
Auto Offset			No
Auto-Annotate	*** Inactive: Do not automatically annotate diagrams**	Activate: Automatically annotate diagrams Deactivate: Do not automatically annotate diagrams	
Colors/Styles	Adjust map colors, line styles, and line widths	Values	
Control Points		Color	15
Control Labels		Color	15
Unlabeled Contours		Line Width	1
		Line Style	1
		Color	15
Labeled Contours		Line Width	1
		Line Style	1
		Color	15
Contour Labels		Color	15

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR ^{241}Am (continued)

"makeGrid" Option

Prompt	Information Entered
ASCII file that contains control point data	42AMHIG.TXT
Binary grid file to be created	42AMHIG.GRD
Column that contains X (east/west) coordinates	1
Column that contains Y (north/south) coordinates	2
Column that contains Z (elevation) value	3

Control Point Data Summary			
	Minimum	**Maximum**	**Average**
X	484989.770	485130.150	485053.385390
Y	1769759.130	1769857.720	1769804.09230
Z	0.06570	0.9330	0.290338
Total number of points ..... 13 Number of points removed by filter 0			

Confirm and/or Adjust Grid Dimensions			
	Minimum	**Maximum**	**Spacing**
X	484989.770	485130.150	4.679333
Y	1769759.130	1769857.720	3.286333

PARAMETER DOCUMENTATION FOR ^{241}Am (continued)

"conTour" Option

Prompt	Information Entered
Binary grid file (model) to be contoured	42AMHIG.GRD
Binary graphics file (contour map) to be created	42AMHIG.GRA
Intervals	
Contour Interval	.100
Labeling Interval	.200
Primary Title	*
Secondary Title	*
Horizontal Axes	*
Vertical Axes	*
Horizontal labeling interval	*
Vertical labeling interval	*

* NOTE: Annotation was added under 'MISC'/'Annotate'

Input Data

Sample Number	^{241}Am (pCi/g)	Easting	Northing
B-1-1	0.0491	484992.58	1769762.54
B-1-2	0.0657	484992.58	1769762.54
B-3-2	0.332	485004.78	1769780.59
B-4-1	0.121	485037.17	1769812.92
B-5-2	0.138	485038.38	1769842.75
B-6-3	0.138	485095.16	1769770.86
B-7-1	0.0707	485077.53	1769759.13
B-8-3	0.358	485076.86	1769778.96
B-9-1D	0.749	485100.34	1769796.48
B-10-2	0.157	485130.15	1769830.9
B-11-2	0.227	485008.37	1769845.94
B-12-2	0.38	485018.59	1769776.28
B-13-1	0.993	484989.77	1769857.72
C-1-1	0.105	485124.33	1769838.13

PARAMETER DOCUMENTATION FOR ^{238}Pu

Subject of Documentation: Figure 11. Predicted activity isopleths for ^{238}Pu at former TA-42.

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Filtering	*** Inactive: All control points used when gridding**	Activate: Ignore control points outside user-specified "window"	
		Deactivate: Include all control points when generating maps and grids	
Gridding	**Inverse distance/Nonradial**		
Algorithm	**Inverse-distance/without radial searching**	Inverse distance weighting exponent	7
		Number of data points to use when interpolating values	3
Auto-Size	Active: Based on constants	**Constant: Compute dimensions by dividing range by constant**	
		Horizontal (X) cell spacing	30
		Vertical (Y) cell spacing	30
		Distance: Multiple of average distances between control points	
		Deactivate: Do not modify grid dimensions from previous session	
Check-Duplicates	**Inactive: No duplicate checking**	Activate: Check for duplicate control points	
		Deactivate: Do not check for duplicate control points	
Average-Clusters	**Inactive: Do not average clustered points**	Activate: Average clustered points	
		Deactivate: Do not average clustered control points	
Polyenhancement	**Inactive: Do not calculate regional polynomial (3)**	Automatic: Automatically determine polynomial order	
		Manual: Manually specify polynomial order	
		Deactivate: Do not add regional polynomial to surface	

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR ^{238}Pu (continued)

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Contouring	*** Low-Fi 2x regular-spacing without masking**		
Fidelity	**Inactive: Contours not forced to honor control points**	Activate: Force contours to honor control points	
		Deactivate: Do not force contours to honor control points	
Smoothing	Activated: Contours will be smoothed 2x	**Activate: Smooth contours**	3
		Deactivate: Do not smooth contours	
Intervals	**Regular: Contour intervals are regularly spaced**	Regular: Contour intervals are equally spaced	
		Irregular: Irregularly spaced (defined within an ASCII file)	
Masking	**Inactive: All contour segments plotted**	Activate: Erase/modify contours that are far from control points	
		Deactivate: All contour segments will be plotted	
		"Proven" (solid) cutoff distance 1	
		"Probable" (dashed) cutoff distance 2	
		"Inferred" (dotted) cutoff distance 3	
Clipping	**Inactive: Plot all contours within grid model**	Activate: Erase contours outside control area	
		Deactivate: Plot all contours within grid model	
Labeling	Activated size = 0.100 Dist = 5.000 Normal		
Status	**Activated: Label contours**	Activate: Label contours	
		Deactivate: Do not label contours	
Dimensions	Medium (0.10000)	Small, Medium, **Large**, Other	
Spacing	Medium (5.00000)	Close, **Medium**, Far, Other	
Type	Normal	**Normal**, Framed	

* The default setting or the setting that was selected is printed in **boldface** type.

PARAMETER DOCUMENTATION FOR ^{238}Pu (continued)

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Decimals	Decimal places to be included with labels = 0		1
Point-Maps	With labels		
Symbol Number			16
Symbol Width			0.1500
Symbol Height			0.1500
Plot Labels			Yes
Label Width			0.1500
Label Height			0.1500
Label X-offset			0.0000
Label Y-offset			0.0000
Label Decimals			0
Auto Offset			No
Auto-Annotate	* **Inactive: Do not automatically annotate diagrams**	Activate: Automatically annotate diagrams Deactivate: Do not automatically annotate diagrams	
Colors/Styles	Adjust map colors, line styles, and line widths	Values	
Control Points		Color	15
Control Labels		Color	15
Unlabeled Contours		Line Width	1
		Line Style	1
		Color	15
Labeled Contours		Line Width	1
		Line Style	1
		Color	15
Contour Labels		Color	15

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR ^{238}Pu (continued)

"makeGrid" Option

Prompt	Information Entered
ASCII file that contains control point data	42PU238H.TXT
Binary grid file to be created	42PU238H.GRD
Column that contains X (east/west) coordinates	1
Column that contains Y (north/south) coordinates	2
Column that contains Z (elevation) value	4

Control Point Data Summary			
	Minimum	**Maximum**	**Average**
X	484989.770	485130.150	485051.373330
Y	1769762.540	1769857.7200	1769807.839200
Z	0.082700	1.7500	0.387142
Total number of points ..... 12 Number of points removed by filter 0			

Confirm and/or Adjust Grid Dimensions			
	Minimum	**Maximum**	**Spacing**
X	484989.7700	485130.150	4.679333
Y	1769762.540	1769857.720	3.172667

PARAMETER DOCUMENTATION FOR ^{238}Pu (continued)

"conTour" Option

Prompt	Information Entered
Binary grid file (model) to be contoured	42PU238H.GRD
Binary graphics file (contour map) to be created	42PU238H.GRA
Intervals	
Contour Interval	.20
Labeling Interval	.40
Primary Title	*
Secondary Title	*
Horizontal Axes	*
Vertical Axes	*
Horizontal labeling interval	*
Vertical labeling interval	*

* NOTE: Annotation was added under 'MISC'/'Annotate'

Input Data

Sample Number	^{238}Pu (pCi/g)	Easting	Northing
B-1-2	0.2	484992.58	1769762.54
B-3-2	1.75	485004.78	1769780.59
B-4-1	0.438	485037.17	1769812.92
B-5-1	0.36	485038.38	1769842.75
B-6-C-2	0.138	485095.16	1769770.86
B-8-3	0.269	485076.86	1769778.96
B-9-3	0.332	485100.34	1769796.48
B-10-1	0.377	485130.15	1769830.90
B-11-1	0.389	485008.37	1769845.94
B-12-1	0.154	485018.59	1769776.28
B-13-1	0.0827	484989.77	1769857.72
C-1-1	0.156	485124.33	1769838.13

PARAMETER DOCUMENTATION FOR ^{239}Pu

Subject of Documentation: Figure 12. Predicted activity isopleths for $^{239,240}Pu$ at former TA-42.

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Filtering	*** Inactive: All control points used when gridding**	Activate: Ignore control points outside user-specified "window"	
		Deactivate: Include all control points when generating maps and grids	
Gridding	**Inverse distance/Nonradial**		
Algorithm	**Inverse-distance/without radial searching**	Inverse distance weighting exponent	6
		Number of data points to use when interpolating values	3
Auto-Size	Active: Based on constants	**Constant: Compute dimensions by dividing range by constant**	
		Horizontal (X) cell spacing	30
		Vertical (Y) cell spacing	30
		Distance: Multiple of average distances between control points	
		Deactivate: Do not modify grid dimensions from previous session	
Check-Duplicates	**Inactive: No duplicate checking**	Activate: Check for duplicate control points	
		Deactivate: Do not check for duplicate control points	
Average-Clusters	**Inactive: Do not average clustered points**	Activate: Average clustered points	
		Deactivate: Do not average clustered control points	
Polyenhancement	**Inactive: Do not calculate regional polynomial (3)**	Automatic: Automatically determine polynomial order	
		Manual: Manually specify polynomial order	
		Deactivate: Do not add regional polynomial to surface	

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR ^{239}Pu (continued)

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Contouring	*** Low-Fi 2x regular-spacing without masking**		
Fidelity	**Inactive: Contours not forced to honor control points**	Activate: Force contours to honor control points	
		Deactivate: Do not force contours to honor control points	
Smoothing	Activated: Contours will be smoothed 2x	**Activate: Smooth contours**	3
		Deactivate: Do not smooth contours	
Intervals	**Regular: Contour intervals are regularly spaced**	Regular: Contour intervals are equally spaced	
		Irregular: Irregularly spaced (defined within an ASCII file)	
Masking	**Inactive: All contour segments plotted**	Activate: Erase/modify contours that are far from control points	
		Deactivate: All contour segments will be plotted	
		"Proven" (solid) cutoff distance 1	
		"Probable" (dashed) cutoff distance 2	
		"Inferred" (dotted) cutoff distance 3	
Clipping	**Inactive: Plot all contours within grid model**	Activate: Erase contours outside control area	
		Deactivate: Plot all contours within grid model	
Labeling	Activated size = 0.100 Dist = 5.000 Normal		
Status	**Activated: Label contours**	Activate: Label contours	
		Deactivate: Do not label contours	
Dimensions	Medium (0.10000)	Small, Medium, **Large**, Other	
Spacing	Medium (5.00000)	Close, **Medium**, Far, Other	
Type	Normal	**Normal**, Framed	

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR ^{239}Pu (continued)

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Decimals	Decimal places to be included with labels = 0		1
Point-Maps	With labels		
Symbol Number			16
Symbol Width			0.1500
Symbol Height			0.1500
Plot Labels			Yes
Label Width			0.1500
Label Height			0.1500
Label X-offset			0.0000
Label Y-offset			0.0000
Label Decimals			0
Auto Offset			No
Auto-Annotate	* **Inactive: Do not automatically annotate diagrams**	Activate: Automatically annotate diagrams Deactivate: Do not automatically annotate diagrams	
Colors/Styles	Adjust map colors, line styles, and line widths	Values	
Control Points		Color	15
Control Labels		Color	15
Unlabeled Contours		Line Width	1
		Line Style	1
		Color	15
Labeled Contours		Line Width	1
		Line Style	1
		Color	15
Contour Labels		Color	15

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR ^{239}Pu (continued)

"makeGrid" Option

Prompt	Information Entered
ASCII file that contains control point data	42PU239H.TXT
Binary grid file to be created	42PU239H.GRD
Column that contains X (east/west) coordinates	1
Column that contains Y (north/south) coordinates	2
Column that contains Z (elevation) value	4

Control Point Data Summary			
	Minimum	Maximum	Average
X	484989.770	485130.150	485051.373330
Y	1769762.540	1769857.720	1769807.839200
Z	0.044100	2.240	0.403233
Total number of points ..... 12 Number of points removed by filter 0			

Confirm and/or Adjust Grid Dimensions			
	Minimum	Maximum	Spacing
X	484989.770	485130.150	4.679333
Y	1769762.540	1769857.720	3.172667

PARAMETER DOCUMENTATION FOR ^{239}Pu (continued)

"conTour" Option

Prompt	Information Entered
Binary grid file (model) to be contoured	42PU239H.GRD
Binary graphics file (contour map) to be created	42PU239H.GRA
Intervals	
Contour Interval	.20
Labeling Interval	.40
Primary Title	*
Secondary Title	*
Horizontal Axes	*
Vertical Axes	*
Horizontal labeling interval	*
Vertical labeling interval	*

* NOTE: Annotation was added under 'MISC'/'Annotate'

Input Data

Sample Number	^{239}Pu (pCi/g)	Easting	Northing
B-1-2	0.0839	484992.58	1769762.54
B-3-2	2.24	485004.78	1769780.59
B-4-2	0.231	485037.17	1769812.92
B-5-2	0.511	485038.38	1769842.75
B-6-C-2	0.0964	485095.16	1769770.86
B-8-C-3	0.0793	485076.86	1769778.96
B-9-1	0.312	485100.34	1769796.48
B-10-1D	0.401	485130.15	1769830.90
B-11-2	0.485	485008.37	1769845.94
B-12-1	0.0441	485018.59	1769776.28
B-13-1	0.0591	484989.77	1769857.72
C-1-1	0.296	485124.33	1769838.13

PARAMETER DOCUMENTATION FOR Pb

Subject of Documentation: Figure 13. Predicted concentration isopleths for lead at former TA-42.

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Filtering	*** Inactive: All control points used when gridding**	Activate: Ignore control points outside user-specified "window"	
		Deactivate: Include all control points when generating maps and grids	
Gridding	**Inverse distance/Nonradial**		
Algorithm	**Inverse-distance/without radial searching**	Inverse distance weighting exponent	4
		Number of data points to use when interpolating values	7
Auto-Size	Active: Based on constants	**Constant: Compute dimensions by dividing range by constant**	
		Horizontal (X) cell spacing	30
		Vertical (Y) cell spacing	30
		Distance: Multiple of average distances between control points	
		Deactivate: Do not modify grid dimensions from previous session	
Check-Duplicates	**Inactive: No duplicate checking**	Activate: Check for duplicate control points	
		Deactivate: Do not check for duplicate control points	
Average-Clusters	**Inactive: Do not average clustered points**	Activate: Average clustered points	
		Deactivate: Do not average clustered control points	
Polyenhancement	**Inactive: Do not calculate regional polynomial (3)**	Automatic: Automatically determine polynomial order	
		Manual: Manually specify polynomial order	
		Deactivate: Do not add regional polynomial to surface	

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR Pb (continued)

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Contouring	*** Low-Fl 2x regular-spacing without masking**		
Fidelity	**Inactive: Contours not forced to honor control points**	Activate: Force contours to honor control points	
		Deactivate: Do not force contours to honor control points	
Smoothing	Activated: Contours will be smoothed 2x	**Activate: Smooth contours**	3
		Deactivate: Do not smooth contours	
Intervals	**Regular: Contour intervals are regularly spaced**	Regular: Contour intervals are equally spaced	
		Irregular: Irregularly spaced (defined within an ASCII file)	
Masking	**Inactive: All contour segments plotted**	Activate: Erase/modify contours that are far from control points	
		Deactivate: All contour segments will be plotted	
		"Proven" (solid) cutoff distance 1	
		"Probable" (dashed) cutoff distance 2	
		"Inferred" (dotted) cutoff distance 3	
Clipping	**Inactive: Plot all contours within grid model**	Activate: Erase contours outside control area	
		Deactivate: Plot all contours within grid model	
Labeling	Activated size = 0.100 Dist = 5.000 Normal		
Status	**Activated: Label contours**	Activate: Label contours	
		Deactivate: Do not label contours	
Dimensions	Medium (0.10000)	Small, Medium, **Large**, Other	
Spacing	Medium (5.00000)	Close, **Medium**, Far, Other	
Type	Normal	**Normal**, Framed	

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR Pb (continued)

"Configure" Option

Menu Item	Default Setting	Setting Choices	Value Entered
Decimals	Decimal places to be included with labels = 0		1
Point-Maps	With labels		
Symbol Number			16
Symbol Width			0.1500
Symbol Height			0.1500
Plot Labels			Yes
Label Width			0.1500
Label Height			0.1500
Label X-offset			0.0000
Label Y-offset			0.0000
Label Decimals			0
Auto Offset			No
Auto-Annotate	* **Inactive: Do not automatically annotate diagrams**	Activate: Automatically annotate diagrams Deactivate: Do not automatically annotate diagrams	
Colors/Styles	Adjust map colors, line styles, and line widths	Values	
Control Points		Color	15
Control Labels		Color	15
Unlabeled Contours		Line Width	1
		Line Style	1
		Color	15
Labeled Contours		Line Width	1
		Line Style	1
		Color	15
Contour Labels		Color	15

* The default setting or the setting that was selected is printed in boldface type.

PARAMETER DOCUMENTATION FOR Pb (continued)

"makeGrid" Option

Prompt	Information Entered
ASCII file that contains control point data	42PBHIG.TXT
Binary grid file to be created	42PBHIG.GRD
Column that contains X (east/west) coordinates	1
Column that contains Y (north/south) coordinates	2
Column that contains Z (elevation) value	4

Control Point Data Summary			
	Minimum	Maximum	Average
X	484991.220000	485004.780000	484996.811430
Y	1769762.540000	1769780.590000	1769770.277100
Z	12.0	28.10	17.371429

Total number of points 7
Number of points removed by filter 0

Confirm and/or Adjust Grid Dimensions			
	Minimum	Maximum	Spacing
X	484991.110	485004.780	484996.811430
Y	1769762.540	1769780.590	0.601667

PARAMETER DOCUMENTATION FOR Pb (continued)

"conTour" Option

Prompt	Information Entered
Binary grid file (model) to be contoured	42PBHIG.GRD
Binary graphics file (contour map) to be created	42PBHIG.GRA
Intervals	
Contour Interval	1.0
Labeling Interval	2.0
Primary Title	*
Secondary Title	*
Horizontal Axes	*
Vertical Axes	*
Horizontal labeling interval	*
Vertical labeling interval	*

* NOTE: Annotation was added under 'MISC'/'Annotate'

Input Data

Sample Number	Pb (mg/kg)	Easting	Northing
B-1-1	14.4	484992.6	1769763
B-2-1	12.	484991.2	1769770
B-3-2	28.1	485004.8	1769781
B-14-2	19	484997.2	1769771
B-15-1	12	484999.3	1769769
B-16-2	10.4	484995.4	1769769
B-18-2R	17.1	484997.3	1769769

APPENDIX C

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