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Radionuclide Concentrations in/on Vegetation at Radioactive-Waste Disposal Area G during the 1995 Growing Season

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RADIONUCLIDE CONCENTRATIONS IN/ON VEGETATION AT RADIOACTIVE-WASTE DISPOSAL AREA G DURING THE 1995 GROWING SEASON

by

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ABSTRACT

Overstory (pinon pine) and understory (grass and forb) vegetation were collected within and around selected points at Area G—a low-level radioactive solid-waste disposal facility at Los Alamos National Laboratory—for the analysis of tritium (^{3}H), strontium (^{90}Sr), plutonium (^{238}Pu and ^{239}Pu), cesium (^{137}Cs), and total uranium. Also, heavy metals (Ag, As, Ba, Be, Cd, Cr, Hg, Ni, Pb, Sb, Se, and Tl) in/on vegetation were determined. In general, most (unwashed) vegetation collected within and around Area G contained ^{3}H, uranium, ^{238}Pu, and ^{239}Pu in higher concentrations than vegetation collected from background areas. Tritium, in particular, was detected as high as 7,300 pCi mL^{-1} in understory vegetation collected from the west side of the transuranic (TRU) pads. The south and west ends of the tritium shaft field also contained elevated levels of ^{3}H in overstory, and especially in understory vegetation, as compared to background; this suggests that ^{3}H may be migrating from this waste repository through surface and subsurface pathways. Also, understory vegetation collected north of the TRU pads (adjacent to the fence line of Area G) contained the highest values of ^{238}Pu and ^{239}Pu as compared to background, and may be a result of surface holding, storage, and/or disposal activities.

I. INTRODUCTION

Solid radioactive wastes have been buried by Los Alamos National Laboratory (LANL) since the early 1940s (Purtymun et al. 1980). Area G—a 25.5-hectare (63-acre), low-level radioactive management and disposal area located on the east end of Mesa del Buey at TA-54—was established in 1957 and, at present, is the Laboratory's primary radioactive-solid-waste burial and storage site (Soholt 1990) (Figure 1). In general, wastes (contaminated equipment, paper, plastics, clothing, building materials, soils, and process wastes) are placed in either pits, trenches, or shafts and then covered with fill material (Hanson et al. 1980). Tritium, uranium, plutonium, and a variety of fission and activation products

are the main isotopes in waste materials deposited at Area G (U.S. DOE 1979).

As part of the Environmental Surveillance Program at LANL, air (Environmental Protection Group 1995), sediment and soil (Conrad et al. 1995, Fresquez et al. 1995a), vegetation (Fresquez et al. 1995b), biota (Biggs et al. 1995), and bees and honey (Fresquez et al. 1994) are collected from within and around radioactive disposal site Area G on an annual basis to help monitor and assess the site's impact on the surrounding community. One important component of this program is the assessment of vegetation growing within and around Area G for radiological contamination; the uptake of isotopes by vegetation, for example, may give some insight into surface (Hanson et al. 1980) and subsurface (Wenzel et al. 1987) contaminant pathways to humans from waste disposal areas. Trees, in particular, have been shown to be excellent indicators of subterranean tritium migration out of low-level radioactive-waste disposal sites (Rickard and Kirby 1987).

The objective of this study was to determine the concentrations of selected radionuclides in/on overstory and understory vegetation within (inside the fence) and around (outside the fence) Area G during the 1995 growing season. These data were compared with radionuclide concentrations in/on vegetation collected from a regional background location upwind of the Laboratory. Also, analyses of heavy metals in vegetation were conducted.

II. METHODS

In August of 1995, the Soils and Foodstuffs Environmental Surveillance Program Team of Ecology Group ESH-20 collected approximately 12 vegetation samples from six areas within and around Area G at TA-54. The six sampling areas were located at (1) south of the tritium shafts just outside the fence, (2) west of the tritium shafts just outside the fence, (3) east side of the new waste pit inside the fence, (4) north of the transuranic (TRU) pads just outside the fence, (5) west side of the TRU pad, and (6) east side of the TRU pad (Figure 2). Background samples were also collected approximately four miles southeast and upwind of the Laboratory. All survey coordinates associated with these sampling sites are listed in Table 1.

At each site, samples were collected from either overstory (pinon pine) or understory (grasses and forbs) vegetation or both. Pinon pine (*Pinus edulis*) are the most typical overstory tree in the Area G vicinity (Tierney and Foxx 1982). Overstory samples consisted of tree-shoot tips approximately 1 to 2 in. in length at the 4- to 5-ft height. Understory samples

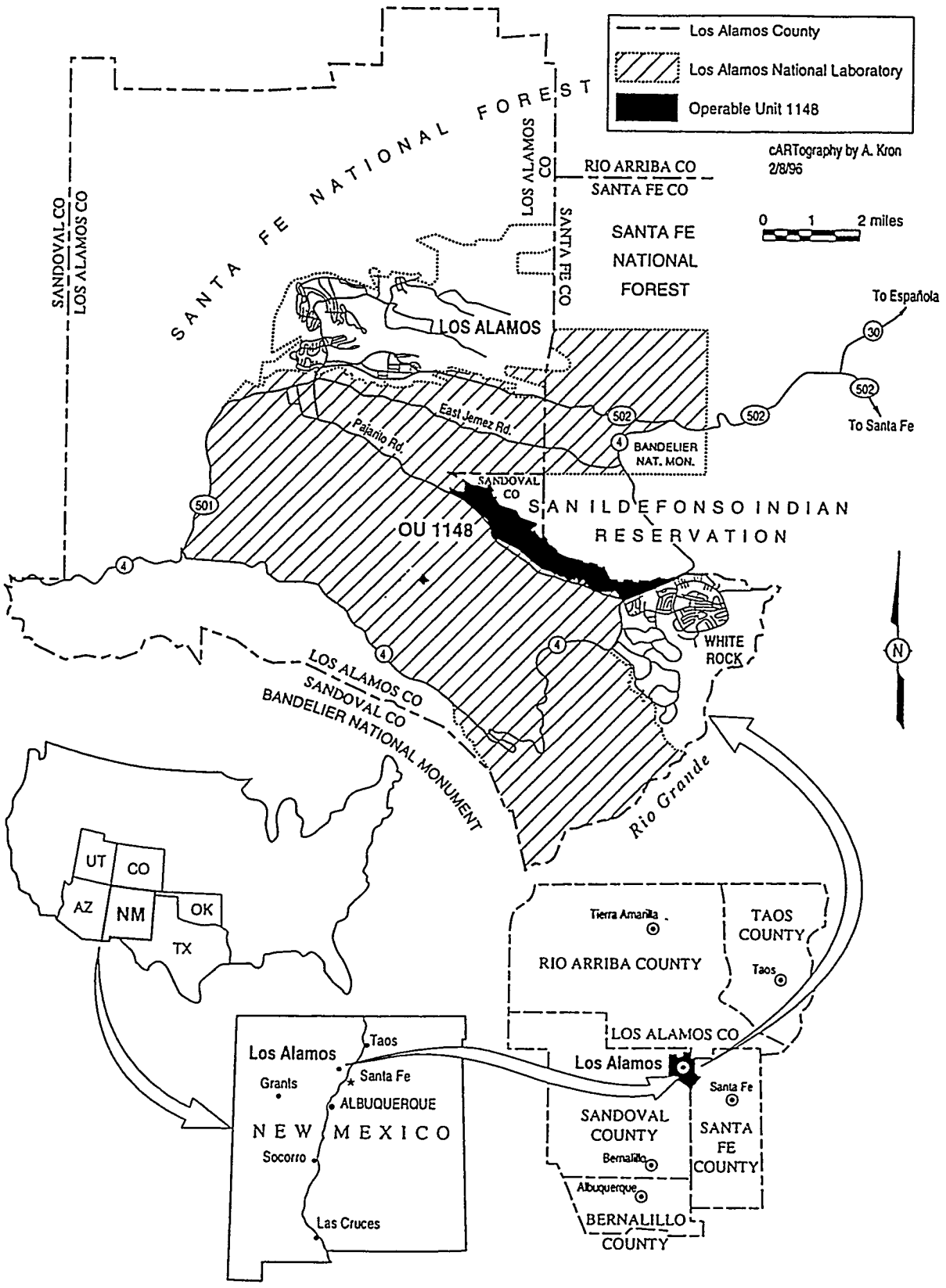

Figure 1. Location of Area G at TA-54 (OU 1148) at Los Alamos National Laboratory.

consisted of grass and forb (top growth) subsamples from the center and corners of a 30- by 30-ft area. The pinon pine trees acted as the center of the square.

Collectors of samples wore plastic gloves and used clean shears. Samples, consisting of 2 to 3 lb of composited material, were double bagged in labeled Ziploc plastic bags and transported to the Laboratory in locked ice chests. At the Laboratory, unwashed samples from each bag were divided into three subsets to provide analysis material for tritium, heavy metals, and other radionuclides (^{90}Sr, ^{238}Pu, ^{239}Pu, ^{137}Cs, and total uranium). Vegetation samples collected at Area G were not washed in order to assess the total amount of radionuclides, be it from root uptake and/or from plant surface (wind-borne and splash) deposition, on the plant to herbivore pathway that would be attributable to Area G operations (re-suspension of soil [contaminated] particles onto plant surfaces by traffic is but one of these activities).

Subsamples for ^{3}H analysis were placed in a glass beaker apparatus to collect distillate water (Salazar 1984). Vegetation subsamples for heavy metals were dried at 70°C for 48 h before being ground in a Wiley mill (40-mm screen) (Fresquez et al. 1990). The rest of the subsample set(s) were placed in 1-L glass beakers and ashed at 500°C for 120

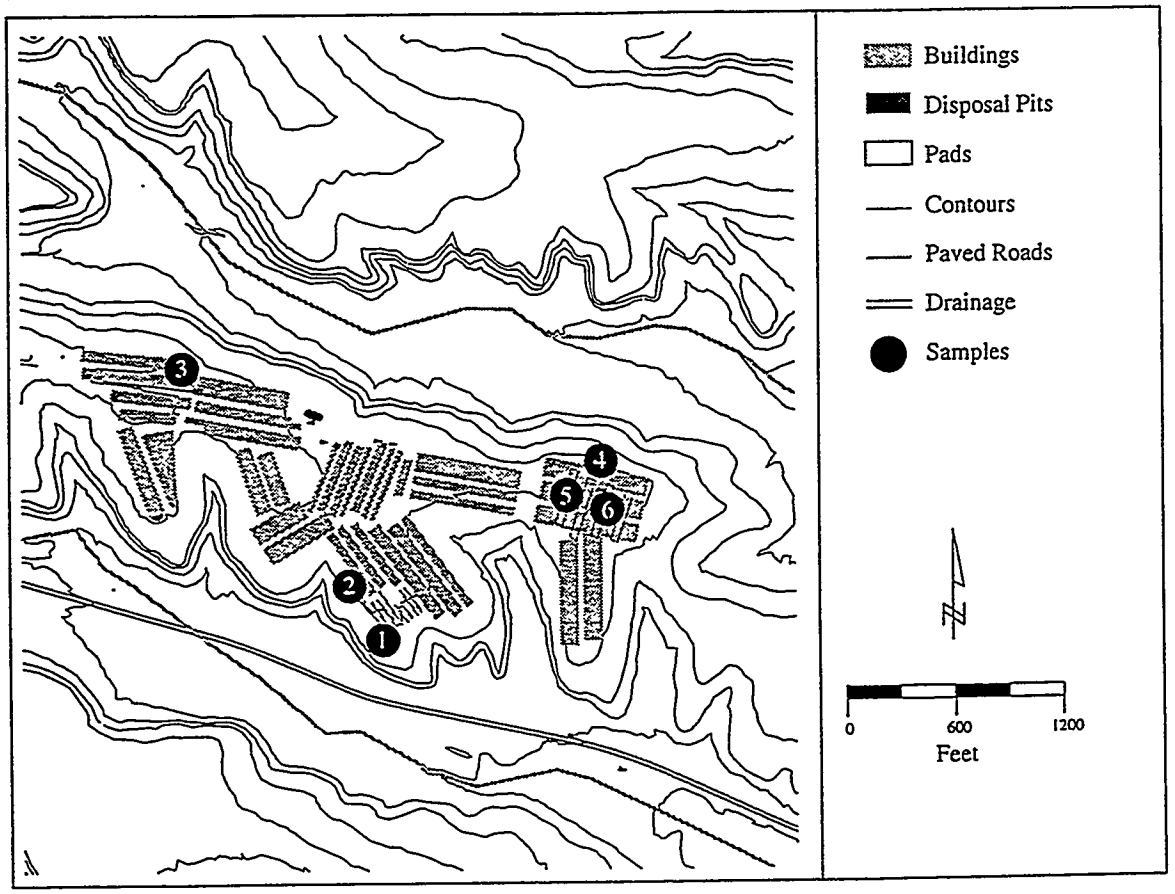

Fig. 2. Locations of vegetation samples collected at Area G.

h; after ashing, the sample was pulverized and homogenized, transferred to labeled 500-mL poly bottles, and submitted with the distillate (water) samples under full chain-of-custody to the Environmental Chemistry Group (CST-9) for the analysis of ^{3}H, ^{90}Sr, ^{238}Pu, ^{239}Pu, ^{137}Cs, and total uranium. All methods of radiochemical analyses have been described previously (Salazar 1984). Radionuclide results were reported in pCi mL^{-1} (of tissue moisture) for tritium, μg for uranium, and pCi g^{-1} of ash for all the other isotopes. Results in grams of ash are usually two to four orders of magnitude higher than live (wet) weight.

For heavy metal analysis, the vegetation was first digested with nitric or a combination of nitric and hydrochloric acid. The heavy metal content in the vegetation was determined by inductively coupled plasma atomic emission spectrometry (ICPES) for Ag, Ba, Be, Cd, Cr, Ni, and Pb; by inductively coupled plasma mass spectrometry (ICPMS) for Sb and Tl; by electrothermal vaporation atomic absorption (ETVAA) for As and Se; and by cold vapor atomic absorption (CVAA) for Hg. Heavy metal results in vegetation were reported in μg dry g^{-1}.

III. RESULTS AND DISCUSSION

Radionuclides. Results of radionuclide concentrations in/on unwashed vegetation collected from Area G during the 1995 growing season are presented in Table 1. In general, most radionuclide concentrations, with the exception of ^{90}Sr and ^{137}Cs, in/on overstory and understory vegetation collected from within and around Area G were detectable (where the analytical result was greater than two times the counting uncertainty) and higher than upper limit background values. The regional statistical reference level (RSRL) or the upper-limit background concentration is defined as the mean plus two standard deviations (95% confidence level) calculated from 1994 (Fresquez et al. 1995b) and 1995 (present study) radionuclide data.

Overstory and understory vegetation collected from within and around Area G were significantly higher in ^{3}H concentrations than vegetation collected from background locations (Table 1). The highest ^{3}H concentrations were detected in understory vegetation collected from the western side of the TRU pads (#5) (7,300 pCi mL^{-1}). Also, not only was understory vegetation higher in ^{3}H than vegetation collected from background locations, understory vegetation contained markedly higher concentrations of ^{3}H than overstory vegetation (e.g., ^{3}H shaft sites #1 and #2, in particular)—a pattern, by the way, that was opposite of last year's result

Table 1. Radionuclide concentrations in vegetation collected from Area G (TA-54) during the 1995 growing season.

Sites	^{3}H (pCi mL^{-1})[a]	^{90}Sr (pCi g^{-1} ash)	Uranium (µg g^{-1} ash)	^{238}Pu (pCi g^{-1} ash)	^{239}Pu (pCi g^{-1} ash)	^{137}Cs (pCi g^{-1} ash)
Radioactive Waste Disposal Area G						
#1 Tritium Shafts (south of the shafts just outside the fence) (n=1756953.488 and e=1643662.784)						
Overstory	386.0 (40.0)[b*c]	6.3 (0.8)	0.47 (0.22)*	-0.001(0.002)	0.003(0.002)	0.63 (1.88)
Understory	1,400.0(140.0)*	3.8 (0.8)	0.94 (1.48)	0.008(0.002)*	0.014(0.002)*	0.59 (0.26)*
#2 Tritium Shafts (west of the shafts just outside the fence) (n=1757285.071 and e=1643397.389)						
Overstory	418.0 (40.0)*	7.1 (1.0)	0.82 (0.16)*	0.003(0.002)*	0.004(0.002)	0.49 (0.24)
Understory	4,200.0(400.0)*	4.1 (0.6)	0.91 (0.18)*	0.003(0.002)	0.010(0.002)*	0.78 (0.28)*
#3 Waste Pits (east of the new pit inside the fence) (n=1758395.475 and e=1642551.376)						
Overstory	2.8 (1.0)*	2.3 (0.8)	2.46 (0.50)*	0.009(0.004)*	0.023(0.006)*	-0.44 (0.48)
Understory	3.2 (1.0)*	1.4 (0.4)	1.95 (1.06)*	0.005(0.002)*	0.014(0.002)*	0.52 (0.24)*
#4 TRU Pads (north of pads just outside the fence) (n=1757983.093 and e=1644840.019)						
Overstory	4.3 (1.2)*	7.2 (1.0)	1.21 (0.24)*	0.025(0.006)*	0.055(0.008)*	0.69 (2.08)
Understory	3.7 (1.2)*	6.1 (0.8)*	1.32 (2.60)	0.080(0.008)*	0.133(0.010)*	0.62 (0.30)*
#5 TRU Pads (west side of the pads) (n=1757798.613 and e=1644869.613)						
Understory	7,300.0(700.0)*	3.0 (0.4)	0.81 (0.16)*	0.001(0.002)	0.009(0.004)*	1.97 (0.52)*
#6 TRU Pads (east side of the pads) (n=1757802.643 and e=1644964.920)						
Understory	2,700.0(280.0)*	1.6 (0.6)	0.86 (0.18)*	0.004(0.002)	0.006(0.002)*	0.29 (0.86)
Regional (Background)						
Overstory	0.0 (0.6)	7.9 (1.2)	0.38 (0.08)	-0.001(0.002)	0.002(0.002)	1.16 (0.46)
OSRSRL[d]	**2.3**	**13.3**	**0.42**	**0.001**	**0.004**	**2.13**
Understory	0.1 (0.6)	3.0 (0.8)	0.57 (0.12)	0.000(0.002)	0.002(0.002)	-0.10 (0.48)
USRSRL[e]	**2.0**	**4.1**	**0.76**	**0.004**	**0.003**	**0.34**

[a] mL of tissue moisture.

[b] (±2 counting uncertainty).

[c]*Detectable value (where the analytical result was higher than two times the counting uncertainty) and higher than upper limit background.

[d] OSRSRL=Overstory regional statistical reference level (i.e., the upper-limit background concentration based on the mean + 2 std dev from 1994 and 1995 data).

[e] USRSRL=Understory regional statistical reference level (i.e., the upper-limit background concentration based on the mean + 2 std dev from 1994 and 1995 data).

(i.e., overstory vegetation collected near the ^{3}H shafts in 1994 contained higher ^{3}H concentrations than understory vegetation) (Table 2).

The differences in ^{3}H concentrations in understory verses overstory vegetation observed in 1994 and 1995 was probably related to several factors, namely: (1) rooting pattern differences between understory and overstory vegetation, (2) amount of precipitation, and (3) temperature in the area prior to sample collection. In 1994 and 1995, for example, the total amount of precipitation received in the Area G area just days prior to sampling was approximately 3 cm (1.2 in) and 0.25 cm (0.1 in), respectively. Also, the mean maximum weekly daylight temperature prior to sampling in 1994 and 1995 was 26°C (79°F) and 33°C (91°F), respectively. The higher amounts of rainfall and lower temperatures in 1994 as compared to 1995 may have moved peak concentrations of ^{3}H, which is very closely associated with the hydrologic cycle and temperature (Wicker and Schultz 1982), from near soil-surface depths (0 to 15 cm), where the optimum water-to-root uptake for understory vegetation occurs, to soil-subsurface depths (5 to 30 cm), where the optimum water-to-root uptake for overstory vegetation occurs (Breshears 1993). Conversely, with little precipitation and markedly hotter temperatures in 1995 as compared to 1994, ^{3}H, due to vapor phase transport from soil-subsurface depths to near soil-surface depths (Conrad et al. 1995), may be more available for plant uptake by the more shallower rooted understory plants than by the deeper-rooted overstory plants.

Concentrations of ^{90}Sr ranged from 1.4 to 7.2 pCi g^{-1} ash in/on vegetation collected from within and around Area G and were mostly within upper limit background concentrations.

Total uranium concentrations in/on vegetation collected from Area G ranged from 0.47 to 2.46 µg g^{-1} ash and were generally lower in concentrations than in past years. The highest uranium concentration was detected in/on pinon trees growing near the new waste pit (#3) and may be more a result of the higher (observed) dust levels on plant surfaces in the area than from a true contamination source. In any case, uranium levels in/on vegetation within and around Area G were just above upper limit background concentrations and closely matched uranium values in/on vegetation collected within and around Area G in 1983 (0.09 to 1.00 µg g^{-1} ash) (Mayfield and Hanson 1983).

Most ^{238}Pu and ^{239}Pu concentrations in/on vegetation collected from within Area G were detectable and higher than upper limit background concentrations. Both ^{238}Pu and ^{239}Pu were highest in/on understory vegetation

Table 2. Comparison of past and present (1994 and 1995) ^{3}H and ^{239}Pu data in vegetation collected at similar sites within and around Area G.

Sites	^{3}H pCi mL^{-1}	^{239}Pu pCi g^{-1} ash
#1 Tritium shafts (south of the shafts just outside fence)		
Understory		
Past[a]	1,450.0	0.03
Present		
1994[b]	201.0	0.02
1995	1,400.0	0.01
#2 Tritium shafts (west of the shafts just outside the fence)		
Overstory		
Past[c]	2,200 to 4,800	0.01
Present		
1994	5,800.0	0.01
1995	418.0	0.00
Understory		
Past[a]	0.4	0.27
Present		
1994	328.0	0.01
1995	4,200.0	0.01
#4 TRU pads (north of the pads just outside fence)		
Overstory		
Past[a]	14.4	0.57 to 3.28
Present		
1994	2.5	0.01
1995	4.3	0.06
Understory		
Past[a]	3,860 to 19,100	0.52 to 1.55
Present		
1994	35.6	0.15
1995	3.7	0.13
#5 TRU pads (west side of the pads)		
Understory		
Past[d]	392 to 101,000	
Present		
1994	177.3	0.01
1995	7,300.0	0.01
#6 TRU pads (east side of the pads)		
Understory		
Past[a]	1,028.0	0.95
Present		
1994	952.5	0.01
1995	2,700.0	0.01

[a]Data from Mayfield and Hanson (1983).
[b]Data from Fresquez et al. (1994).
[c]Data (1985) from Jacobson (1992).
[d]Data from Purtymun (1973).

samples (0.080 and 0.133 pCi g^{-1} ash, respectively) collected north of the TRU pads outside the fence (#4). Overstory and understory vegetation collected from this general location north of the TRU pads in 1980 contained ^{239}Pu at concentrations ranging from 0.57 to 3.28 and from 0.52 to 1.55 pCi g^{-1} ash, respectively (Table 2) (Mayfield and Hanson 1983). Mayfield and Hanson (1983) attributed the higher ^{239}Pu levels in/on understory vegetation collected from Area G, compared with vegetation collected from background areas, to occasional spills during disposal operations and/or to surface storage and holding practices. Most Pu (nearly 100%) found in/on vegetation, however, is due to soil deposition (wind-born and/or raindrop splash) on the plant surface rather than from plant (root) uptake (Watters et al. 1983); and therefore, would probably be found in significantly lower concentrations in vegetation at Area G if it was rinsed with water before analysis(White et al. 1981).

Cesium-137 ranged in/on concentration from -0.44 to 1.97 pCi g^{-1} ash in vegetation collected from Area G. All of the overstory samples contained ^{137}Cs levels within upper limit background concentrations. Most understory samples, on the other hand, contained detectable and higher ^{137}Cs levels than upper limit background. The highest level of ^{137}Cs was detected in/on understory vegetation collected from the west side of the TRU pads (#5).

Heavy Metals. With the exception of a few slightly elevated heavy metal elements in/on vegetation at few sites as compared to background, most heavy metals in/on overstory and understory vegetation collected within and around Area G were within normal background concentrations (Table 3). Barium was detected in slightly higher concentrations in vegetation collected at almost all of the sites at Area G than upper limit background concentrations. The reasons for the slightly higher values of Ba in/on vegetation at Area G as compared to background are not completely known, as Ba in soils within (Conrad et al. 1995) and around (Longmire et al. 1994, Fresquez et al. 1996) Area G were within normal background concentrations. Only one site, understory vegetation collected at the south end of the ^{3}H shaft field (#1), exhibited any kind of a trend; that is, more than one heavy metal element, namely Ba, Be, Cd, Cr, and Ni, were detected at above background concentrations.

IV. ACKNOWLEDGMENT

Thanks to Greg Stone, Air Quality Group (ESH-17), and to Mary Salisbury, Ecology Group (ESH-20) for providing TA-54 temperature and

Table 3. Trace and heavy metals (µg dry g^{-1}) in vegetation collected from Area G (TA-54) during the 1995 growing season.

Sites	Ag	As	Ba	Be	Cd	Cr	Hg	Ni	Pb	Sb	Se	Tl
Radioactive Wastes Disposal Area G												
#1 Tritium Shafts (south of the shafts just outside the fence)												
Overstory	<1.0	<0.2	14.0	<0.08	<0.4	<0.5	<0.1	<1.0	<4.0	<1.0	0.1	<1.0
Understory	<1.0	<0.2	29.0	5.50	5.2	5.8	<0.1	2.3	<4.0	<1.0	0.3	<1.0
#2 Tritium Shafts (west of the shafts just outside the fence)												
Overstory	<1.0	<0.2	27.0	<0.08	<0.4	<0.5	<0.1	<1.0	<4.0	<1.0	0.1	<1.0
Understory	<1.0	<0.2	25.0	<0.08	<0.4	<0.4	<0.1	<1.0	<4.0	<1.0	0.2	<1.0
#3 Waste Pits (east of the new pit inside the fence)												
Overstory	<1.0	<0.2	8.0	<0.08	<0.4	<0.5	<0.1	<1.0	<4.0	1.3	<0.1	<1.0
Understory	<1.0	<0.2	25.0	<0.08	0.8	<0.5	<0.1	31.0	<10.0	<1.0	0.1	<1.0
#4 TRU Pads (north of pads just outside the fence)												
Overstory	<1.0	<0.2	14.0	<0.08	<0.4	<0.5	<0.1	<1.0	<4.0	<1.0	0.1	<1.0
Understory	<1.0	<0.2	31.0	<0.08	0.5	<0.5	<0.1	<1.0	<4.0	<1.0	0.2	<1.0
#5 TRU Pads (west side of the pads)												
Understory	<1.0	<0.2	47.0	0.09	0.7	<0.5	<0.1	5.9	<4.0	<1.0	0.3	<1.0
#6 TRU Pads (east side of the pads)												
Understory	<1.0	<0.2	43.0	<0.08	<0.4	<0.6	<0.1	<1.0	<4.0	<1.0	0.3	<1.0
Regional (Background)												
Overstory	<1.0	<0.2	11.0	<0.08	<0.4	<0.5	<0.1	<1.0	<4.0	<1.0	0.1	<1.0
OSRSRL[a]			13.0								0.3	
Understory	<1.0	<0.2	11.0	<0.08	<0.4	<0.5	<0.1	<1.0	<4.0	<1.0	2.0	<1.0
USRSRL[b]			13.0								2.8	

[a]Overstory regional statistical reference level (mean + 2 sigma).

[b]Understory regional statistical reference level (mean + 2 sigma).

precipitation, and survey coordinate data, respectively. Also, thanks to Paul Torrez, a high school coop student, with help in tabulating the data. This manuscript was reviewed by Ron Conrad (ESH-19) and edited by Hector Hinojosa (CIC-1)—Thanks.

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APPENDIX A

RAW DATA PRINTOUTS OF RADIONUCLIDE CONCENTRATIONS IN UNDERSTORY AND OVERSTORY VEGETATION COLLECTED WITHIN AND AROUND AREA G DURING 1995

********** CST ANALYTICAL REPORT **********

Prepared by: AKS on 11-Oct-1995

ANALYSIS: U REQUEST NUMBER: 22490 MATRIX: BV ANALYST: EDWARD GONZALES PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

ANALYTICAL TECHNIQUE: KPA ANALYTICAL PROCEDURE: NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
1-O	95.13748	0.47	0.11	UG/G	10/11/95	
1-U	95.13749	0.94	0.74	UG/G	10/11/95	
2-O	95.13750	0.82	0.08	UG/G	10/11/95	
2-U	95.13751	0.91	0.09	UG/G	10/11/95	
3-O	95.13752	2.46	0.25	UG/G	10/11/95	
3-U	95.13753	1.95	0.53	UG/G	10/11/95	
4-O	95.13754	1.21	0.12	UG/G	10/11/95	
4-U	95.13755	1.32	0.13	UG/G	10/11/95	
5-U	95.13756	0.81	0.08	UG/G	10/11/95	
6-U	95.13757	0.86	0.09	UG/G	10/11/95	
BG-O	95.13758	0.38	0.04	UG/G	10/11/95	
BG-U	95.13759	0.57	0.06	UG/G	10/11/95	

********** CST QUALITY ASSURANCE REPORT *********

Prepared by: AKS on 11-Oct-1995

REQUEST NUMBER: 22490 MATRIX: BV ANALYST: EDWARD GONZALES PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.33290	2.12	0.21	UG/L	2.5	0.25	10/11/95	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

___ Only qualitative data requested

X Only Open (non-blind) QC samples run with this sample batch.

___ No QC samples run with this sample batch.

___ No QC samples for this constituent and matrix type available within CST

REPORT NUMBER: 38620

Analyst	Reviewer	Team Leader	QA Officer
10/11/95	10-13-95	10/19/95	10/20/95
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. I, pp. 19-20.

REPORT NUMBER: 38819

Rev 5

********** CST ANALYTICAL REPORT **********

Prepared by: CEA on 27-Oct-1995

REQUEST NUMBER: 22490 MATRIX: BV ANALYST: EDWARD GONZALES PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

pCi/g only.

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE		ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
1-O	95.13748	PU-238	RAS	-	0.001	0.001	PCI/G	10/27/95	51%
1-O	95.13748	PU-239	RAS		0.003	0.002	PCI/G	10/27/95	51%
1-U	95.13749	PU-238	RAS		0.008	0.001	PCI/G	10/27/95	89%
1-U	95.13749	PU-239	RAS		0.014	0.001	PCI/G	10/27/95	89%
2-O	95.13750	PU-238	RAS		0.003	0.001	PCI/G	10/27/95	84%
2-O	95.13750	PU-239	RAS		0.004	0.001	PCI/G	10/27/95	84%
2-U	95.13751	PU-238	RAS		0.003	0.001	PCI/G	10/27/95	95%
2-U	95.13751	PU-239	RAS		0.01	0.001	PCI/G	10/27/95	95%
3-O	95.13752	PU-238	RAS		0.009	0.002	PCI/G	10/27/95	85%
3-O	95.13752	PU-239	RAS		0.023	0.003	PCI/G	10/27/95	85%
3-U	95.13753	PU-238	RAS		0.005	0.001	PCI/G	10/27/95	96%
3-U	95.13753	PU-239	RAS		0.014	0.001	PCI/G	10/27/95	96%
4-O	95.13754	PU-238	RAS		0.025	0.003	PCI/G	10/27/95	80%
4-O	95.13754	PU-239	RAS		0.055	0.004	PCI/G	10/27/95	80%
4-U	95.13755	PU-238	RAS		0.08	0.004	PCI/G	10/27/95	86%
4-U	95.13755	PU-239	RAS		0.133	0.005	PCI/G	10/27/95	86%
5-U	95.13756	PU-238	RAS		0.001	0.001	PCI/G	10/27/95	42%
5-U	95.13756	PU-239	RAS		0.009	0.002	PCI/G	10/27/95	42%
6-U	95.13757	PU-238	RAS		0.004	0.001	PCI/G	10/27/95	92%
6-U	95.13757	PU-239	RAS		0.006	0.001	PCI/G	10/27/95	92%
BG-O	95.13758	PU-238	RAS	-	0.001		PCI/G	10/27/95	60%
BG-O	95.13758	PU-239	RAS		0.002	0.001	PCI/G	10/27/95	60%
BG-U	95.13759	PU-238	RAS		0.0		PCI/G	10/27/95	70%
BG-U	95.13759	PU-239	RAS		0.002	0.001	PCI/G	10/27/95	70%

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REPORT NUMBER: 38819 (continued)

********** CST QUALITY ASSURANCE REPORT *********

Prepared by: CEA on 27-Oct-1995

REQUEST NUMBER: 22490 MATRIX: BV ANALYST: EDWARD GONZALES PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: PAGE:

SUMMARY OF TRACER RECOVERY IN CUSTOMER AND QA SAMPLES

CUSTOMER NUMBER	CST SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COLLECTION DATE	COMMENT
1-O	95.13748	PU-242T	4.	2.04	PCI/SAMPLE	8/17/95	51%
1-U	95.13749	PU-242T	4.	3.56	PCI/SAMPLE	8/17/95	89%
2-O	95.13750	PU-242T	4.	3.36	PCI/SAMPLE	8/17/95	84%
2-U	95.13751	PU-242T	4.	3.8	PCI/SAMPLE	8/17/95	95%
3-O	95.13752	PU-242T	4.	3.4	PCI/SAMPLE	8/17/95	85%
3-U	95.13753	PU-242T	4.	3.84	PCI/SAMPLE	8/17/95	96%
4-O	95.13754	PU-242T	4.	3.2	PCI/SAMPLE	8/17/95	80%
4-U	95.13755	PU-242T	4.	3.44	PCI/SAMPLE	8/17/95	86%
5-U	95.13756	PU-242T	4.	1.68	PCI/SAMPLE	8/17/95	42%
6-U	95.13757	PU-242T	4.	3.68	PCI/SAMPLE	8/17/95	92%
BG-O	95.13758	PU-242T	4.	2.4	PCI/SAMPLE	8/17/95	60%
BG-U	95.13759	PU-242T	4.	2.8	PCI/SAMPLE	8/17/95	70%

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.33824	PU-238	3.1704	0.1256	PCI/SAMPLE	3.2	0.1	10/27/95	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

X Only Open (non-blind) QC samples run with this sample batch.

___ No QC samples run with this sample batch.

X No QC samples for this constituent and matrix type available within CST

REPORT NUMBER: 38819				
	EEA	Eng	ST	mag
	Analyst	Reviewer	Team Leader	QA Officer
	10/27/95	10-27-95	10/31/95	11/1/95
	Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. I, pp. 19-20.

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REPORT NUMBER: 38381

River 5 3H

********** CST ANALYTICAL REPORT **********

Prepared by: ROBINSON on 26-Sep-1995

ANALYSIS: H-3 REQUEST NUMBER: 22461 MATRIX: W ANALYST: RICHARD ROBINSON PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

ANALYTICAL TECHNIQUE: LS ANALYTICAL PROCEDURE: ER210 NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

	CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	pCi/L	pCi/mL
3H South	1-O	95.13404	386.	20.	NCI/L	8/30/95	386,000		386
	1-U	95.13405	1400.	70.	NCI/L	8/30/95	1,400,000		1,400
3H West	2-O	95.13406	418.	20.	NCI/L	8/30/95	418,000		418
	2-U	95.13407	4200.	200.	NCI/L	8/30/95	4,200,000		4,200
Pit	3-O	95.13408	2800.	500.	PCI/L	8/30/95			2.8
	3-U	95.13409	3200.	500.	PCI/L	8/30/95			3.2
Tumpod N	4-O	95.13410	4300.	600.	PCI/L	8/30/95			4.3
	4-U	95.13411	3700.	600.	PCI/L	8/30/95			3.7
	5-U	95.13412	7300.	350.	NCI/L	8/30/95	7,300,000		7,300
	6-U	95.13413	2700.	140.	NCI/L	8/30/95	2,700,000		2700
	BG-O	95.13414	0.0	300.	PCI/L	8/30/95			0.0
	BG-U	95.13415	100.	300.	PCI/L	8/30/95			0.1

********** CST QUALITY ASSURANCE REPORT **********

Prepared by: ROBINSON on 26-Sep-1995

REQUEST NUMBER: 22461 MATRIX: W ANALYST: RICHARD ROBINSON PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.33081	- 100.	300.	PCI/L	0.0		9/18/95	UNDER CONTROL
00.33081	- 100.	300.	PCI/L	0.0		9/18/95	UNDER CONTROL
00.33081	- 100.	300.	PCI/L	0.0		8/30/95	UNDER CONTROL
00.33081	100.	300.	PCI/L	0.0		8/30/95	UNDER CONTROL
00.33089	13700.	1100.	PCI/L	14825.	1482.5	8/30/95	UNDER CONTROL
00.33089	13500.	1100.	PCI/L	14825.	1482.5	8/30/95	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
95.12081	9.3	0.9	NCI/L	10.7	0.4	8/30/95	UNDER CONTROL
95.12082	15.7	1.2	NCI/L	16.9	0.6	8/30/95	UNDER CONTROL
95.13416	11.9	1.	NCI/L	11.9	0.4	8/30/95	UNDER CONTROL

REPORT NUMBER: 38381

Analyst	Reviewer	Team Leader	QA Officer
092695	9/26/95	9/26/95	9/26/95
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. I, pp. 19-20.

REPORT NUMBER: 39233

Area 6
137 Cs

********** CST ANALYTICAL REPORT **********

Prepared by: YIG on 11-Dec-1995

ANALYSIS: CS-137 REQUEST NUMBER: 22490 MATRIX: BV ANALYST: SAMMY GARCIA PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

ANALYTICAL TECHNIQUE: G ANALYTICAL PROCEDURE: NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
1-O	95.13748	0.63	0.94	PCI/G	12/11/95	
1-U	95.13749	0.59	0.13	PCI/G	12/11/95	
2-O	95.13750	0.49	0.12	PCI/G	12/11/95	
2-U	95.13751	0.78	0.14	PCI/G	12/11/95	
3-O	95.13752	- 0.44	0.24	PCI/G	12/11/95	
3-U	95.13753	0.52	0.12	PCI/G	12/11/95	
4-O	95.13754	0.69	1.04	PCI/G	12/11/95	
4-U	95.13755	0.62	0.15	PCI/G	12/11/95	
5-U	95.13756	1.97	0.26	PCI/G	12/11/95	
6-U	95.13757	0.29	0.43	PCI/G	12/11/95	
BG-O	95.13758	1.16	0.23	PCI/G	12/11/95	
BG-U	95.13759	- 0.1	0.24	PCI/G	12/11/95	

REPORT NUMBER: 39369

Page:

********** CST ANALYTICAL REPORT **********

Prepared by: AKS on 4-Jan-1996

ANALYSIS: SR-90 REQUEST NUMBER: 22490 MATRIX: BV ANALYST: EDWARD GONZALES PROGRAM CODE: M34

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

ANALYTICAL TECHNIQUE: PC ANALYTICAL PROCEDURE: ER 190 NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
1-O	95.13748	6.3	0.4	PCI/G	1/04/96	
1-U	95.13749	3.8	0.4	PCI/G	1/04/96	
2-O	95.13750	7.1	0.5	PCI/G	1/04/96	
2-U	95.13751	4.1	0.3	PCI/G	1/04/96	
3-O	95.13752	2.3	0.4	PCI/G	1/04/96	
3-U	95.13753	1.4	0.2	PCI/G	1/04/96	
4-O	95.13754	7.2	0.5	PCI/G	1/04/96	
4-U	95.13755	6.1	0.4	PCI/G	1/04/96	
5-U	95.13756	3.	0.2	PCI/G	1/04/96	
6-U	95.13757	1.6	0.3	PCI/G	1/04/96	
BG-O	95.13758	7.9	0.6	PCI/G	1/04/96	
BG-U	95.13759	3.	0.4	PCI/G	1/04/96	

********** CST QUALITY ASSURANCE REPORT *********

Prepared by: AKS on 4-Jan-1996

REQUEST NUMBER: 22490 MATRIX: BV ANALYST: EDWARD GONZALES PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

___ Only qualitative data requested

___ Only Blind QC samples run with this sample batch.

X No QC samples run with this sample batch.

___ No QC samples for this constituent and matrix type available within CST

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

___ Only qualitative data requested

___ Only Open (non-blind) QC samples run with this sample batch.

X No QC samples run with this sample batch.

___ No QC samples for this constituent and matrix type available within CST

REPORT NUMBER: 39369

Analyst	Reviewer	Team Leader	QA Officer
1/4/96	1-12-96	1/13/96	1/16/96
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

APPENDIX B

RAW DATA PRINTOUTS OF HEAVY METAL CONCENTRATIONS IN UNDERSTORY AND OVERSTORY VEGETATION COLLECTED WITHIN AND AROUND AREA G DURING 1995

REPORT NUMBER: 38334

*********** CST ANALYTICAL REPORT ************

Prepared by: M. KOZUBAL on 21-Sep-1995

REQUEST NUMBER: 22497 MATRIX: BV ANALYST: OES PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: EM90126 PAGE: 70

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
1-0	95.13781	AG	ICPES	< 1.		UG/G	9/21/95	
1-0	95.13781	BA	ICPES	14.	1.	UG/G	9/21/95	
1-0	95.13781	BE	ICPES	< 0.08		UG/G	9/21/95	
1-0	95.13781	CD	ICPES	< 0.4		UG/G	9/21/95	
1-0	95.13781	CR	ICPES	< 0.5		UG/G	9/21/95	
1-0	95.13781	NI	ICPES	< 1.		UG/G	9/21/95	
1-0	95.13781	PB	ICPES	< 4.		UG/G	9/21/95	
1-U	95.13782	AG	ICPES	< 1.		UG/G	9/21/95	
1-U	95.13782	BA	ICPES	29.	3.	UG/G	9/21/95	
1-U	95.13782	BE	ICPES	5.5	0.6	UG/G	9/21/95	
1-U	95.13782	CD	ICPES	5.2	0.5	UG/G	9/21/95	
1-U	95.13782	CR	ICPES	5.8	0.6	UG/G	9/21/95	
1-U	95.13782	NI	ICPES	2.3	1.	UG/G	9/21/95	
1-U	95.13782	PB	ICPES	< 4.		UG/G	9/21/95	
2-0	95.13783	AG	ICPES	< 1.		UG/G	9/21/95	
2-0	95.13783	BA	ICPES	27.	3.	UG/G	9/21/95	
2-0	95.13783	BE	ICPES	< 0.08		UG/G	9/21/95	
2-0	95.13783	CD	ICPES	< 0.4		UG/G	9/21/95	
2-0	95.13783	CR	ICPES	< 0.5		UG/G	9/21/95	
2-0	95.13783	NI	ICPES	< 1.		UG/G	9/21/95	
2-0	95.13783	PB	ICPES	< 4.		UG/G	9/21/95	
2-U	95.13784	AG	ICPES	< 1.		UG/G	9/21/95	
2-U	95.13784	BA	ICPES	25.	3.	UG/G	9/21/95	
2-U	95.13784	BE	ICPES	< 0.08		UG/G	9/21/95	
2-U	95.13784	CD	ICPES	< 0.4		UG/G	9/21/95	
2-U	95.13784	CR	ICPES	< 0.4		UG/G	9/21/95	
2-U	95.13784	NI	ICPES	< 1.		UG/G	9/21/95	
2-U	95.13784	PB	ICPES	< 4.		UG/G	9/21/95	
3-0	95.13785	AG	ICPES	< 1.		UG/G	9/21/95	
3-0	95.13785	BA	ICPES	8.	0.8	UG/G	9/21/95	
3-0	95.13785	BE	ICPES	< 0.08		UG/G	9/21/95	
3-0	95.13785	CD	ICPES	< 0.4		UG/G	9/21/95	
3-0	95.13785	CR	ICPES	< 0.5		UG/G	9/21/95	
3-0	95.13785	NI	ICPES	< 1.		UG/G	9/21/95	
3-0	95.13785	PB	ICPES	< 4.		UG/G	9/21/95	
3-U	95.13786	AG	ICPES	< 1.		UG/G	9/21/95	
3-U	95.13786	BA	ICPES	25.	3.	UG/G	9/21/95	

3-U	95.13786	BE	ICPES	< 0.08		UG/G	9/21/95
3-U	95.13786	CD	ICPES	0.76	0.66	UG/G	9/21/95
3-U	95.13786	CR	ICPES	< 0.5		UG/G	9/21/95
3-U	95.13786	NI	ICPES	31.	4.	UG/G	9/21/95
3-U	95.13786	PB	ICPES	< 10.		UG/G	9/21/95
4-O	95.13787	AG	ICPES	< 1.		UG/G	9/21/95
4-O	95.13787	BA	ICPES	14.	1.	UG/G	9/21/95
4-O	95.13787	BE	ICPES	< 0.08		UG/G	9/21/95
4-O	95.13787	CD	ICPES	< 0.4		UG/G	9/21/95
4-O	95.13787	CR	ICPES	< 0.5		UG/G	9/21/95
4-O	95.13787	NI	ICPES	< 1.		UG/G	9/21/95
4-O	95.13787	PB	ICPES	< 4.		UG/G	9/21/95
4-U	95.13788	AG	ICPES	< 1.		UG/G	9/21/95
4-U	95.13788	BA	ICPES	31.	3.	UG/G	9/21/95
4-U	95.13788	BE	ICPES	< 0.08		UG/G	9/21/95
4-U	95.13788	CD	ICPES	0.45	0.4	UG/G	9/21/95
4-U	95.13788	CR	ICPES	< 0.5		UG/G	9/21/95
4-U	95.13788	NI	ICPES	< 1.		UG/G	9/21/95
4-U	95.13788	PB	ICPES	< 4.		UG/G	9/21/95
5-U	95.13789	AG	ICPES	< 1.		UG/G	9/21/95
5-U	95.13789	BA	ICPES	47.	5.	UG/G	9/21/95
5-U	95.13789	BE	ICPES	0.09	0.08	UG/G	9/21/95
5-U	95.13789	CD	ICPES	0.68	0.51	UG/G	9/21/95
5-U	95.13789	CR	ICPES	< 0.5		UG/G	9/21/95
5-U	95.13789	NI	ICPES	5.9	1.	UG/G	9/21/95
5-U	95.13789	PB	ICPES	< 4.		UG/G	9/21/95
6-U	95.13790	AG	ICPES	< 1.		UG/G	9/21/95
6-U	95.13790	BA	ICPES	43.	4.	UG/G	9/21/95
6-U	95.13790	BE	ICPES	< 0.08		UG/G	9/21/95
6-U	95.13790	CD	ICPES	< 0.4		UG/G	9/21/95
6-U	95.13790	CR	ICPES	0.6	0.5	UG/G	9/21/95
6-U	95.13790	NI	ICPES	< 1.		UG/G	9/21/95
6-U	95.13790	PB	ICPES	< 4.		UG/G	9/21/95
BG-O	95.13791	AG	ICPES	< 1.		UG/G	9/21/95
BG-O	95.13791	BA	ICPES	11.	1.	UG/G	9/21/95
BG-O	95.13791	BE	ICPES	< 0.08		UG/G	9/21/95
BG-O	95.13791	CD	ICPES	< 0.4		UG/G	9/21/95
BG-O	95.13791	CR	ICPES	< 0.5		UG/G	9/21/95
BG-O	95.13791	NI	ICPES	< 1.		UG/G	9/21/95
BG-O	95.13791	PB	ICPES	< 4.		UG/G	9/21/95
BG-U	95.13792	AG	ICPES	< 1.		UG/G	9/21/95
BG-U	95.13792	BA	ICPES	11.	1.	UG/G	9/21/95
BG-U	95.13792	BE	ICPES	< 0.08		UG/G	9/21/95
BG-U	95.13792	CD	ICPES	< 0.4		UG/G	9/21/95
BG-U	95.13792	CR	ICPES	< 0.5		UG/G	9/21/95
BG-U	95.13792	NI	ICPES	< 1.		UG/G	9/21/95
BG-U	95.13792	PB	ICPES	< 4.		UG/G	9/21/95

CUSTOMER SAMPLE DUPLICATES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
1-O	95.13781	AG	ICPES	< 1.		UG/G	9/21/95	
1-O	95.13781	BA	ICPES	15.	1.	UG/G	9/21/95	
1-O	95.13781	BE	ICPES	< 0.08		UG/G	9/21/95	
1-O	95.13781	CD	ICPES	< 0.4		UG/G	9/21/95	
1-O	95.13781	CR	ICPES	< 0.5		UG/G	9/21/95	
1-O	95.13781	NI	ICPES	< 1.		UG/G	9/21/95	

1-0	95.13781 PB	ICPES	< 4.	UG/G	9/21/95

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REPORT NUMBER: 38334 (continued)

********** CST QUALITY ASSURANCE REPORT *********

Prepared by: M. KOZUBAL on 21-Sep-1995

REQUEST NUMBER: 22497 MATRIX: BV ANALYST: OES PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: EM90126 PAGE: 70

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00580	BA	18.	2.	UG/G	21.	3.	9/21/95	UNDER CONTROL
00.00580	PB	13.	6.	UG/G	13.	2.	9/21/95	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

___ Only qualitative data requested

X Only Open (non-blind) QC samples run with this sample batch.

___ No QC samples run with this sample batch.

___ No QC samples for this constituent and matrix type available within CST

REPORT NUMBER: 38334

Analyst	Reviewer	Team Leader	QA Officer
9-21-95	9-21-95	10/30/95	10/31/96
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in

'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. I, pp. 19-20.

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REPORT NUMBER: 38210

Area 6 Veg - metals.

********** CST ANALYTICAL REPORT **********

Prepared by: PEC on 18-Sep-1995

REQUEST NUMBER: 22497 MATRIX: BV ANALYST: AAS PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

ug/g dry

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
1-0	95.13781	AS	ETVAA	< 0.2		UG/G	8/31/95	
1-0	95.13781	HG	CVAA	< 0.1		UG/G	9/18/95	
1-0	95.13781	SE	ETVAA	0.1	0.1	UG/G	8/31/95	
1-U	95.13782	AS	ETVAA	< 0.2		UG/G	8/31/95	
1-U	95.13782	HG	CVAA	< 0.1		UG/G	9/18/95	
1-U	95.13782	SE	ETVAA	0.3	0.1	UG/G	8/31/95	
2-0	95.13783	AS	ETVAA	< 0.2		UG/G	8/31/95	
2-0	95.13783	HG	CVAA	< 0.1		UG/G	9/18/95	
2-0	95.13783	SE	ETVAA	0.1	0.1	UG/G	8/31/95	
2-U	95.13784	AS	ETVAA	< 0.2		UG/G	8/31/95	
2-U	95.13784	HG	CVAA	< 0.1		UG/G	9/18/95	
2-U	95.13784	SE	ETVAA	0.2	0.1	UG/G	8/31/95	
3-0	95.13785	AS	ETVAA	< 0.2		UG/G	8/31/95	
3-0	95.13785	HG	CVAA	< 0.1		UG/G	9/18/95	
3-0	95.13785	SE	ETVAA	< 0.1		UG/G	8/31/95	
3-U	95.13786	AS	ETVAA	< 0.2		UG/G	8/31/95	
3-U	95.13786	HG	CVAA	< 0.1		UG/G	9/18/95	
3-U	95.13786	SE	ETVAA	0.1	0.1	UG/G	8/31/95	
4-0	95.13787	AS	ETVAA	< 0.2		UG/G	8/31/95	
4-0	95.13787	HG	CVAA	< 0.1		UG/G	9/18/95	
4-0	95.13787	SE	ETVAA	0.1	0.1	UG/G	8/31/95	
4-U	95.13788	AS	ETVAA	< 0.2		UG/G	8/31/95	
4-U	95.13788	HG	CVAA	< 0.1		UG/G	9/18/95	
4-U	95.13788	SE	ETVAA	0.2	0.1	UG/G	8/31/95	
5-U	95.13789	AS	ETVAA	< 0.2		UG/G	8/31/95	
5-U	95.13789	HG	CVAA	< 0.1		UG/G	9/18/95	
5-U	95.13789	SE	ETVAA	0.3	0.1	UG/G	8/31/95	
6-U	95.13790	AS	ETVAA	< 0.2		UG/G	8/31/95	
6-U	95.13790	HG	CVAA	< 0.1		UG/G	9/18/95	
6-U	95.13790	SE	ETVAA	0.3	0.1	UG/G	8/31/95	
BG-0	95.13791	AS	ETVAA	< 0.2		UG/G	8/31/95	
BG-0	95.13791	HG	CVAA	< 0.1		UG/G	9/18/95	
BG-0	95.13791	SE	ETVAA	0.1	0.1	UG/G	8/31/95	
BG-U	95.13792	AS	ETVAA	< 0.2		UG/G	8/31/95	
BG-U	95.13792	HG	CVAA	< 0.1		UG/G	9/18/95	
BG-U	95.13792	SE	ETVAA	2.	0.4	UG/G	8/31/95	

REPORT NUMBER: 38814

alla G Veg - Metals

********** CST ANALYTICAL REPORT **********

Prepared by: MKOBY on 27-Oct-1995

REQUEST NUMBER: 22497 MATRIX: BV ANALYST: IMS PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
1-O	95.13781	SB	ICPMS	< 1.		UG/G	10/27/95	
1-O	95.13781	TL	ICPMS	< 1.		UG/G	10/27/95	
1-U	95.13782	SB	ICPMS	< 1.		UG/G	10/27/95	
1-U	95.13782	TL	ICPMS	< 1.		UG/G	10/27/95	
2-O	95.13783	SB	ICPMS	< 1.		UG/G	10/27/95	
2-O	95.13783	TL	ICPMS	< 1.		UG/G	10/27/95	
2-U	95.13784	SB	ICPMS	< 1.		UG/G	10/27/95	
2-U	95.13784	TL	ICPMS	< 1.		UG/G	10/27/95	
3-O	95.13785	SB	ICPMS	1.3	1.	UG/G	10/27/95	
3-O	95.13785	TL	ICPMS	< 1.		UG/G	10/27/95	
3-U	95.13786	SB	ICPMS	< 1.		UG/G	10/27/95	
3-U	95.13786	TL	ICPMS	< 1.		UG/G	10/27/95	
4-O	95.13787	SB	ICPMS	< 1.		UG/G	10/27/95	
4-O	95.13787	TL	ICPMS	< 1.		UG/G	10/27/95	
4-U	95.13788	SB	ICPMS	< 1.		UG/G	10/27/95	
4-U	95.13788	TL	ICPMS	< 1.		UG/G	10/27/95	
5-U	95.13789	SB	ICPMS	< 1.		UG/G	10/27/95	
5-U	95.13789	TL	ICPMS	< 1.		UG/G	10/27/95	
6-U	95.13790	SB	ICPMS	< 1.		UG/G	10/27/95	
6-U	95.13790	TL	ICPMS	< 1.		UG/G	10/27/95	
BG-O	95.13791	SB	ICPMS	< 1.		UG/G	10/27/95	
BG-O	95.13791	TL	ICPMS	< 1.		UG/G	10/27/95	
BG-U	95.13792	SB	ICPMS	< 1.		UG/G	10/27/95	
BG-U	95.13792	TL	ICPMS	< 1.		UG/G	10/27/95	

CUSTOMER SAMPLE DUPLICATES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
1-O	95.13781	SB	ICPMS	< 1.		UG/G	10/27/95	
1-O	95.13781	TL	ICPMS	< 1.		UG/G	10/27/95	

MATRIX SPIKES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT
1-0	95.13781	SB	ICPMS	5.	4.5	UG/G	10/27/95	
1-0	95.13781	TL	ICPMS	5.	5.3	UG/G	10/27/95	

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REPORT NUMBER: 38814 (continued)

********** CST QUALITY ASSURANCE REPORT *********

Prepared by: MKOBY on 27-Oct-1995

REQUEST NUMBER: 22497 MATRIX: BV ANALYST: IMS PROGRAM CODE: M344

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: PAGE:

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00580	SB	< 1000.	1000.	NG/G	40.		10/27/95	UNDER CONTROL
00.00580	TL	< 1000.	1000.	NG/G	< 10.		10/27/95	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

___ Only qualitative data requested

✓ Only Open (non-blind) QC samples run with this sample batch.

___ No QC samples run with this sample batch.

___ No QC samples for this constituent and matrix type available within CST

REPORT NUMBER: 38814	Analyst	Reviewer	Team Leader	QA Officer
	10/27/95 Date	10/27/95 Date	10/30/95 Date	10/31/95 Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in

'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. I, pp. 19-20.

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