TA-22 9/28/95

Expedited Cleanup Completion Report for

Potential Release Site 22-015(c) Outfall from a Former Plating and Etching Facility

Field Unit 5

Environmental Restoration Project

September, 1995
Revision 1

A Department of Energy Environmental Cleanup Project

Los Alamos
NATIONAL LABORATORY

LA-UR-96-467

2144

Attachment 7

Expedited Cleanup Plan Completion Report
Potential Release Site 22-015(C)
Outfall from a Former Plating and Etching Facility

1.0 SUMMARY OF EXPEDITED CLEANUP

1.1 OVERVIEW

PRS 22-015(c) is a former outfall and related runoff area originating from a floor drainage system in Building TA-22-52, a plating and circuit etching shop that operated from approximately 1953 to 1977. The former TA-22 plating shop is located on Two Mile Mesa on the northern flank of Pajarito Canyon in Los Alamos County. PRS 22-015(c) lies within US Department of Energy (DOE)-owned land This site is included in the Hazardous and Solid Waste Amendments module to the Los Alamos National Laboratory, Resource Conservation and Recovery Act, EPA I.D. NM0890010515. Figures 1 and 2 are maps of the PRS regional location and the site location respectively.

The PRS includes a drainage channel leading to a former pond area (a depression in the land surface where effluent and stormwater collect) located near the edge of the mesa; an overflow drainage channel from the pond area that flowed downhill to a wagon road; and two channels that flowed across the road and discharged over a rock cliff to Pajarito Canyon.

PRS 22-015(c) was contaminated with metals (arsenic, chromium, copper, lead, nickel, and silver). Arsenic and lead were detected above screening action levels (SALs). Cesium 137 and Strontium 90 were also detected in the pond area at concentrations just above the Laboratory SALs.

1.2 EXPEDITED CLEANUP

Cleanup activities commenced on 12 September, 1995 and restoration activities were completed on 21 September, 1995. Evacuation proceeded by use of a backhoe and front-end loader. Analytical results obtained from the on-site field laboratory were used to provide quick turnaround data on metal concentrations. Verification samples were collected once the contaminated soil was removed and were sent to an off-site contract laboratory. A summary of the verification sampling results and a comparison to the cleanup levels established in the EC Plan are presented in Appendix A. Verification of the cleanup was based on analytical results as specified in the EC Plan. Additional data for constituents which were not identified as contaminants of concern as well as the XRF data from the on-site laboratory are also presented in Appendix A.

Prior to commencement of excavation activities, as required in the cleanup plan, five biased samples were collected from the hillside and one from the pond area. These

samples were analyzed for the metals of concern (including Cr VI). As required by the EC plan, results were compared to SALs and ecological screening thresholds to determine if leaving these soils in place pose an unacceptable human health or ecological risk. The results indicate that hexavelant chromium is not present in the contaminated soil matrix. Sample results and an ecological assessment are included as Appendix B.

Soil excavation began on 12 August, 1995 and continued through 14 August, 1995. Field screening for volatile organic compounds and radiological activity was performed during the entire excavation. The front end loader was used to transport the excavated soil onto a waste bin. The frontend loader was checked for radiological activity each time it left the excavation to eliminate the potential spread of contamination. Figure 3 is a detailed schematic showing the areas of PRS 22-015(c) that were excavated during these EC activities. As shown in the figure, the pond area excavation was not exactly 44 ft x 100 ft. Some field decisions were made to stay away from areas clearly uncontaminated and include other areas that were. Samples were taken from the un-excavated areas and analyzed for metals using XRF techniques. The XRF and verification sample locations are shown in Figure 4.

2.0 DISCUSSION OF SAMPLING AND ANALYSIS

2.1 VERIFICATION SAMPLING AND ANALYSIS

Verification sampling was done by the Spade and Scoop Method, LANL-ER-SOP-6.09, R0. The data from the soil samples indicate that all analytes detected are well below the cleanup levels established in the EC Plan.

2.1.1 SAMPLING OBJECTIVES

The sampling objective was to determine if the cleanup levels had been met. The primary chemicals of concern were arsenic, cadmium, chromium, lead, copper, nickel, silver.

2.1.2 QA/QC

Samples were promptly hand delivered following chain of custody procedures to the CST-3 Sample Management Office. An off-site laboratory on contract to LANL performed the analysis.

2.2 SITE RESTORATION

Site restoration, including backfilling, regrading, and re-seeding was completed according to the EC and the Storm Water Pollution Prevention Plans. The seed used to revegetate the area was a mixture of sideoates gramma, little bluestem, blue gamma, Indian ricegrass,

and western wheatgrass. It was applied at a rate of 30 pounds per acre and covered with straw for protection and to retain moisture during its germination.

3.0 MODIFICATIONS TO THE EC PLAN

The EC Plan was followed with one exception. The excavation followed the schematic on the EC Plan, however field decisions were made to expand on some areas and exclude others. A detailed schematic of the excavated area was previously referenced.

4.0 QUANTITIES AND TYPES OF WASTE GENERATED

The cleanup activities generated 260 cubic yards of waste from the excavated soil. A sample from each bin was taken and analyzed for radioactivity, and a separate sample was taken and analyzed for volatile organic compounds. As discussed in the cleanup plan, TCLP analysis on the "worst case" samples did not approach TCLP limits. Trace concentrations of volatile organics were detected in two bins. This waste was designated as RCRA hazardous and transported to Chemical Waste Management in Kettlemen Hills California for disposal. No contaminates were detected in the other eleven bins. This waste was disposed of at Waste Management of New Mexico industrial landfill in Rio Rancho.

5.0 OUTSTANDING ITEMS FROM THE ACCEPTANCE INSPECTION

The acceptance inspection checklist (Appendix C) was completed by and independent party. There were no outstanding items identified during the acceptance inspection. Based on this inspection, this action is certified (Appendix E) by the independent party.

6.0 PROBLEMS ENCOUNTERED AND LESSONS LEARNED

Analytical results from the on-site field laboratory for metals using XRF techniques was conducted to make decisions on cleanup efficiency. The results were not available soon enough to make decisions. This is however partly due to the short duration of the excavation activities. The XRF results were consistent with the results from the fixed lab.

7.0 CONCLUSIONS

This report serves as the formal request for regulator concurrence to remove PRS-015(c) from the HSWA Module.

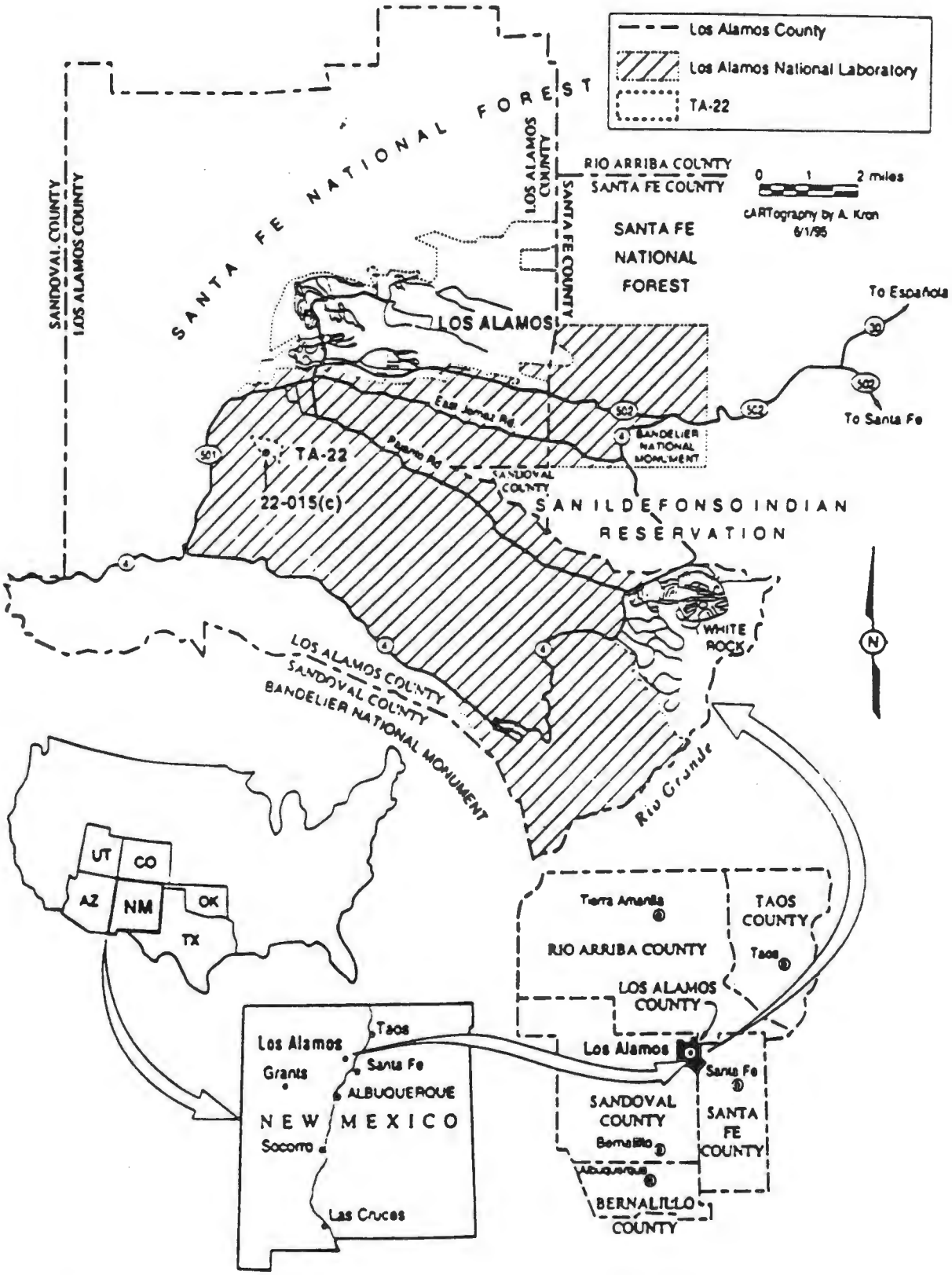


Figure 1. Regional location map.

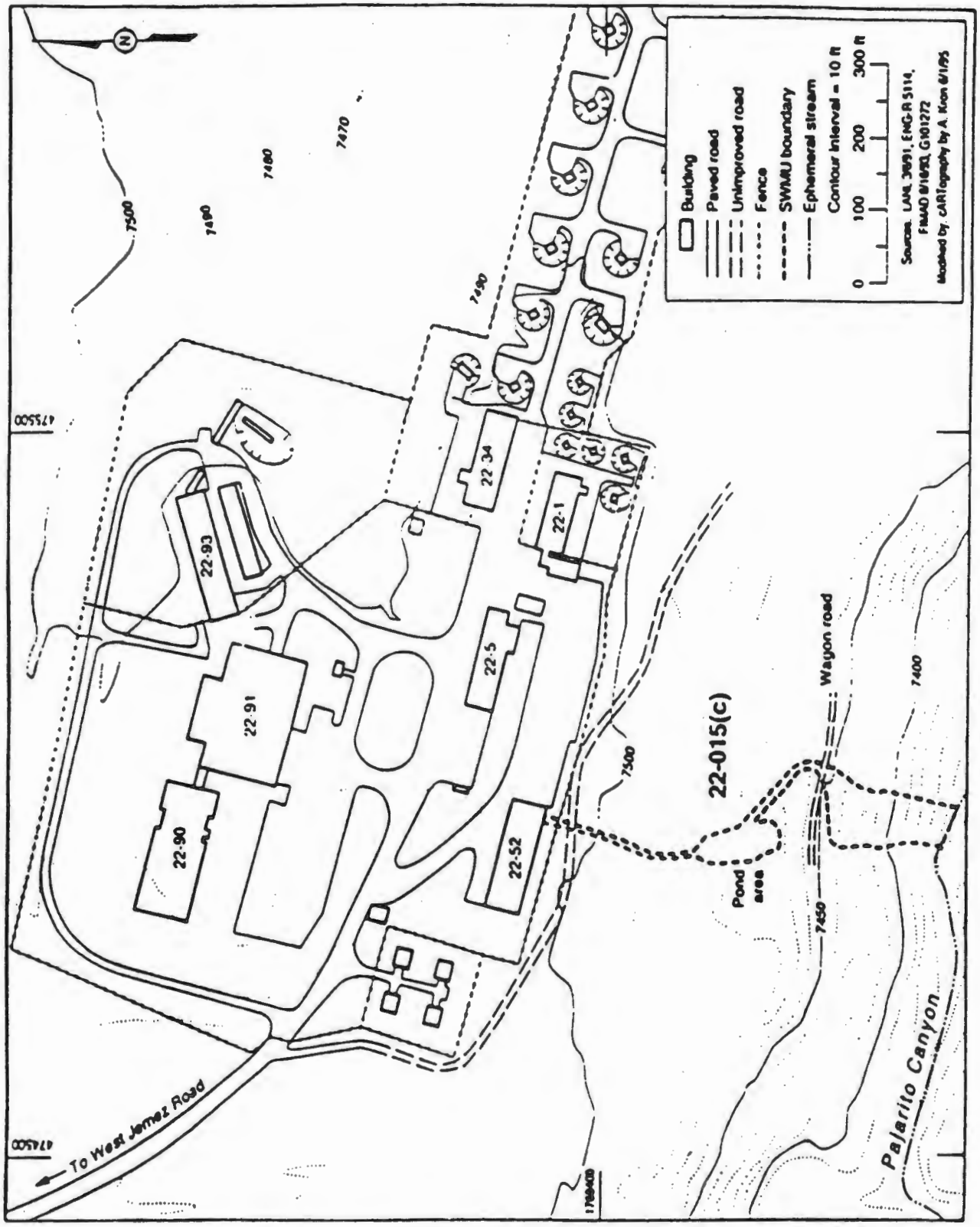
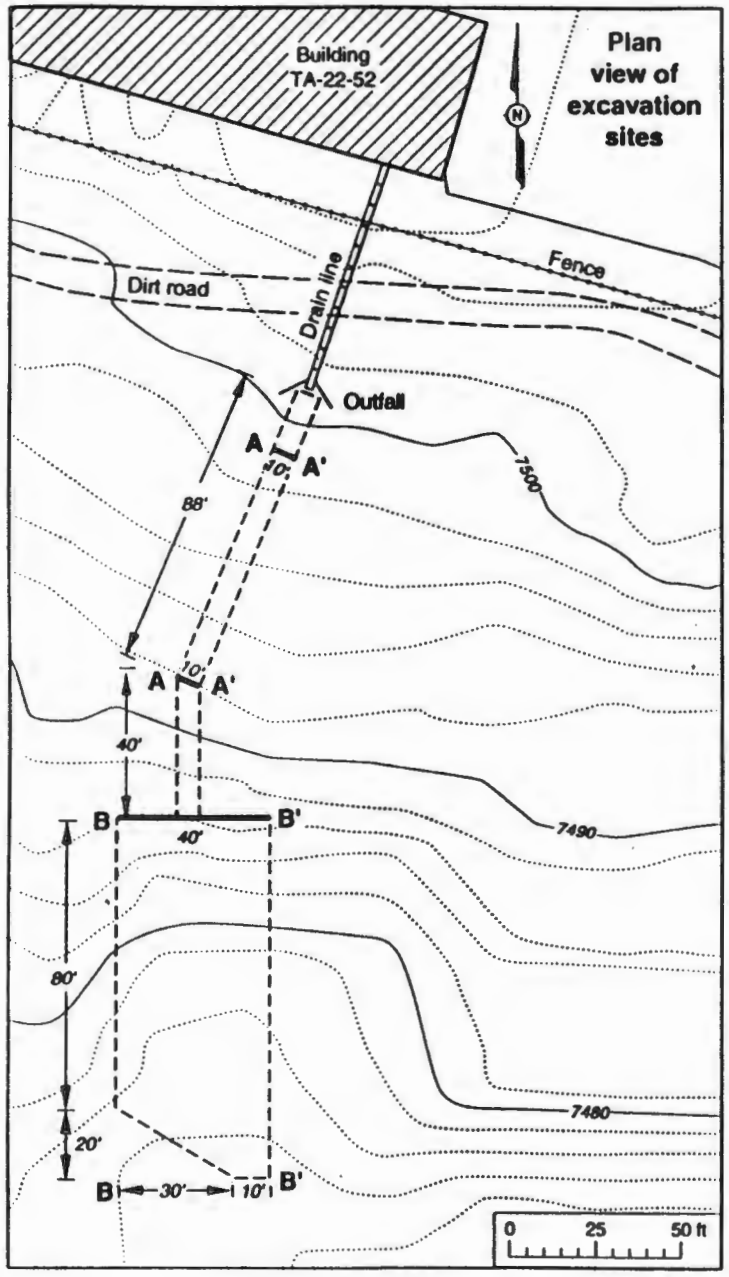
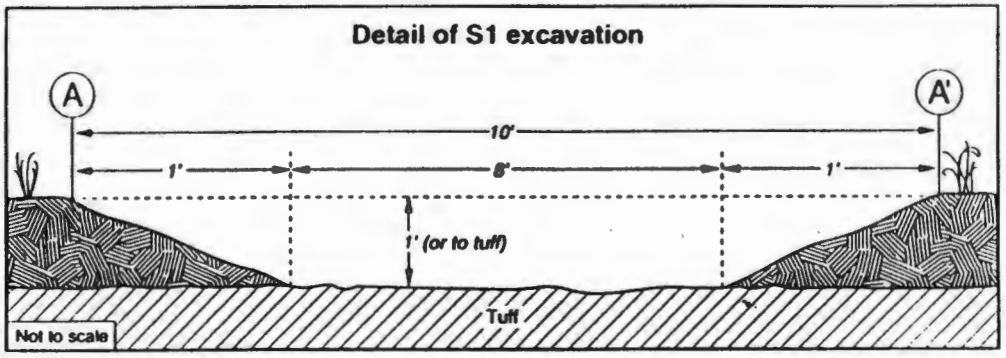
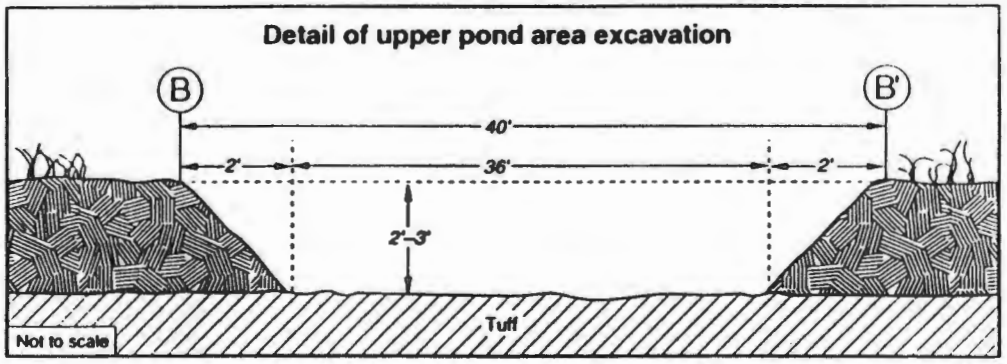


Figure 2. PRS 22-015(c) site location map.







cARTography by A. Kron 9/28/95

Figure 3. Schematic showing excavated area.

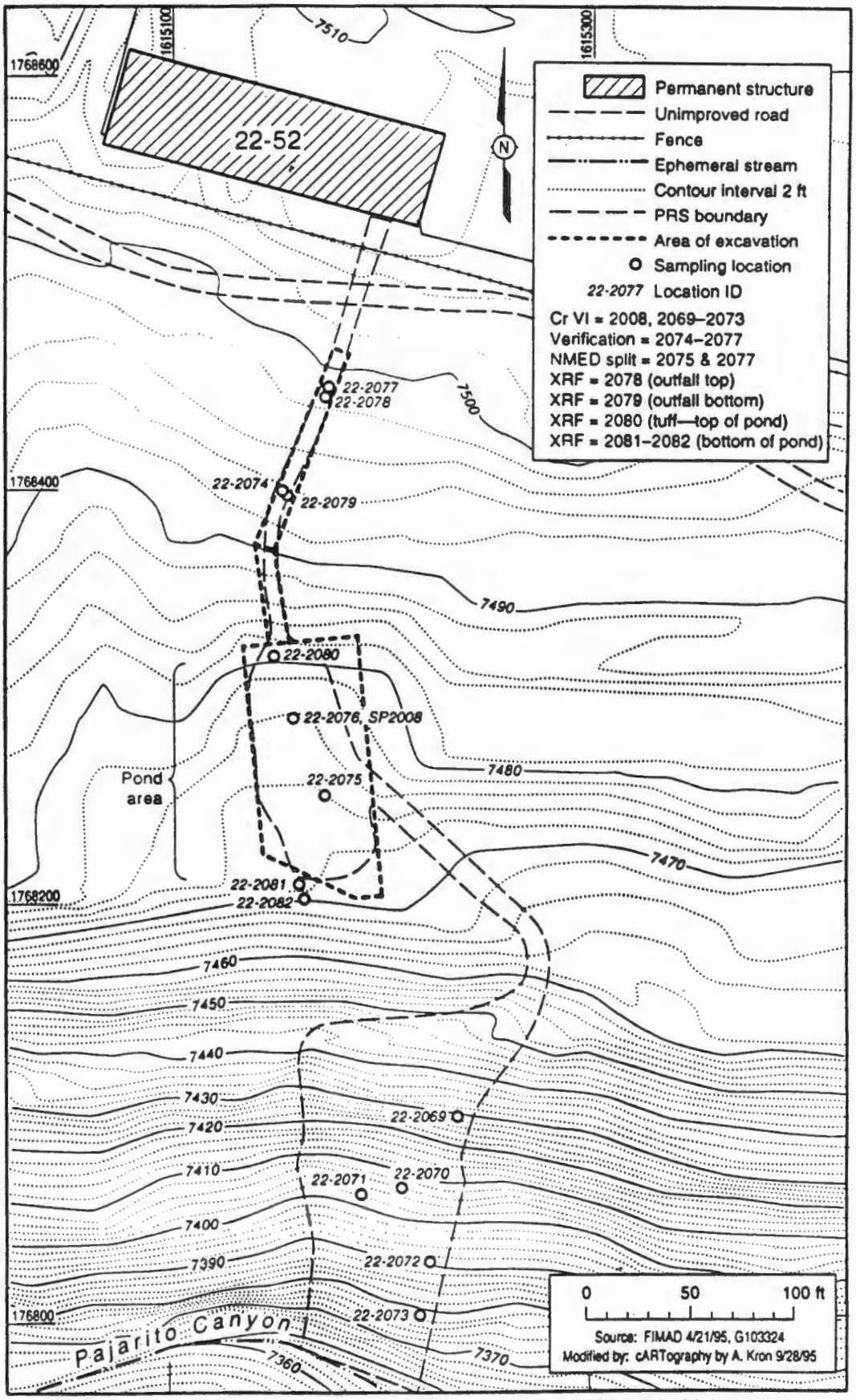


Figure 4. Location of verification and XRF samples for PRS 22-015(c).

Appendix A

Analytical Data

Appendix A
Summary of Verification Data
(mg/kg)

Analyte	Sample Location					Cleanup Level
	2074	2075	2076	2077	2077(duplicate)	
Arsenic	4.5	3.3	7.6	1.7	1.3	25
Cadmium	2.4	3.3	7.6	1.7	1.3	25
Chromium	120	67	160	17	17	204,400*
Lead	28	12	30	11	16	3000
Copper	410	190	1500	160	160	7500
Nickel	72	100	150	38	41	4100
Silver	5.1	8.3	15	3.9	3.9	1000

* Note: Total metal analysis was performed. Cleanup level listed for Chromium is for Chromium III.

Appendix A PRS 22-015(c)
Additional Data and XRF Metals Results
Non PCOCs

Comparison Value	Al (mg/kg)	As (mg/kg)	Ba (mg/kg)	Be (mg/kg)	Ca (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	K (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Na (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	V (mg/kg)	Zn (mg/kg)
Upper tolerance limit[a]	58,900	11.6	1,140	3.31	54,400	2.7	51.1	34.2	15.7	35,600	0.1	6,180	16,100	1,030	1,880	26.7	39	66	101
Screening action level[c]	NA[b]	NA[b]	5,600	NA[b]	NA[b]	80	NA[b]	400d	3,000	NA[b]	24	NA[b]	NA[b]	11,000	NA[b]	1,600	400	560	24,000

Location ID	Al (mg/kg)	As (mg/kg)	Ba (mg/kg)	Be (mg/kg)	Ca (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	K (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Na (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	V (mg/kg)	Zn (mg/kg)
22-2074	3,200	4.5	19	<.64	720	2.4	1.3	120	410	10,000	0.13	420	630	87	170	72	28	8.5	37
22-2075	5,800	3.3	46	<.69	970	11	2.8	67	190	8,800	< 0.14	750	810	99	150	100	12	11	42
22-2076	3,400	7.6	35	< 0.68	840	8.2	2.7	160	1500	12,000	0.27	510	510	96	120	150	30	15	41
22-2077	3,500	1.7	19	< 0.65	580	1.9	< 1.3	17	160	7,100	< 0.13	570	450	35	170	38	11	5.7	33
22-2077 Duplicate	NA	NA	NA	< 0.66	680	1.8	1.3	17	160	8,600	< 0.13	720	590	42	210	41	16	6.2	28
XRF-2078	NA	10	10	NA	700	5	20	55	20	30	10	1500	NA	30	NA	60	10	16	11
XRF-2079	NA	10	10	NA	700	5	20	55	20	30	10	1500	NA	30	NA	60	10	16	11
XRF-2080	NA	10	10	NA	700	5	20	55	20	30	10	1500	NA	30	NA	60	10	16	11
XRF-2081	NA	10	10	NA	700	5	20	55	20	30	10	1500	NA	30	NA	60	10	16	11
XRF-2082	NA	10	10	NA	700	5	20	55	20	30	10	1500	NA	30	NA	60	10	16	11

a Limit at the 99th percentile with a 95% confidence level of a range of regional background concentrations

b Action level not developed for Environmental Restoration Project screening assessments

c Action level developed for Environmental Restoration Project screening assessments

d Level is for chromium (VI)

Appendix B

Ecorisk Support Documentation

Appendix B

ECOLOGICAL RISK ASSESSMENT FOR PRS 22-015(C)

by Mike Ebinger

and

PRS 22-015 Hill Side Data

(total metals and Cr VI)

Sampling on the Hillslope, PRS 22-015c

In late August and early September, 1995, samples on the hillslope at the south of PRS 22-015c at TA-22 were collected and analyzed for aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, total chromium and chromium VI, cobalt, copper, lead, iron, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. The following ecological screening assessment was completed on this suite of chemicals. These samples were initiated as part of an expedited cleanup plan and were designed to evaluate the chemicals in the soils separate from the chemicals in the tuff. The desired samples were flagged August 28, 1995 and collected September 1, 1995. There were no samples collected in the drainage of the stream in Pajarito Canyon even though there is sediment that is clearly deposited as a result of runoff from the hillslope. Sampling in the drainage was deferred because it is part of the canyons study.

The hillslope is littered with rock fragments that spall from nearby cliffs and trees that have fallen across the slope due to natural processes. These features serve as natural silt dams on the hillslope where soil material collects upslope from the silt dams in small, local catchments. The area of the catchments is approximately 1 to 5 m^2 and support growth of grasses such as mountain muhly and soil macrofauna such as earthworms. The material trapped in the catchments appears rich in soil organic matter and has the dark color associated with horizons enriched in organic carbon. Pine needles and other forest litter in various stages of decomposition and fine mineral material are present in these soils. The texture of the collected soils ranges from loam to silt loam because of the collected materials and organic matter.

PRS 22-015c was surveyed as part of a biological assessment of all former OUs, and detailed results of the assessment are presented elsewhere (Salisbury, 1994). Briefly, the hillslope is part of the south-facing slopes surveyed in Pajarito Canyon. Ponderosa pine is the dominant tree species, and Douglas fir, one-seed juniper, White fir, and Gambel oak are also common. Bluegrass, Mountain muhly, and Little bluestem are the dominant grasses on the hillslope. Small mammals found along hillslopes or in the drainage of Pajarito Canyon include long-tailed vole, mountain vole, white-footed mouse, and deer

mouse. Larger mammals seen in the hillslope area include elk, mule deer, and coyote. Although habitat exists for several threatened or endangered species, no individuals of the threatened or endangered species were located within this PRS. The species of interest for PRS 22-015c are Northern goshawk, Spotted bat, and Meadow jumping mouse according to Salisbury (1994). The bottom of Pajarito Canyon has been identified as a floodplain, and areas within the canyon bottom have been designated as wetlands (Salisbury, 1994). A potential wetland was noted at the confluence of the hillslope drainage with the stream in Pajarito Canyon during reconnaissance for sampling.

Chemicals of potential concern (COPCs) were identified in the EC plan and listed above. Soil concentrations of these analytes are listed in Table 1. An ecological screening assessment was conducted for the hillslope using these COPCs and the screening scheme shown in Figure 1. The first step of the screening assessment was to evaluate the reported concentrations against the upper tolerance limits of the analytes in soils. A UTL is the upper 99th percentile of the concentration of a COPC from a soil sample in an unaffected area at Los Alamos. For example, Table 1 shows the UTL for arsenic as 11.6 mg/kg, and this means that 99% of the soil samples from unaffected areas will have arsenic concentrations of 11.6 mg/kg or less. Most of the COPCs were less than the UTLs except for those samples shown in Table 2. Those COPCs less than UTLs were not considered further in the screening assessment, whereas arsenic, antimony, cadmium, chromium, and iron were evaluated in more detail.

The next step in the screening assessment was to evaluate the habitat of the hillslope. Figure 1 shows the matrix used for the habitat evaluation. The hillslope area has been disturbed by human activity. but not enough to score the site as industrial or for residential development. Thus, the landscape condition score is 2. Accessibility by receptors to COPCs was also scored as 2 because there is access to open spaces from the hillslope and because there is potential transport of COPCs out of the PRS into the canyon bottom. The product of the two scores is 4 which moves the screening assessment into the ecotoxicological screening action (ESAL) comparison.

ESALs were defined as a reference dose to different guilds of animals based on their body weight and ingestion (Ebinger et al, 1994). ESALs are analogous with SALs except that different metabolic rates and different feeding guilds were accounted for in ESALs. Values of the ESALs were generally less than

the UTLs for soils, and UTLs were used instead of ESALs when the ESAL was less than the UTL for a particular COPC. All COPCs in Table 2 except for Ni and Cr for mammals had ESALs < UTL.

Risk ratios are defined as the soil concentration divided by the ESAL or UTL as appropriate. Risk ratios calculated with ESALs also included the uncertainty factor (UF) of 10 and a similar calculation with the UF equal to one. Risk ratios with UF equal to one will be greater than ratios calculated with the nominal ESAL. In all calculations, risk ratios less than one indicate that the soil concentration is less than the ESAL or UTL, and ratios greater than one indicate that the soil concentration exceeds the ESAL or UTL. Summaries of the ESAL or UTL comparisons and risk ratio calculations are in the paragraphs below. Table 3 shows the risk ratios and whether they were calculated with ESALs or UTLs.

Results of ESAL/Soil Concentration Comparisons

The risk ratios were all greater than 1 for each of the COPCs listed in Table 2 and ranges from 1.1 to over 100 (Table 3). These ratios would suggest that PRS 22-015c should be evaluated for EC or VCA, or a more detailed ecological risk assessment should be conducted. The final decision box in the screening assessment flowchart (Figure 1) shows the decision logic. For PRS 22-015c, however, there is another step possible in the assessment. Since the source of the metals in the soil samples will be removed through an EC, it is reasonable to recommend the hillslope for NFA and retain the hillslope for ecological analysis over a larger assessment unit such as the canyons or a site-wide ecological risk assessment.

The expedited cleanup (EC) plan addressed removing the pond area and the contamination from the electroplating processes at PRS 22-015c. Since the pond area is the source of the metals found on the hillslope, removal of the source will decrease the concentration of the COPCs found on the hillslope with time. Continued runoff from the hillslope will move the contaminants from the hillslope locations into the canyon drainage, creating an apparent reduction in soil concentrations of all COPCs in this part of the PRS. It is reasonable to expect the soil concentrations to drop below ESALs or UTLs given enough time. Consideration of COPCs with regard to ecological risk on the hillslope may be of little concern because of continued removal of COPCs and no supply of new COPCs, and because the spatial scale of PRS 22-015c is small compared to the canyon system or to the Laboratory reservation as a whole. Residual

COPCs may play an important role in the ecological risk assessment of the canyons or of the entire Laboratory reservation because they remain in the ecosystem. While no further action (NFA) on the hillslopes is reasonable with regard to PRS 22-015c, NFA with regard to larger-scale ecological assessment cannot be recommended without an ecological risk assessment at the larger scale.

Conclusions

The data from the September, 1995 sampling indicate that most metals are found in the soils at concentrations less than the UTLs established for Los Alamos soils. Those samples that exceeded the UTLs were investigated further using the screening assessment methodology represented in Figure 1. ESALs or UTLs were exceeded for each COPC that was retained after initial comparison to UTLs. One conclusion that can be drawn from the results is that more detailed risk assessment at PRS 22-015c is required or that clean up of the hillslope is needed. A more reasonable conclusion is to recommend NFA for the hillslope because the source term for the COPCs has been removed, and the location of the PRS on slopes ranging from 60° to 75° that would make effective cleanup difficult. Cleanup of the hillslope could result in considerable damage to the environment because of the cleanup operations on steep slopes and could put workers at higher risk of injury than operations in a more favorable location.

REFERENCES

Salisbury, Mary (1994). Biological Assessment for Environmental Restoration Program Operable Unit 1111 TA-6, -7, -22, -40, -58, and -62. Los Alamos National Laboratory Report LA-UR-94-1754.

Figure 1. Flowchart for ecological risk screening assessment.

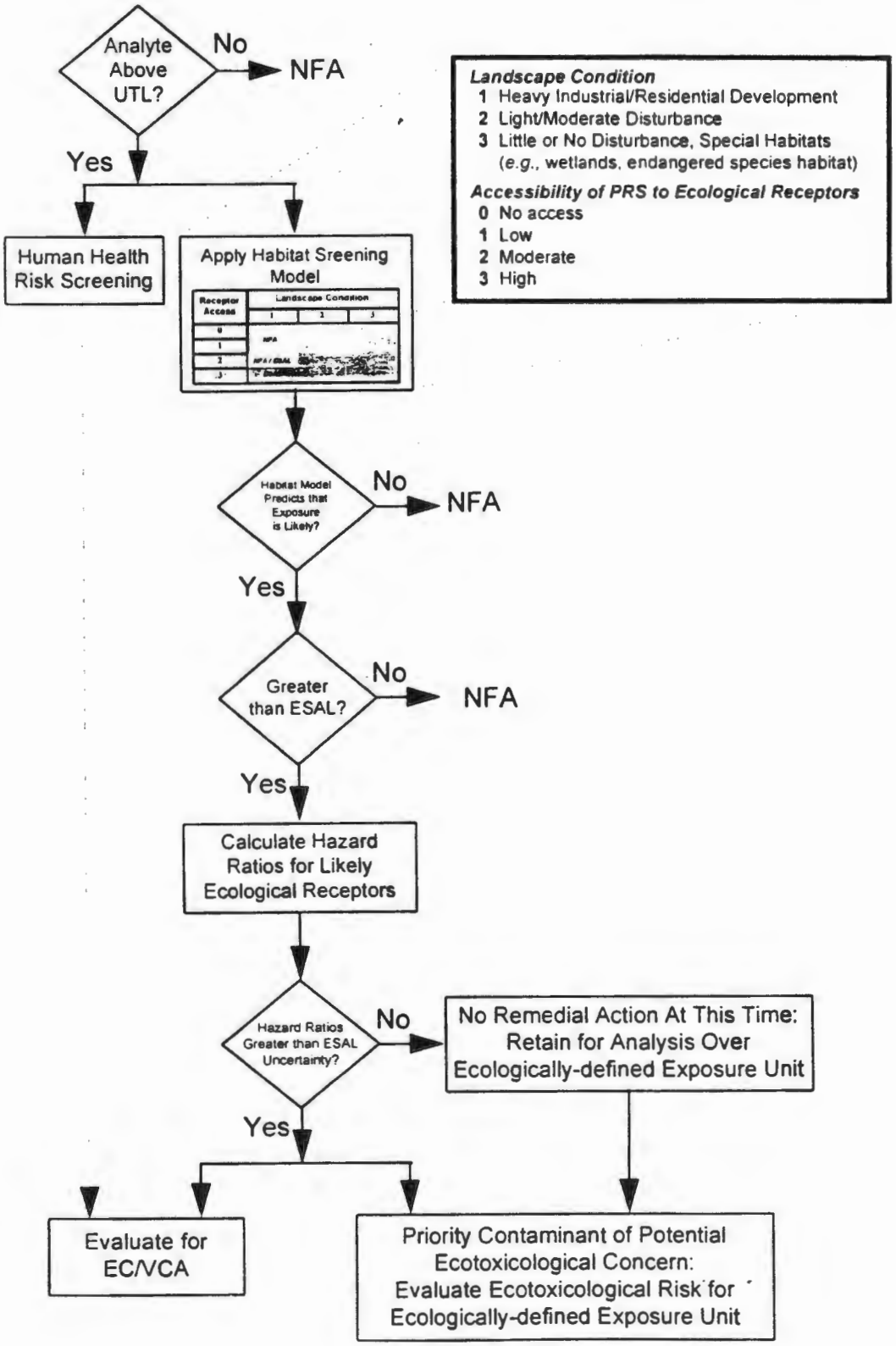


Table 1. Data from hillslope sampling, September, 1995. UTL is the upper tolerance limit or 99th percentile of the confidence interval of the mean soil concentration from unaffected soils. SAL is the screening action level for human health risk assessment.

Data for EC at Plating Outfall, TA-22 (Sampled 9/1/95)

	Concentrations by Sample ID Number (Concentrations in mg/kg)										
Analyte	2008	2008D	2008L	2009	2010	2011	2012	2013	2014	UTL[1]	SAL[1]
Aluminum	4030	3182	15996	3170	5490	4380	6260	4870	5190	123000	
Antimony	9.9	9.9	39.2	10.8	10	11.3	12.2	12.3	11	1	32
Arsenic	2.7	4.1	10.72	3.5	10.6	2.9	21.3	15.2	5.8	9.35	
Barium	19.8	20.6	78.61	66.8	49.5	98.8	84	48	51.3	407	5600
Beryllium	1.2	1.1	4.66	1.1	0.88	0.5	1.3	1.1	0.9	2.49	
Cadmium	8.6	6.7	34.03	139	5.7	3.2	42.8	23.3	22.8	2.7	80
Calcium	1260	1656	5004	2610	1430	5570	2710	1560	2090	54400	
Chromium, Total	34.7	56	137.7	394	149	45.4	442	249	588	27.1	80000
Chromium VI	-0.13	nd[2]	nd	-0.13	-0.13	-0.14	0.17	0.19	-0.14		400
Cobalt	2.2	1.8	8.7	8.7	5.7	3.1	8.2	4.2	7.6	30.3	
Copper	179	337	707	1280	4330	92.7	11500	5920	3730	46	3000
Iron	11800	13338	46638	7130	23800	7980	52100	37400	16100	35600	
Lead	7.8	11.3	30.9	103	68.6	25.4	174	120	288	27.4	400
Magnesium	695	756	2756	706	854	1160	959	704	875	16100	
Manganese	173	212	688	277	255	485	274	192	209	908	11000
Mercury	0.06	0.06	nd	0.36	0.14	0.09	0.29	0.31	0.6	0.1	24
Nickel	110	132	437	1060	533	143	1160	981	1450	18.3	1600
Potassium	570	528	2262	691	873	1080	919	690	860	6180	
Selenium	0.73	0.73	2.9	0.75	0.74	0.84	0.9	0.91	0.8	1.7	400
Silver	1.4	1.5	5.4	43.3	7.3	4.6	13.2	7.8	34.3	1.61	400
Sodium	131	181	521	124	120	107	159	136	141	3320	
Thallium	0.83	0.83	3.3	0.86	0.84	0.95	1.9	1	0.9	1	6.4
Vanadium	13.6	18.8	53.9	19	43.7	13.2	87.7	61.8	34.2	52.4	560
Zinc	43.7	45.8	173.4	168	120	58.8	214	168	201	59.9	24000

[1] UTL from FIMAD Data, SAL from FIMAD or Appendix B, Ebinger et al (1994) (all mg/kg)
[2] nd means no measurement made
[3] SAL of 80,000 mg/kg-d in Cr (III)

Table 2. COPCs that were greater than UTL in Table 1.

Analyte	Sample Ids
Antimony	All
Arsenic	2010, 2012, 2013
Cadmium	All
Total Chromium	All
Copper	All
Lead	2009, 2010, 2012, 2013, 2014
Mercury	2009, 2010, 2012, 2013, 2014
Nickel	All
Silver	2009 - 2014
Zinc	2009, 2010, 2012, 2013, 2014

Table 3. Risk ratios for all COPCs with concentrations greater than the initial UTL comparison.

Ni Risk Ratios

Sample	Ni (mg/kg)	Risk Ratios: *Mammals* Small Insectivores	Large Insectivores	Small Carnivores	Large Carnivores	Small Nectovores	Large Nectivores	Small Omnivores	Large Omnivores	Small Granivores	Large Granivores
UF = 10											
2008	110	5.50E+00	1.05E+00	7.88E+00	2.69E+00	9.94E+00	1.47E+00	7.30E+00	1.41E+00	5.59E+00	1.07E+00
2009	1060	5.30E+01	1.02E+01	7.59E+01	2.59E+01	9.58E+01	1.41E+01	7.04E+01	1.36E+01	5.38E+01	1.03E+01
2010	533	2.67E+01	5.11E+00	3.82E+01	1.30E+01	4.82E+01	7.11E+00	3.54E+01	6.82E+00	2.71E+01	5.19E+00
2011	143	7.15E+00	1.37E+00	1.02E+01	3.50E+00	1.29E+01	1.91E+00	9.50E+00	1.83E+00	7.26E+00	1.39E+00
2012	1160	5.80E+01	1.11E+01	8.31E+01	2.84E+01	1.05E+02	1.55E+01	7.70E+01	1.49E+01	5.89E+01	1.13E+01
2013	981	4.91E+01	9.40E+00	7.02E+01	2.40E+01	8.87E+01	1.31E+01	6.51E+01	1.26E+01	4.98E+01	9.56E+00
2014	1450	7.25E+01	1.39E+01	1.04E+02	3.54E+01	1.31E+02	1.93E+01	9.63E+01	1.86E+01	7.37E+01	1.41E+01
UF = 1											
2008	110	5.50E-01	1.05E-01	7.88E-01	2.69E-01	9.94E-01	1.47E-01	7.30E-01	1.41E-01	5.59E-01	1.07E-01
2009	1060	5.30E+00	1.02E+00	7.59E+00	2.59E+00	9.58E+00	1.41E+00	7.04E+00	1.36E+00	5.38E+00	1.03E+00
2010	533	2.67E+00	5.11E-01	3.82E+00	1.30E+00	4.82E+00	7.11E-01	3.54E+00	6.82E-01	2.71E+00	5.19E-01
2011	143	7.15E-01	1.37E-01	1.02E+00	3.50E-01	1.29E+00	1.91E-01	9.50E-01	1.83E-01	7.26E-01	1.39E-01
2012	1160	5.80E+00	1.11E+00	8.31E+00	2.84E+00	1.05E+01	1.55E+00	7.70E+00	1.49E+00	5.89E+00	1.13E+00
2013	981	4.91E+00	9.40E-01	7.02E+00	2.40E+00	8.87E+00	1.31E+00	6.51E+00	1.26E+00	4.98E+00	9.56E-01
2014	1450	7.25E+00	1.39E+00	1.04E+01	3.54E+00	1.31E+01	1.93E+00	9.63E+00	1.86E+00	7.37E+00	1.41E+00

Risk Ratios, Ni											
		Risk Ratios: *Birds*									
Sample	Ni (mg/kg)	Small Insectivores	Large Insectivores	Small Carnivores	Large Carnivores	Small Nectovores	Large Nectivores	Small Omnivores	Large Omnivores	Small Granivores	Large Granivores
UF = 10											
2008	110	1.39E+01	1.61E+00	1.13E+01	3.97E+00	1.77E+01	1.25E+01	2.53E+01	2.07E+00	1.35E+01	1.56E+00
2009	1060	1.34E+02	1.55E+01	1.09E+02	3.83E+01	1.71E+02	1.20E+02	2.44E+02	1.99E+01	1.30E+02	1.50E+01
2010	533	6.74E+01	7.80E+00	5.50E+01	1.92E+01	8.58E+01	6.05E+01	1.23E+02	1.00E+01	6.52E+01	7.55E+00
2011	143	1.81E+01	2.09E+00	1.47E+01	5.16E+00	2.30E+01	1.62E+01	3.29E+01	2.69E+00	1.75E+01	2.03E+00
2012	1160	1.47E+02	1.70E+01	1.20E+02	4.19E+01	1.87E+02	1.32E+02	2.67E+02	2.18E+01	1.42E+02	1.64E+01
2013	981	1.24E+02	1.43E+01	1.01E+02	3.54E+01	1.58E+02	1.11E+02	2.26E+02	1.85E+01	1.20E+02	1.39E+01
2014	1450	1.83E+02	2.12E+01	1.50E+02	5.23E+01	2.33E+02	1.65E+02	3.34E+02	2.73E+01	1.77E+02	2.05E+01
UF = 1											
2008	110	1.39E+00	1.61E-01	1.13E+00	3.97E-01	1.77E+00	1.25E+00	2.53E+00	2.07E-01	1.35E+00	1.56E-01
2009	1060	1.34E+01	1.55E+00	1.09E+01	3.83E+00	1.71E+01	1.20E+01	2.44E+01	1.99E+00	1.30E+01	1.50E+00
2010	533	6.74E+00	7.80E-01	5.50E+00	1.92E+00	8.58E+00	6.05E+00	1.23E+01	1.00E+00	6.52E+00	7.55E-01
2011	143	1.81E+00	2.09E-01	1.47E+00	5.16E-01	2.30E+00	1.62E+00	3.29E+00	2.69E-01	1.75E+00	2.03E-01
2012	1160	1.47E+01	1.70E+00	1.20E+01	4.19E+00	1.87E+01	1.32E+01	2.67E+01	2.18E+00	1.42E+01	1.64E+00
2013	981	1.24E+01	1.43E+00	1.01E+01	3.54E+00	1.58E+01	1.11E+01	2.26E+01	1.85E+00	1.20E+01	1.39E+00
2014	1450	1.83E+01	2.12E+00	1.50E+01	5.23E+00	2.33E+01	1.65E+01	3.34E+01	2.73E+00	1.77E+01	2.05E+00

Risk Ratios, Ag											
(ESAL< UTL)											
		Risk Ratios: *Birds and Mammals*									
Sample	Ag (mg/kg)	Small Insectivores	Large Insectivores	Small Carnivores	Large Carnivores	Small Nectovores	Large Nectivores	Small Omnivores	Large Omnivores	Small Granivores	Large Granivores
UF = 10											
2009	43.3	2.69E+01	2.69E+01	2.69E+01	2.69E+01	2.69E+01	2.69E+01	2.69E+01	2.69E+01	2.69E+01	2.69E+01
2010	7.3	4.53E+00	4.53E+00	4.53E+00	4.53E+00	4.53E+00	4.53E+00	4.53E+00	4.53E+00	4.53E+00	4.53E+00
2011	4.6	2.86E+00	2.86E+00	2.86E+00	2.86E+00	2.86E+00	2.86E+00	2.86E+00	2.86E+00	2.86E+00	2.86E+00
2012	13.2	8.20E+00	8.20E+00	8.20E+00	8.20E+00	8.20E+00	8.20E+00	8.20E+00	8.20E+00	8.20E+00	8.20E+00
2013	7.8	4.84E+00	4.84E+00	4.84E+00	4.84E+00	4.84E+00	4.84E+00	4.84E+00	4.84E+00	4.84E+00	4.84E+00
2014	34.3	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01

Risk Ratios, Zn											
(ESAL< UTL)											
		Risk Ratios: *Birds and Mammals*									
Sample	Zn (mg/kg)	Small Insectivores	Large Insectivores	Small Carnivores	Large Carnivores	Small Nectovores	Large Nectivores	Small Omnivores	Large Omnivores	Small Granivores	Large Granivores
UF = 10											
2009	168	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00
2010	120	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00
2011	58.8	9.82E-01	9.82E-01	9.82E-01	9.82E-01	9.82E-01	9.82E-01	9.82E-01	9.82E-01	9.82E-01	9.82E-01
2012	214	3.57E+00	3.57E+00	3.57E+00	3.57E+00	3.57E+00	3.57E+00	3.57E+00	3.57E+00	3.57E+00	3.57E+00
2013	168	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00
2014	201	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00

Risk Ratios, Cu
(ESAL< UTL)

Sample	Cu (mg/kg)	Risk Ratios: *Birds and Mammals* Small Insectivores	Large Insectivores	Small Carnivores	Large Carnivores	Small Nectovores	Large Nectivores	Small Omnivores	Large Omnivores	Small Granivores	Large Granivores
UF = 10											
2008	179	3.89E+00	3.89E+00	3.89E+00	3.89E+00	3.89E+00	3.89E+00	3.89E+00	3.89E+00	3.89E+00	3.89E+00
2009	1280	2.78E+01	2.78E+01	2.78E+01	2.78E+01	2.78E+01	2.78E+01	2.78E+01	2.78E+01	2.78E+01	2.78E+01
2010	4330	9.41E+01	9.41E+01	9.41E+01	9.41E+01	9.41E+01	9.41E+01	9.41E+01	9.41E+01	9.41E+01	9.41E+01
2011	92.7	2.02E+00	2.02E+00	2.02E+00	2.02E+00	2.02E+00	2.02E+00	2.02E+00	2.02E+00	2.02E+00	2.02E+00
2012	11500	2.50E+02	2.50E+02	2.50E+02	2.50E+02	2.50E+02	2.50E+02	2.50E+02	2.50E+02	2.50E+02	2.50E+02
2013	5920	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02
2014	3730	8.11E+01	8.11E+01	8.11E+01	8.11E+01	8.11E+01	8.11E+01	8.11E+01	8.11E+01	8.11E+01	8.11E+01

Risk Ratios, Pb
(ESAL< UTL)

Sample	Pb (mg/kg)	Risk Ratios: *Birds and Mammals* Small Insectivores	Large Insectivores	Small Carnivores	Large Carnivores	Small Nectovores	Large Nectivores	Small Omnivores	Large Omnivores	Small Granivores	Large Granivores
UF = 10											
2009	103	3.76E+00	3.76E+00	3.76E+00	3.76E+00	3.76E+00	3.76E+00	3.76E+00	3.76E+00	3.76E+00	3.76E+00
2010	68.6	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00
2012	174	6.35E+00	6.35E+00	6.35E+00	6.35E+00	6.35E+00	6.35E+00	6.35E+00	6.35E+00	6.35E+00	6.35E+00
2013	120	4.38E+00	4.38E+00	4.38E+00	4.38E+00	4.38E+00	4.38E+00	4.38E+00	4.38E+00	4.38E+00	4.38E+00
2014	288	1.05E+01	1.05E+01	1.05E+01	1.05E+01	1.05E+01	1.05E+01	1.05E+01	1.05E+01	1.05E+01	1.05E+01

Cr Risk Ratios											
		Risk Ratios: *Mammals*									
Sample	Cr (mg/kg)	Small Insectivores	Large Insectivores	Small Carnivores	Large Carnivores	Small Nectovores	Large Nectivores	Small Omnivores	Large Omnivores	Small Granivores	Large Granivores
UF = 10											
2008	34.7	4.13E+01	7.92E+00	5.92E+01	2.02E+01	7.47E+01	1.10E+01	5.49E+01	1.06E+01	4.20E+01	8.05E+00
2009	394	4.69E+02	8.99E+01	6.72E+02	2.29E+02	8.48E+02	1.25E+02	6.23E+02	1.20E+02	4.77E+02	9.14E+01
2010	149	1.77E+02	3.40E+01	2.54E+02	8.67E+01	3.21E+02	4.73E+01	2.36E+02	4.54E+01	1.80E+02	3.46E+01
2011	45.4	5.40E+01	1.04E+01	7.74E+01	2.64E+01	9.77E+01	1.44E+01	7.18E+01	1.38E+01	5.49E+01	1.05E+01
2012	442	5.26E+02	1.01E+02	7.54E+02	2.57E+02	9.51E+02	1.40E+02	6.99E+02	1.35E+02	5.35E+02	1.03E+02
2013	249	2.96E+02	5.68E+01	4.24E+02	1.45E+02	5.36E+02	7.91E+01	3.94E+02	7.59E+01	3.01E+02	5.78E+01
2014	588	7.00E+02	1.34E+02	1.00E+03	3.42E+02	1.27E+03	1.87E+02	9.30E+02	1.79E+02	7.11E+02	1.36E+02
UF = 1											
2008	34.7	4.13E+00	7.92E-01	5.92E+00	2.02E+00	7.47E+00	1.10E+00	5.49E+00	1.06E+00	4.20E+00	8.05E-01
2009	394	4.69E+01	8.99E+00	6.72E+01	2.29E+01	8.48E+01	1.25E+01	6.23E+01	1.20E+01	4.77E+01	9.14E+00
2010	149	1.77E+01	3.40E+00	2.54E+01	8.67E+00	3.21E+01	4.73E+00	2.36E+01	4.54E+00	1.80E+01	3.46E+00
2011	45.4	5.40E+00	1.04E+00	7.74E+00	2.64E+00	9.77E+00	1.44E+00	7.18E+00	1.38E+00	5.49E+00	1.05E+00
2012	442	5.26E+01	1.01E+01	7.54E+01	2.57E+01	9.51E+01	1.40E+01	6.99E+01	1.35E+01	5.35E+01	1.03E+01
2013	249	2.96E+01	5.68E+00	4.24E+01	1.45E+01	5.36E+01	7.91E+00	3.94E+01	7.59E+00	3.01E+01	5.78E+00
2014	588	7.00E+01	1.34E+01	1.00E+02	3.42E+01	1.27E+02	1.87E+01	9.30E+01	1.79E+01	7.11E+01	1.36E+01

Risk Ratios, As											
(ESAL < UTL)											
		Risk Ratios: *Birds and Mammals*									
Sample	**As (mg/kg)**	**Small Insectivores**	**Large Insectivores**	**Small Carnivores**	**Large Carnivores**	**Small Nectovores**	**Large Nectivores**	**Small Omnivores**	**Large Omnivores**	**Small Granivores**	**Large Granivores**
UF = 10											
2010	10.6	1.13E+00	1.13E+00	1.13E+00	1.13E+00	1.13E+00	1.13E+00	1.13E+00	1.13E+00	1.13E+00	1.13E+00
2012	21.3	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00	2.28E+00
2013	15.2	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00
Risk Ratios, Cr Total											
(ESAL < UTL)											
		Risk Ratios: *Birds*									
Sample	**Cr (mg/kg)**	**Small Insectivores**	**Large Insectivores**	**Small Carnivores**	**Large Carnivores**	**Small Nectovores**	**Large Nectivores**	**Small Omnivores**	**Large Omnivores**	**Small Granivores**	**Large Granivores**
UF = 10											
2008	34.7	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00
2009	394	1.45E+01	1.45E+01	1.45E+01	1.45E+01	1.45E+01	1.45E+01	1.45E+01	1.45E+01	1.45E+01	1.45E+01
2010	149	5.50E+00	5.50E+00	5.50E+00	5.50E+00	5.50E+00	5.50E+00	5.50E+00	5.50E+00	5.50E+00	5.50E+00
2011	45.4	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00
2012	442	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01	1.63E+01
2013	249	9.19E+00	9.19E+00	9.19E+00	9.19E+00	9.19E+00	9.19E+00	9.19E+00	9.19E+00	9.19E+00	9.19E+00
2014	588	2.17E+01	2.17E+01	2.17E+01	2.17E+01	2.17E+01	2.17E+01	2.17E+01	2.17E+01	2.17E+01	2.17E+01

Risk Ratios, Cd

(ESAL < UTL, Use UTL for ESAL)

		Risk Ratios: *Birds and Mammals*									
Sample	Cd (mg/kg)	Small Insectivores	Large Insectivores	Small Carnivores	Large Carnivores	Small Nectovores	Large Nectivores	Small Omnivores	Large Omnivores	Small Granivores	Large Granivores
UF = 10											
2008	8.6	3.19E+00	3.19E+00	3.19E+00	3.19E+00	3.19E+00	3.19E+00	3.19E+00	3.19E+00	3.19E+00	3.19E+00
2009	139	5.15E+01	5.15E+01	5.15E+01	5.15E+01	5.15E+01	5.15E+01	5.15E+01	5.15E+01	5.15E+01	5.15E+01
2010	5.7	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00
2011	302	1.12E+02	1.12E+02	1.12E+02	1.12E+02	1.12E+02	1.12E+02	1.12E+02	1.12E+02	1.12E+02	1.12E+02
2012	42.8	1.59E+01	1.59E+01	1.59E+01	1.59E+01	1.59E+01	1.59E+01	1.59E+01	1.59E+01	1.59E+01	1.59E+01
2013	23.3	8.63E+00	8.63E+00	8.63E+00	8.63E+00	8.63E+00	8.63E+00	8.63E+00	8.63E+00	8.63E+00	8.63E+00
2014	22.8	8.44E+00	8.44E+00	8.44E+00	8.44E+00	8.44E+00	8.44E+00	8.44E+00	8.44E+00	8.44E+00	8.44E+00

Risk Ratios, Sb (Antimony)

(ESAL < UTL)

		Risk Ratios: *Birds and Mammals*									
Sample	Sb (mg/kg)	Small Insectivores	Large Insectivores	Small Carnivores	Large Carnivores	Small Nectovores	Large Nectivores	Small Omnivores	Large Omnivores	Small Granivores	Large Granivores
UF = 10											
2008	9.9	9.90E+00	9.90E+00	9.90E+00	9.90E+00	9.90E+00	9.90E+00	9.90E+00	9.90E+00	9.90E+00	9.90E+00
2009	10.8	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01
2010	10	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01
2011	11.3	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01
2012	12.2	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01
2013	12.3	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01
2014	11	1.10E+01	1.10E+01	1.10E+01	1.10E+01	1.10E+01	1.10E+01	1.10E+01	1.10E+01	1.10E+01	1.10E+01

Appendix C

Acceptance Inspection Checklist

APPENDIX C

ACCEPTANCE INSPECTION CHECKLIST

Unit Number and Description

22-015(c) Outfall

✓ EPA and DOE notified at least 10 days in advance of field work.

✓ Contaminated soil removed.

✓ Verification samples cinfirm contamination remaining at the site is below established cleanup levels.

✓ All waste generated is characterized and managed appropriately.

✓ Health and Ecological Risk Assessed on hillside.

✓ Excavated area backfilled with clean fill.

✓ Site restored.

Reviewer David McInroy

Signature: _____

Appendix D

Photographs

PRS 22-015(c) - Excavation and removal of stained soil in ponding area of outfall

Appendix E

Certification of Completion

Certification of Completion

I certify that all the work pertaining to the Expedited Cleanup (EC) of PRS 22-015(c) has been completed in accordance with the Department of Energy approved EC Plan entitled Expedited Cleanup Plan for Solid Waste management Unit 22-015(c), June 1995, Revision 0. Based on my personal involvement or inquiry of the person or persons who managed this cleanup, a review of all the data gathered, and a visit to this site, to the best of my knowledge and belief, all criteria have been met or exceeded. I believe that the completion of this EC is protective to both human health and the environment. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Cheryl Rofer
Field Unit 5 Field Project Leader
Environmental Restoration Project
Los Alamos National Laboratory

9/28/95
Date Signed

Dave McInroy
Regulatory Compliance Manager, Independent Review
Environmental Restoration Project Office
Los Alamos National Laboratory

9/29/95
Date Signed