LA-13647-PR
Progress Report

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Edited by Hector Hinojosa, Group CIC-1

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Issued: November 1999

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ABSTRACT

Soils and unwashed overstory and understory vegetation were collected at eight locations within and around Area G, a disposal facility for low-level, radioactive solid waste at Los Alamos National Laboratory. The samples were analyzed for ^{3}H, ^{238}Pu, ^{239}Pu, ^{90}Sr, ^{241}Am, ^{137}Cs, ^{tot}U. Most of the radionuclide concentrations in soils and vegetation were within the upper 95% level of background concentrations except for ^{3}H and ^{239}Pu. Tritium concentrations in vegetation from most sites were greater than background concentrations of about 2 pCi mL^{-1}. The concentrations of ^{239}Pu in soils and understory vegetation were largest in samples collected several meters north of the transuranic waste pad area and were consistent with previous results. Based on ^{3}H and ^{239}Pu data through 1998, it was shown that concentrations were 1) significantly greater than background concentrations ($p<0.05$) in soils and vegetation collected from most locations at Area G, and 2) there was no systematic increase or decrease in concentrations with time apparent in the data.

I. INTRODUCTION

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

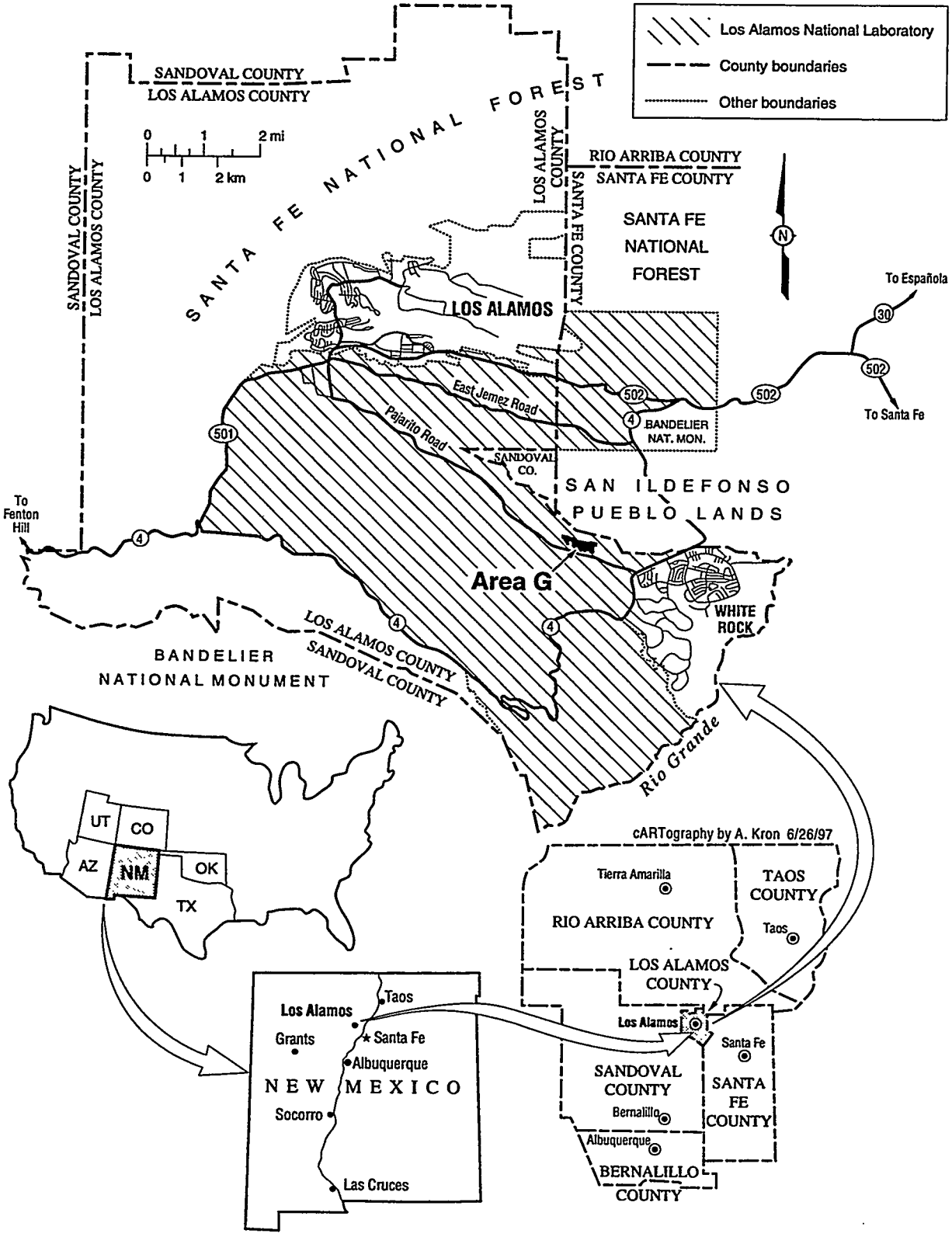

Figure 1. The location of Area G at Los Alamos National Laboratory.

tonium, 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 (ESP) at LANL, air (LANL 1998), water (Mullen et al. 1996), soils/sediment (Conrad et al. 1995, 1996; Fresquez et al. 1996a, 1997b, 1998a), vegetation (Fresquez et al. 1995, 1996b, 1997a, 1998b), small mammals (Biggs et al. 1995, 1997; Bennett et al. 1996), and bees (Fresquez et al. 1997a, Haarmann and Fresquez 1998, 1999) are collected annually from within and around radioactive waste disposal site Area G to help monitor and assess the site's impact on the surrounding environment. Radionuclides in game animals such as elk and deer have also been recently assessed around Area G (Ferenbaugh et al. 1999).

Two components of the Area G surveillance program are the assessments of soil and vegetation within and around Area G for radiological contamination. The soil sampling program is the most direct means of estimating the types, concentrations, and distributions of radionuclides in the environment within and around nuclear facilities (Fresquez et al. 1998). Soil provides an integrating medium, or reservoir, that can account for contaminants released to the atmosphere, either directly from gaseous effluents such as air stack emissions, or indirectly from the resuspension of on-site contamination (fugitive dust) (Healy 1977). Subsequently, the knowledge gained from the radiological surveillance of soil is critical to provide information about potential exposure by way of several pathways that include soil ingestion, consumption of food crops, resuspension of radionuclides into the air, and contamination of groundwater. Exposure to radionuclides by these pathways may result in radiation doses to humans (Hakonson et al. 1981). The uptake of radionuclides by vegetation may also give some insight into surface (Hansen et al. 1980) and subsurface (Wenzel et al. 1987) pathways of contaminants to humans from waste disposal areas. Trees, in particular, have been shown to be excellent indicators of subterranean tritium migration from low-level radioactive waste disposal sites (Rickard and Kirby 1987).

The objective of this annual survey was to measure the concentrations of selected radionuclides in surface soils

and unwashed overstory and understory vegetation within and around Area G during the 1998 growing season. These data were compared to radionuclide concentrations in soils and vegetation collected from regional background locations. The background areas are located away from LANL, and radionuclide concentrations result from naturally occurring elements and/or from worldwide fallout. In addition, ^{3}H and Pu data were examined for trends over a five-year period since 1994.

II. METHODS

In June of 1998, the Soils, Foodstuffs, and Biota Environmental Contaminant Surveillance Program Team of LANL's Ecology Group, ESH-20, collected eight samples of surface soils and 13 vegetation samples from areas within and around Area G at TA-54 (Figure 2). Table 1 lists the sampling locations and location descriptions that are shown on Figure 2. Sample locations 3, 5, 7a, and 7b are inside the Area G fence, whereas locations 1, 2, 4, and 8 are outside the Area G fence. Location 8 is west of Area G in the proposed expansion area. Location #6 at Transuranic (TRU) Waste Pad #4 was removed after sampling in 1997 and is no longer available for sampling (Fresquez et al. 1998). Background samples of soils were collected as part of the ESP (LANL 1998), and background samples of vegetation were collected south and upwind of the Laboratory at Bandelier National Monument.

At each site, soil samples were collected from the surface with a stainless steel soil ring 10 cm (4 in.) in diameter driven 5 cm (2 in.) into the soil (ASTM 1990). Samples were collected from the center and corners of a square plot of 10 m (33 ft) per side. The five subsamples were combined and mixed thoroughly in a three-gallon Ziploc® bag, and a subsample from the composite was placed in a 500-mL poly bottle. Samples were submitted under full chain-of-custody to the Chemical Science and Technology Division group (CST-9) for analysis of ^{3}H, ^{238}Pu, ^{239}Pu, ^{137}Cs, ^{tot}U, ^{90}Sr, and ^{241}Am. All methods of radiochemical analyses have been described previously (Fresquez et al. 1996a). Radionuclide results were reported in pCi mL^{-1} of soil moisture for ^{3}H, $\mu g\ g^{-1}$ dry soil for ^{tot}U, and pCi g^{-1} dry soil for all the other isotopes.

Samples of overstory and understory vegetation were collected when

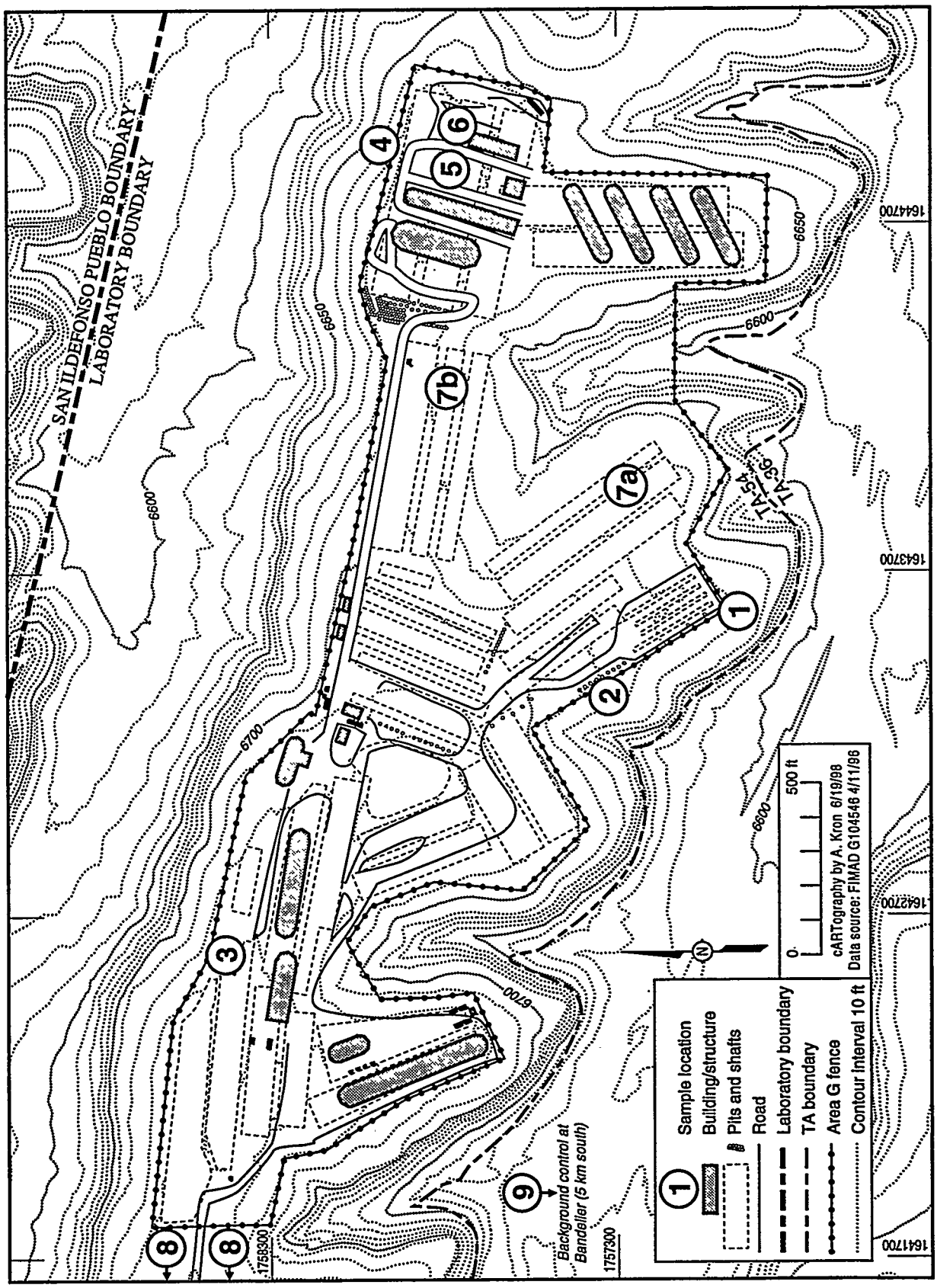

Figure 2. Site/sample locations of soils and vegetation at Area G. Site #8 is located farther west and Site #9 is located farther south than what is shown here.

both types were found. Clippings of tree shoots (overstory) or the top growth of grasses and forbs (understory) were composited for transport to the laboratory. Overstory samples were mainly from piñon pine (*Pinus edulis*) because piñon pine is the prevalent tree in the area (Tierney and Foxx 1982). Samples of the overstory consisted of the tips of tree-shoots approximately 2.5 to 5.1 cm (1 to 2 in.) in length at a height of 1.3 to 1.6 m (4 to 5 ft), and samples were collected at locations 1, 2, 3, 4, and 8. Samples of the understory were collected from each of the sampling locations, and all samples were collected from the same 10- x 10-m plots as the soil samples.

Personnel collecting samples wore plastic gloves and used clean shears to clip vegetation; all materials were decontaminated (washed with soap and water) between sampling locations. Samples were clippings that ranged from 0.9 to 1.4 kg (2 to 3 lb) of composited material and were placed in labeled double-bagged Ziploc® plastic bags and transported to the laboratory in locked ice chests. Each sample was divided into two subsets to provide enough material for analysis of ^{3}H and the other radionuclides. Samples were not washed, and thus represent the total concentration of radionuclides deposited on the plant surfaces by rainsplash and/or airborne deposition as well as radionuclides taken up by plant roots. The total radionuclide concentration is a realistic measure of the amount available to receptors that consume the plants at Area G.

Part of the vegetation sample was subsampled for ^{3}H analysis. The subsamples were placed in glass beakers to collect distillate water (Salazar 1984). The remaining portion of each subsample was placed in a 1-L glass beaker and slowly ashed at 500°C for 120 h. The ashed sample was pulverized and homogenized, then transferred to labeled 500-mL poly bottles and submitted with the distillate samples under full chain-of-custody to CST-9 for the analysis of ^{3}H, ^{238}Pu, ^{239}Pu, ^{137}Cs, ^{tot}U, ^{241}Am, ^{90}Sr. All methods of radiochemical analyses have been described previously (Fresquez et al. 1996b). Radionuclide results were reported in pCi mL^{-1} of tissue moisture for ^{3}H, $\mu g\ g^{-1}$ ash for ^{tot}U, and pCi g^{-1} ash for all the other isotopes. Results reported in grams of ash are usually two to four orders of magnitude greater than live (wet) weight.

III. RESULTS

Radionuclide Concentrations in Soils. Results of radionuclide concentrations in soils are given in Table 2. The actual CST-9 analytical reports are included in Appendix A for reference. Detectable concentrations of radionuclides of interest were found in most samples. A detectable concentration was considered a result that was greater than two times the counting uncertainty. Measured concentrations for ^{3}H, ^{239}Pu, ^{tot}U, and ^{90}Sr were greater than the regional statistical reference level (RSRL) at most locations. The RSRL is the mean + two standard deviations of the upper 95% confidence interval of background concentrations. The data for the background concentrations were collected from regional, non-LANL soils collected from 1993 through 1997 (LANL 1998).

Tritium concentrations for all Area G sites were greater than the RSRL, and tritium for the background soil was less than the RSRL (Table 2). Samples from the ^{3}H shaft locations (locations 1 and 2, Figure 2) contained the largest concentrations, and ^{3}H concentrations appear to decrease with distance from the ^{3}H shafts.

All sites sampled, including the background site, had ^{90}Sr concentrations greater than RSRL values. The concentrations measured in the samples, however, were only slightly larger than the RSRLs, and there is a possibility that the sample values reflect analytical error instead of actual contamination from Area G operations. These results mark the first time concentrations of ^{90}Sr have been found in excess of RSRLs at Area G.

Concentrations of ^{tot}U exceeded RSRLs for all Area G locations except for locations 4 and 5 and the background location. Uranium concentrations in Bandelier Tuff range up to 11 $\mu g\ g^{-1}$ (Crowe et al. 1978) and could explain the observed variation in the results as well as the concentrations above the RSRLs. The range of ^{tot}U in the soil samples was 2.19 $\mu g\ g^{-1}$ to 5.45 $\mu g\ g^{-1}$ and do not pose significantly larger health risks than background concentrations to humans or the environment.

The concentrations of ^{239}Pu and ^{241}Am were greater than RSRLs at locations 3, 4, and 7b. These locations are near the TRU pads and Pits 6, 17, and 18, all of which contain waste that may have been contaminated with either

^{239}Pu , ^{241}Am, or both. Samples from location 4 also contained ^{137}Cs and were greater than the RSRL. The results from location 4 were expected since the TRU pads are the likely source for the radionuclides, and the location of location 4 is a few meters north of the pads and outside the Area G fence.

Many of the samples collected contained concentrations of radionuclides that were greater than the RSRLs. However, the concentrations of all nuclides in the samples were much less than LANL screening action levels (SALs). The SALs were developed to keep potential doses to humans residing on the site to 10 mrem yr^{-1} or less (FIMAD 1997). Based on the results provided in this report, exposure to Area G soils would result in doses much less than the 10 mrem yr^{-1} limit from any one radionuclide or from all radionuclides combined. Therefore, exposure to radionuclides in Area G soils pose little risk to animals (deer and elk) and humans and are considered of no concern (Ferengbaugh et al. 1999).

Statistical analyses of soil concentration data were conducted because ^{3}H and ^{239}Pu concentrations at Area G have been consistently greater than background. Wilcoxan rank sum tests showed that ^{3}H in soils collected at locations 1, 2, 3, and 5 were significantly ($p<0.05$) greater than the background sites (Table 3). Wilcoxan rank sum tests also showed that ^{239}Pu from locations 2, 3, and 4 were significantly ($p<0.05$) greater than background concentrations in soils, whereas there were not enough data from locations 5, 7a, 7b, and 8 to test (Table 3). The statistical analyses suggest that Area G soils are measurably affected by Area G operations, but that the magnitude of the impact from 1994 through 1998 is insignificant with respect to adverse impacts on human health.

Radionuclide Concentrations in Vegetation. Table 4 shows radionuclide concentrations in unwashed vegetation collected from within and around Area G during the 1998 growing season. The CST-9 analytical reports are included in Appendix B for reference.

Understory vegetation was collected at each sampling location, but overstory vegetation was collected only at locations 1, 2, 3, 4, 8, and the background location because there was no overstory at locations 5, 7a, or 7b. Most radionuclide concentrations in unwashed

overstory and understory vegetation were equal to or slightly greater than RSRLs. The RSRL mean values + two standard deviations were calculated from data collected from 1994 to 1997 (Fresquez et al. 1995, 1996b, 1997b). As in previous years, ^{3}H concentrations in overstory and understory vegetation from the ^{3}H shaft (locations 1 and 2) and from the TRU waste pad area (location 5) were greater than background concentrations. Similarly, ^{239}Pu concentrations in understory vegetation collected from location 4 were greater than in background samples and correlate well with the soils data.

Analysis of the data set collected between 1994 and 1998 indicates that ^{3}H in the overstory was significantly greater than background at all sites sampled except location 8, the planned expansion area. Concentrations of ^{3}H in understory samples were also greater than background at all sites except location 8 (Table 5). The statistics compiled from 1994 through 1998 suggest that Area G operations have impacted the soils and vegetation at the sampling locations, but the magnitude of the impact has been minimal and not of concern to human health.

Table 6 shows results of ^{3}H and ^{239}Pu concentrations in unwashed vegetation from selected locations at Area G through 1998. Tritium concentrations in overstory vegetation increased slightly from 1994 through 1998 at all sites except location #2 (Figure 3). At location 2, ^{3}H ranged from 207 pCi mL^{-1} to 8740 pCi mL^{-1}, and the largest values were measured in 1994 and 1998. Tritium concentrations in understory vegetation increased at each location from 1994 through 1996, decreased in 1997, and increased in 1998 (Figure 4). The sharp decrease in ^{3}H concentrations in 1997 as compared to past years is not completely understood, but may be due to the difference in time of sampling, barometric pressure, and/or to the amount of precipitation received at Area G. For example, in 1996 samples were collected in July and the total amount of precipitation received for the ten days prior to sampling was approximately one inch, whereas only 0.3 inches of rain fell ten days before sampling in June 1997.

Concentrations of ^{239}Pu in the overstory samples increased from 1994 through 1997 then decreased in 1998 with two exceptions (Figures 5 and 6). First, the ^{239}Pu concentration from the

location 3 sample in 1997 was markedly greater than before 1997 or in 1998. One large measurement followed by a return to smaller values similar to previous values could indicate a sample contaminated with a discrete particle of ^{239}Pu was collected in 1997. The second exception is noted at location 1 where ^{239}Pu values decreased from 1994 through 1995 then steadily increased through 1998 (Figure 6). It remains uncertain whether the steady increase is due to variability in the actual Pu concentration or to an actual increase in soil Pu. However, data from the other locations seem to fluctuate and suggest that the apparent increase at location 1 is also part of the expected fluctuation.

Concentrations of ^{239}Pu collected from understory vegetation at locations 1, 2, 3, and 5 in 1994, 1995, and 1996 were relatively constant then increased in 1997 (Figure 7). ^{239}Pu concentrations from locations 1, 2, and 5 decreased in 1998, whereas the concentration increased again in the sample collected from location 3. The ^{239}Pu concentrations in samples collected from location 6 were small from 1994 through 1996, then increased an order of magnitude in 1997. Location 6 was unavailable for sampling after 1997 because it was removed as part of normal operations at Area G. Concentrations of ^{239}Pu were largest each year at location 4, and the concentrations remained between 1.45 x 10^{-3} pCi g^{-1} ash to 1.53 pCi g^{-1} ash except in 1995 when the concentration decreased to 8.0 x 10^{-4} pCi g^{-1} ash (Figure 7). The increased concentrations measured in 1997 at all locations were likely the result of Pu-containing dust on the surface of the vegetation that was not washed off by rainfall, and not due to root uptake of Pu (Whicker and Schultz 1982). From a statistical standpoint, there were no significant ($p<0.05$) increasing or decreasing trends in radionuclide concentrations in vegetation over time at these sites or at the other sites at Area G.

IV. ACKNOWLEDGMENTS

Thanks to the 1998 field crew (Paul Torrez, Melanie Martinez, and Jennifer Tenbrink) for sample collection and processing, and to Rhonda Robinson for help in tabulating the data. Also, special thanks to Mary Mullen for the statistical analysis, to Andy Kron for figure construction, and to Hector Hinojosa for editing the manuscript.

Table 1. Descriptions of sampling locations shown on Figure 2.

Location Number	Description
1	South of tritium shafts immediately outside the Area G fence
2	West of the high-level tritium shafts immediately outside the Area G fence
3	East of the active waste pit inside the Area G fence
4	Outside the Area G fence north of the transuranic (TRU) waste pads #2 and 4
5	On top of TRU Waste Pad #3 inside the Area G fence
6	On top of TRU Waste Pad #2 inside Area G fence. Site removed before sampling in 1998.
7a	Southeastern portions of Pits 17 and 18 inside the Area G fence
7b	East end of Pit 6 inside the Area G fence
8	Proposed expansion area one-half mile west of the entrance gate to Area G and outside the Area G fence
9	Background locations were near Bandelier National Monument approximately 5 km south of Area G.

Table 2. Radionuclide concentrations in soils (dry weight) collected from Area G in 1998.[1] Bold values are equal to or greater than RSRL values.

	Sample Locations										
Element	**#1**	**#2**	**#3**	**#4**	**#5**	**#7a**	**#7b**	**#8**	**BG**	**RSRL[2]**	**SAL[3]**
^{3}H (pCi/mL)[4]	**115.00**	**147.50**	**2.42**	**7.40**	**39.90**	**3.06**	**6.40**	**1.15**	0.25	1.1	260.0
	(4.50)[5]	(5.40)	(0.81)	(1.10)	(2.30)	(0.85)	(1.00)	(0.74)	(0.15)		
^{238}Pu (pCi/g)	0.007	0.003	**0.034**	**0.272**	0.001	0.003	0.004	0.000	0.001	0.010	27.0
	(0.002)	(0.001)	(0.003)	(0.013)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001		
^{239}Pu (pCi/g)	**0.021**	0.016	**0.039**	**0.954**	0.007	0.007	**0.025**	0.008	0.011	0.021	24.0
	(0.003)	(0.003)	(0.003)	(0.031)	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)		
^{tot}U (µg/g)	**3.69**	**3.75**	**3.85**	3.12	2.19	**4.47**	**4.35**	**5.45**	1.92	3.2	29.0
	(0.37)	(0.38)	(0.39)	(0.31)	(0.22)	(0.45)	(0.44)	(0.55)	(0.44)		
^{137}Cs (pCi/g)	0.21	0.34	0.22	**0.76**	0.02	-0.00	0.08	0.23	0.28	0.60	5.1
	(0.03)	(0.04)	(0.13)	(0.08)	(0.01)	(0.08)	(0.02)	(0.03)	(0.01)		
^{90}Sr (pCi/g)	**1.83**	**1.85**	**1.74**	**1.88**	**2.38**	**1.28**	**2.11**	**1.88**	**1.26**	0.71	4.4
	(0.54)	(0.60)	(0.59)	(0.58)	(0.60)	(0.47)	(0.64)	(0.68)	(0.26)		
^{241}Am (pCi/g)	0.009	0.007	**0.017**	**0.150**	0.007	0.007	**0.016**	0.008	0.006	0.011	22.0
	(0.002)	(0.002)	(0.002)	(0.020)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)		

[1] Location #1=tritium shafts (south of the shafts just outside the fence), #2=tritium shafts (west of the shafts just outside the fence), #3=waste pits (east of the new pit inside the fence), #4=TRU waste pads (north of pads #3 and 4 just outside the fence), #5=TRU waste pad #2, #7a=Pits #17 and 18 (southeastern portions), #7b=Pits (eastern end), #8=expansion area, and BG=background (south and upwind of LANL).

[2] Regional Statistical Reference Level; this is the upper (95%) level background concentrations (mean + 2 std dev) from 1993-1997 (LANL 1998).

[3] Screening Action Level (FIMAD 1997).

[4] Concentration for ^{3}H is based on soil moisture.

[5] Values in parentheses are one counting uncertainty.

Table 3. Mean (±SD) ^{3}H and ^{239}Pu concentrations in soils (dry weight) collected from Area G from 1994 through 1998.

	Sample Locations[1]								
Element	**#1**	**#2**	**#3**	**#4**	**#5**	**#7a**	**#7b**	**#8**	**BG**
^{3}H (pCi/mL)[2]	65	123	1.4	2.9	20	2.40	4.1	0.20	-0.023
	(43)*[3]	(64)*	(1.0)*	(3.9)	(17)*	(0.89)[4]	(3.3)[4]	(0.83)	(0.370)
^{239}Pu (pCi/g)	0.0240	0.027	0.0450	0.49	0.018	0.0100	0.021	0.13	0.015
	(0.0023)	0.013*	(0.0065)*	(0.45)*	(0.010)[4]	(0.0042)[4]	(0.01)[4]	(0.20)	0.004

[1] Location #1=tritium shafts (south of the shafts just outside the fence), #2=tritium shafts (west of the shafts just outside the fence), #3=waste pits (east of the new pit inside the fence), #4=TRU waste pads (north of pads #3 and 4 just outside the fence), #5=TRU waste pad #2, #7a=Pits #17 and 18 (southeastern portions), #7b=Pits (eastern end), #8=expansion area, and BG=background (south and upwind of LANL).

[2] Concentration for ^{3}H is based on soil moisture.

[3] A *denotes a significant difference between the site and BG at the 0.05 probability level using a Wilcoxon Rank Sum Test.

[4] Statistical tests were not conducted due to the insufficient number of data points (n<3).

Table 4. Radionuclide concentrations in unwashed vegetation collected from Area G in 1998. Bold values are equal to or greater than RSRL values, and "ND" indicates that no sample was collected.

	Sample Locations[1]									
Element	**#1**	**#2**	**#3**	**#4**	**#5**	**#7a**	**#7b**	**#8**	**BG**	**RSRL[2]**
^{3}H (pCi mL^{-1})[3]										
OS[4]	**1460.00**	**8740.00**	**6.70**	**9.60**	ND	ND	ND	1.64	1.84	1.9
	(41.00)[5]	(240.00)	(1.00)	(1.20)				(0.77)	(0.78)	
US	**1974.00**	**2624.00**	**5.58**	**13.60**	**5600.00**	**17.60**	**23.00**	**2.12**	**2.83**	1.6
	(55.00)	(72.00)	(0.99)	(1.30)	(150.00)	(1.50)	(1.70)	(0.80)	(0.84)	
^{238}Pu (pCi g^{-1} ash)										
OS	0.007	-0.002	0.014	0.015	ND	ND	ND	-0.003	-0.001	0.038
	(0.002)	(0.002)	(0.005)	(0.003)				(0.002	(0.001)	
US	0.004	0.002	0.004	**0.042**	0.002	**0.009**	0.002	-0.000	0.003	0.005
	(0.002)	(0.001)	(0.004)	(0.005)	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	
^{239}Pu (pCi g^{-1} ash)										
OS	0.064	0.016	**0.104**	**0.087**	ND	ND	ND	0.003	0.002	0.075
	(0.006)	(0.004)	(0.011)	(0.008)				(0.003)	(0.002)	
US	**0.011**	0.008	**0.034**	**0.145**	**0.014**	**0.073**	**0.046**	0.001	0.002	0.011
	(0.003)	(0.002)	(0.007)	(0.010)	(0.003)	(0.008)	(0.006)	(0.003)	(0.003)	
^{90}Sr (pCi g^{-1} ash)										
OS	3.51	3.37	2.20	3.31	ND	ND	ND	1.89	1.88	17.09
	(0.52)	(0.32)	(0.25)	(0.48)				(0.31)	(0.24)	
US	**4.12**	2.93	**5.01**	**5.81**	2.05	1.66	2.43	3.53	2.98	3.8
	(0.49)	(0.49)	(0.43)	(0.48)	(0.22)	(0.51)	(0.42)	(0.83)	(0.61)	

Table 4, Cont.

	Sample Locations									
Element	**#1**	**#2**	**#3**	**#4**	**#5**	**#7a**	**#7b**	**#8**	**BG**	**RSRL[2]**
^{137}Cs (pCi g^{-1} ash)										
OS	-0.09	-0.20	0.11	0.40	ND	ND	ND	-0.11	-0.16	1.7
	(0.10)	(0.30)	(0.17)	(0.09)				(0.10)	(0.17)	
US	-0.08	-0.11	0.85	0.40	-0.20	0.74	-0.05	-0.08	-0.10	0.94
	(0.10)	(0.11)	(0.12)	(0.08)	(0.30)	(1.11)	(0.11)	(0.11)	(0.10)	
^{241}Am (pCi g^{-1} ash)										
OS	**0.036**	**0.035**	**0.042**	**0.017**	ND	ND	ND	0.011	-0.002	0.017
	(0.008)	(0.008)	(0.007)	(0.004)				(0.005)	(0.004)	
US	0.019	0.004	0.029	0.062	0.005	**0.873**	0.035	0.003	0.006	0.010
	(0.010)	(0.003)	(0.010)	(0.008)	(0.003)	(0.043)	(0.011)	(0.007)	(0.002)	
^{Tot}U (µg g^{-1} ash)										
OS	1.31	0.84	**2.24**	1.03	ND	ND	ND	0.88	0.60	1.6
	(0.13)	(0.08)	(0.22)	(0.10)				(0.09)	(0.06)	
US	0.61	0.53	**1.16**	1.40	0.68	0.70	1.03	0.94	0.38	1.5
	(0.06)	(0.05)	(0.12)	(0.14)	(0.07)	(0.07)	(0.10)	(0.09)	(0.04)	

[1] Location #1=tritium shafts (south of the shafts just outside the fence), #2=tritium shafts (west of the shafts just outside the fence), #3=waste pits (east of the new pit inside the fence), #4=TRU waste pads (north of pads #3 and 4 just outside the fence), #5=TRU waste pad #2, #7a=Pits #17 and 18 (southeastern portions), #7b=Pits (eastern end), #8=expansion area, and BG=background (south and upwind of LANL).

[2] Regional Statistical Reference Level; this is the upper (95%) level background concentration (mean + 2 std dev) from 1994-1997.

[3] Concentration for ^{3}H is based on soil moisture.

[4] OS is overstory vegetation (trees), US is understory vegetation (grasses/forbs).

[5] Values in parentheses are one counting uncertainty.

Table 5. Mean (±SD) ^{3}H and ^{239}Pu concentrations in vegetation (dry weight) collected from Area G from 1994 through 1998.[1] Blank values indicate no data were collected.

	Sample Locations[1]								
Element	**#1**	**#2**	**#3**	**#4**	**#5**	**#7a**	**#7b**	**#8**	**BG**
^{3}H (pCi/mL)[2]									
OS[3]	815 (691)*[4]	4234 (4554)*	2.8 (2.8)*	4.0 (4.1)*				0.68 (0.83)	0.41 (0.96)
US	2918 (3667)*	2948 (2136)*	2.6 (2.3)*	4.8 (6.0)*	4338 (2838)*	10 (10)[5]	16.8 (8.8)[5]	0.91 (1.09)	0.83 (1.34)
^{239}Pu (pCi/g ash)									
OS	0.020 (0.026)	0.013 (0.012)	0.60 (1.22)*	0.065 (0.066)*				0.0060 (0.0061)	0.012 (0.022)
US	0.0160 (0.0081)*	0.0098 (0.0031)*	0.0240 (0.0082)*	0.1440 (0.0076)*	0.022 (0.020)*	0.044 (0.042)[5]	0.083 (0.052)[5]	0.0055 (0.0055)	0.0045 (0.0030)

[1] Location #1=tritium shafts (south of the shafts just outside the fence), #2=tritium shafts (west of the shafts just outside the fence), #3=waste pits (east of the new pit inside the fence), #4=TRU waste pads (north of pads #3 and 4 just outside the fence), #5=TRU waste pad #2, #7a=Pits #17 and 18 (southeastern portions), #7b=Pits (eastern end), #8=expansion area, and BG=background (south and upwind of LANL).

[2] Concentration for ^{3}H is based on soil moisture.

[3] OS is overstory vegetation (trees), US is understory vegetation (grasses/forbs).

[4] A *denotes a significant difference between the site and BG at the 0.05 probability level using a Wilcoxon Rank Sum Test.

[5] Statistical tests were not conducted due to the insufficient number of data points (n<3).

Table 6. Comparison of past and present ^{3}H and ^{239}Pu data in unwashed vegetation collected at selected 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		
Before 1994[1]	1450.0	0.03
1994[2]	201.0	0.02
1995[3]	1400.0	0.01
1996	8279.0	0.01
1997	19.2	0.03
1998	1974.0	0.01
#2 Tritium shafts (west of the [high level] shafts just outside the fence)		
Overstory		
Before 1994[4]	2200.0 to 4800.0	0.01
1994[2]	5800.0	0.01
1995[3]	418.0	0.00
1996	7569.0	0.00
1997	207.0	0.03
1998	8740.0	0.02
Understory		
Before 1994[1]	0.4	0.27
1994[2]	328.0	0.01
1995[3]	4200.0	0.01
1996	4890.0	0.01
1997	77.5	0.01
1998	2624.0	0.01
#4 TRU waste pads (north of pad #2 and #4 just outside fence)		
Overstory		
Before 1994[1]	14.4	0.57 to 3.28
1994[2]	2.5	0.01
1995[3]	4.3	0.06
1996	0.9	0.00
1997	1.1	0.17
1998	9.6	0.09
Understory		
Before 1994[1]	3860.0 to 19100.0	0.52 to 1.55
1994[2]	35.6	0.15
1995[3]	3.7	0.13
1996	0.8	0.15
1997	1.1	0.15
1998	13.6	0.15
#5 TRU waste pads (pad #2)		
Understory		
Before 1994[5]	392.0 to 101000.0	
1994[2]	177.3	0.01
1995[3]	7300.0	0.01
1996	3788.0	0.01
1997	664.0	0.05
1998	5600.0	0.01

[1] Mayfield and Hansen' See Fresquez et al. (1998) Table 5 for specific references to past data.
[2] Fresquez et al. 1995
[3] Fresquez et al. 1996b
[4] Jacobson 1992
[5] Purtymun 1973

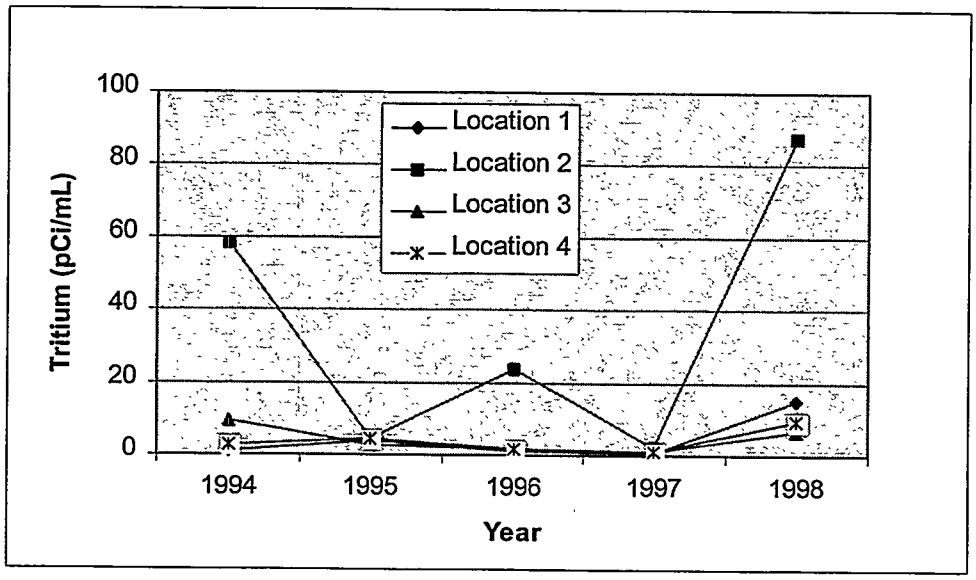

Figure 3. Tritium concentrations in overstory vegetation at Area G from 1994 through 1998. Overstory was found only at Locations 1 through 4. Values for Locations 1 and 2 are actual values divided by 100, values for Locations 3 and 4 are actual values.

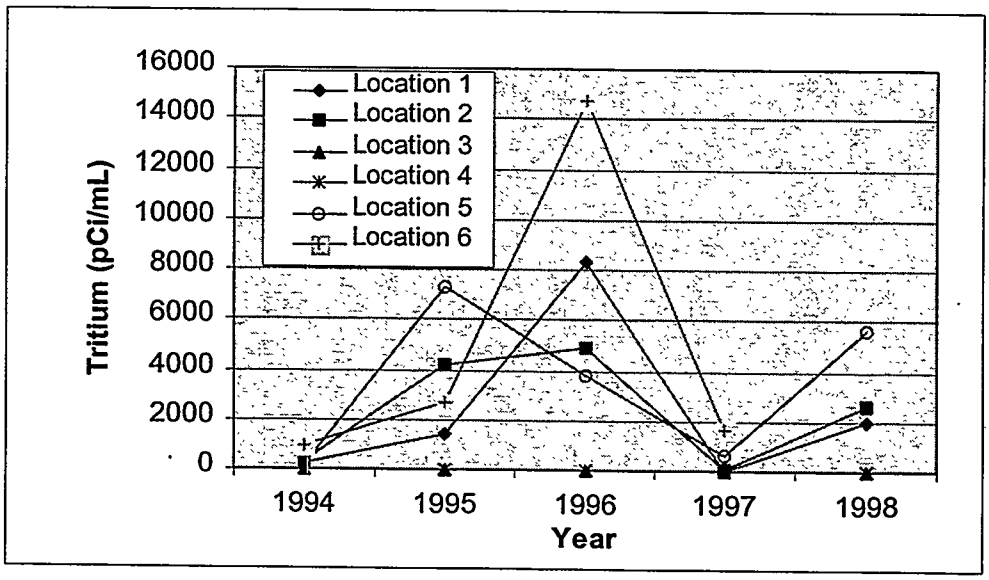

Figure 4. Tritium concentrations from understory vegetation at Area G from 1994 through 1998. Actual value for Location #6 in 1997 is 147440 pCi ml^{-1} and is shown here divided by 10.

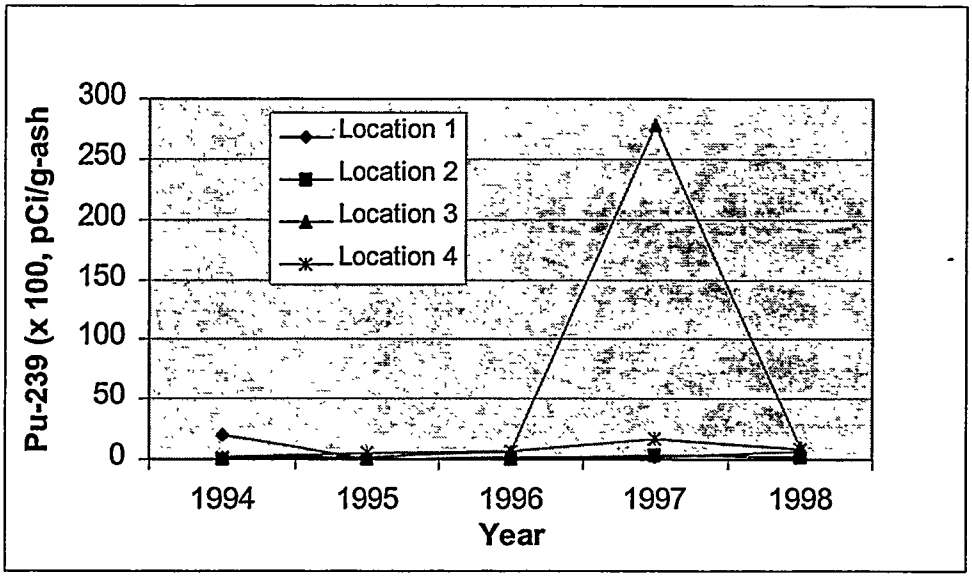

Figure 5. Concentrations of ^{239}Pu in Overstory vegetation at Area G from 1994 through 1998. Only locations 1 through 4 had overstory vegetation. All values are actual values x 100.

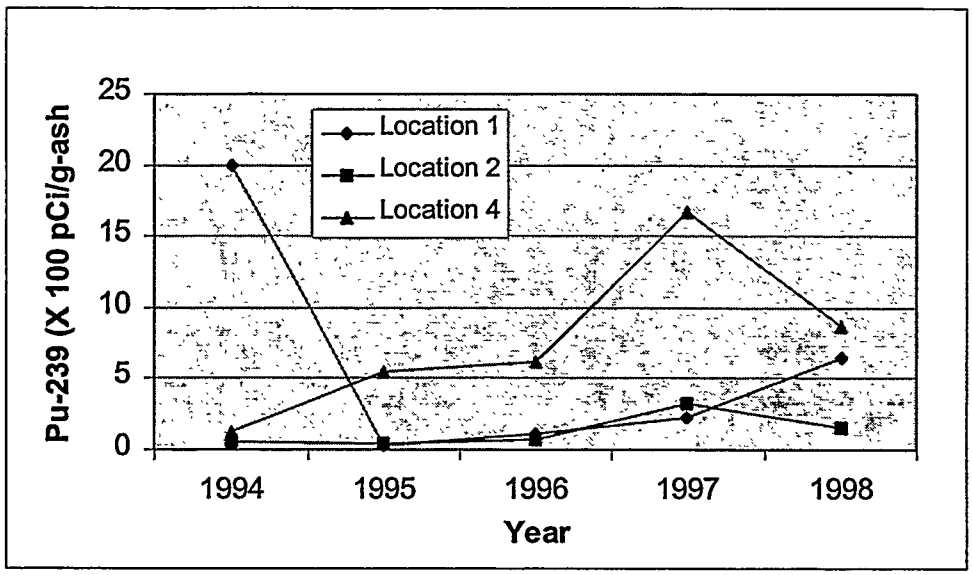

Figure 6. Concentrations of ^{239}Pu in Overstory vegetation at Area G from 1994 through 1998. Same graph as Figure 5 but Location 3 omitted. All values are actual values x 100.

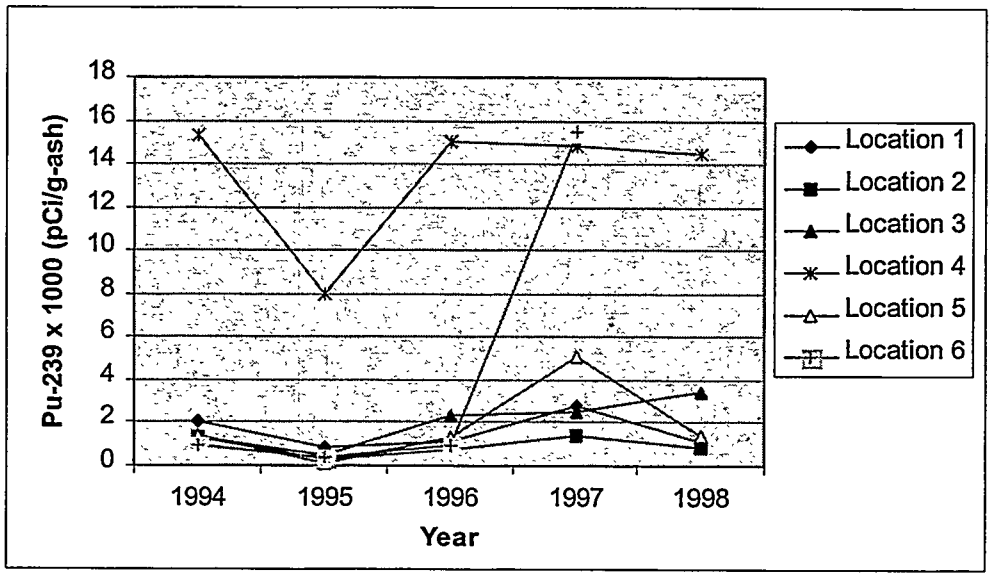

Figure 7. ^{239}Pu in understory vegetation at Area G from 1994 through 1998. All values are actual concentrations x 1000.

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APPENDIX A

CST ANALYTICAL REPORTS OF RADIONUCLIDES IN SOIL SURFACE SAMPLES AT AREA G

Case Narration

Submission ID 100029377

Analysis: Tritium in soil

The following data package contains data for all soil samples submitted June 11,1998. Samples were analyzed 6/25/98 with the addition of one open and one blind QC. All open QC'S were "In Control". On subsequent analysis the blind QC was listed being "Out of Control,"due to a high result value. It is my opinion that the date quality for these samples were not affected by the lost of the blind QC.

06-30-98

ANTHONY SANCHEZ

Anthony J. Sanchez 6/30/98

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id : 100029377

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	7C2000M34A02106CA3	**Due Date:**	12-AUG-98
Requester Group:	ESH-20	**Logged Date:**	11-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

A-2

CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156862	#3	H-3	2420	810	pCi/L	
			H-3 MDA	479		pCi/L	
200063681	300156868	#4	H-3	7400	1100	pCi/L	
			H-3 MDA	479		pCi/L	
200063682	300156874	#5	H-3	39900	2300	pCi/L	
			H-3 MDA	479		pCi/L	
200063683	300156880	#7B	H-3	6400	1000	pCi/L	
			H-3 MDA	479		pCi/L	
200063684	300156890	#7A	H-3	3060	850	pCi/L	
			H-3 MDA	479		pCi/L	
200063685	300156892	#1	H-3	115000	4500	pCi/L	
			H-3 MDA	479		pCi/L	
200063686	300156899	#2	H-3	147500	5400	pCi/L	
			H-3 MDA	479		pCi/L	
200063687	300156904	#8	H-3	1150	740	pCi/L	
			H-3 MDA	479		pCi/L	

**** FINAL REPORT ****

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id : 100029377

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200063691	300156914	H-3	20800	1600	pCi/L	7080	184	pCi/L	OUT OF CONTROL

A-13

OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.38287	300159271	H-3	0.00031	0.00068	uCi/L	0	0	uCi/L	IN CONTROL
00.39689	300159272	H-3	0.0136	0.0013	uCi/L	0.01469	0.00147	uCi/L	IN CONTROL

**** FINAL REPORT ****

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id : 100029377

Analyst	Review	Team Leader	QA Officer
6/23/98	7-02-98	07/07/98	07/07/98
Date	Date	Date	Date

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: PU RAS ENV **Method Area: EH-ALPHA** **Submission Id : 100029377**

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	7C2000M34A02106CA3	**Due Date:**	12-AUG-98
Requester Group:	ESH-20	**Logged Date:**	11-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

A-5

CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156863	#3	Pu-238	0.0338	0.0029	pCi/g	
			Pu-239	0.0392	0.0031	pCi/g	
			Pu-242T Recovery	53.81		%	
200063681	300156869	#4	Pu-238	0.2719	0.0126	pCi/g	
			Pu-239	0.9535	0.0311	pCi/g	
			Pu-242T Recovery	37.50		%	
200063682	300156875	#5	Pu-238	0.0006	0.0005	pCi/g	
			Pu-239	0.0074	0.0013	pCi/g	
			Pu-242T Recovery	74.99		%	
200063683	300156881	#7B	Pu-238	0.0044	0.0009	pCi/g	
			Pu-239	0.0249	0.0020	pCi/g	
			Pu-242T Recovery	76.88		%	
200063684	300156891	#7A	Pu-238	0.0032	0.0008	pCi/g	
			Pu-239	0.0072	0.0012	pCi/g	
			Pu-242T Recovery	78.37		%	
200063685	300156893	#1	Pu-238	0.0069	0.0018	pCi/g	
			Pu-239	0.0206	0.0029	pCi/g	
			Pu-242T Recovery	45.63		%	

000005

****** FINAL REPORT ******

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029377

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200063686	300156900	#2	Pu-238	0.0025	0.0011	pCi/g	
			Pu-239	0.0163	0.0026	pCi/g	
			Pu-242T Recovery	43.63		%	
200063687	300156905	#8	Pu-238	0.0004	0.0004	pCi/g	
			Pu-239	0.0077	0.0013	pCi/g	
			Pu-242T Recovery	76.49		%	

DUPLICATE TASKS

A-6

Sample Id	Task Id	Original Task	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156863		Pu-238	0.0338	0.0029	pCi/g	
			Pu-239	0.0392	0.0031	pCi/g	
			Pu-242T Recovery	53.81		%	
200070372	300169184	300156863	Pu-238	0.0685	0.0037	pCi/g	
			Pu-239	0.0483	0.0031	pCi/g	
			Pu-242T Recovery	79.17		%	

**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029377

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200063688	300156910	Pu-238	0.9170	0.0250	pCi/g	0.93	0.032	pCi/g	IN CONTROL
		Pu-239	0.4920	0.0155.	pCi/g	0.49	0.02	pCi/g	IN CONTROL

4-4

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.22776	300169185	Pu-238	-0.0001	0.0004	pCi/g	0.0	0.0	pCi/g	IN CONTROL
		Pu-239	0.0010	0.0012	pCi/g	0.0	0.0	pCi/g	IN CONTROL

QC-007

**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029377

Analyst	Review	Team Leader	QA Officer
LJP	SJG	[illegible]	NK
19 Aug 98	8/24/98	8/24/98	08/24/98
Date	Date	Date	Date

A-8

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100029377

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	7C2000M34A02106CA3	**Due Date:**	12-AUG-98
Requester Group:	ESH-20	**Logged Date:**	11-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

A-9

CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156867	#3	U	3.85	0.39	ug/g	
200063681	300156873	#4	U	3.12	0.31	ug/g	
200063682	300156879	#5	U	2.19	0.22	ug/g	
200063683	300156885	#7B	U	4.35	0.44	ug/g	
200063684	300156889	#7A	U	4.47	0.45	ug/g	
200063685	300156897	#1	U	3.69	0.37	ug/g	
200063686	300156898	#2	U	3.75	0.38	ug/g	
200063687	300156909	#8	U	5.45	0.55	ug/g	

DUPLICATE TASKS

Sample Id	Task Id	Original Task	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156867		U	3.85	0.39	ug/g	
200069488	300167757	300156867	U	2.52	0.25	ug/g	

**** FINAL REPORT ****

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100029377

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200063690	300156913	U	1.83	0.18	ug/g	1.5	0.0	ug/g	IN CONTROL

OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.38058	300167755	U	9.92	0.99	ug/L	10.1	1.0	ug/L	IN CONTROL

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.22776	300167756	U	0.00	0.01	ug/g	0	0	ug/g	IN CONTROL

**** FINAL REPORT ****

10K-23

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100029377

Analyst	Review	Team Leader	QA Officer
ml	Ey	B	NK
8/11/98	8-12-98	8/12/98	08/13/98
Date	Date	Date	Date

11-4

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

Los Alamos
NATIONAL LABORATORY

memorandum

Chemical Science & Technology
Inorganic Trace Analysis, CST-9
MS K484
Los Alamos, New Mexico 87545
(505) 667-3269
FAX (505) 665-5982

To/MS: Phillip R. Fresquez, MS M887
From/MS: S. R. Garcia, CST-9, MS K484
Phone/FAX: 5-0270/**5-5982**
Symbol: CST-9-PRF-98-12
Date: September 8, 1998

SUBJECT: SUBMISSION 100029377 Cs-137 GENERIC GAMMA RESULTS IN SOILS

Please be advised that GENERIC GAMMA Cs-137 results for submission id 100029377 have been reported and entered into the SQL*LIMS database. Both open and blind QC's were *IN CONTROL.*

Should you have any questions concerning this submission, please feel free to call or send an e-mail message to me at....**garcia_s@lanl.gov**.

A-12

04

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: GENERIC GAMMA Method Area: EH-GAMMA Submission Id : 100029377

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	7C2000M34A02106CA3	**Due Date:**	12-AUG-98
Requester Group:	ESH-20	**Logged Date:**	11-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156866	#3	CS-137	0.22	0.13	pCi/g	
200063681	300156872	#4	CS-137	0.76	0.08	pCi/g	
200063682	300156878	#5	CS-137	0.02	0.01	pCi/g	
200063683	300156884	#7B	CS-137	0.08	0.02	pCi/g	
200063684	300156888	#7A	CS-137	-0.00	0.08	pCi/g	
200063685	300156896	#1	CS-137	0.21	0.03	pCi/g	
200063686	300156903	#2	CS-137	0.34	0.04	pCi/g	
200063687	300156908	#8	CS-137	0.23	0.03	pCi/g	

A-13

DUPLICATE TASKS

Sample Id	Task Id	Original Task	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156866		CS-137	0.22	0.13	pCi/g	
200072749	300173434	300156866	CS-137	0.29	0.04	pCi/g	

**** FINAL REPORT ****

Method: GENERIC GAMMA Method Area: EH-GAMMA Submission Id : 100029377

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200063692	300156916	CS-137	5.36	0.44	pCi/g	5.27	.17	pCi/g	IN CONTROL

OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.33404	300173433	CS-137	4.45	0.37	pCi/g	4.9800	0.1600	pCi/g	IN CONTROL

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00:22776	300173432	CS-137	0.03	0.04	pCi/g	0.0	0.0	pCi/g	IN CONTROL

**** FINAL REPORT ****

Method: GENERIC GAMMA Method Area: EH-GAMMA Submission Id : 100029377

Analyst	Review	Team Leader	QA Officer
9/8/98	9/9/98	9/9/98	09/09/98
Date	Date	Date	Date

A-15

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

Los Alamos
NATIONAL LABORATORY
memorandum
Chemical Science and Technology
Responsible Chemistry for America
CST-9/Inorganic Trace Analysis
Los Alamos, New Mexico 87545

To/MS: Philip Fresquez/M887
From/MS: *Edward R. Gonzales/K484*, CST-9
Phone/FAX: 7-9059/5-5982
Symbol: CST-9/94
Date: 08-12-98

Case Narration

Analysis: Sr-90

Narration

The blind QC run with this set of samples is listed "Out of Control". The problem seems to be restricted to the QC itself since samples are traced and the open QC added to this set is in control. Since the problem appears to be isolated to the QC it is my opinion that this error does not reflect on the quality of the remaining sample data. We are in the process of correcting this problem. If you have any concerns please call Edward Gonzales at 667-9059.

A-16

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100029377

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	7C2000M34A02106CA3	**Due Date:**	12-AUG-98
Requester Group:	ESH-20	**Logged Date:**	11-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

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CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156864	#3	Sr-90	1.74	0.59	pCi/g	
			Sr-90 MDA	0.62		pCi/g	
200063681	300156870	#4	Sr-90	1.88	0.58	pCi/g	
			Sr-90 MDA	0.57		pCi/g	
200063682	300156876	#5	Sr-90	2.38	0.6	pCi/g	
			Sr-90 MDA	0.58		pCi/g	
200063683	300156882	#7B	Sr-90	2.11	0.64	pCi/g	
			Sr-90 MDA	0.65		pCi/g	
200063684	300156886	#7A	Sr-90	1.28	0.47	pCi/g	
			Sr-90 MDA	0.48		pCi/g	
200063685	300156894	#1	Sr-90	1.83	0.54	pCi/g	
			Sr-90 MDA	0.53		pCi/g	
200063686	300156901	#2	Sr-90	1.85	0.6	pCi/g	
			Sr-90 MDA	0.61		pCi/g	
200063687	300156906	#8	Sr-90	1.88	0.68	pCi/g	
			Sr-90 MDA	0.72		pCi/g	

**** FINAL REPORT ****

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100029377

DUPLICATE TASKS

Sample Id	Task Id	Original Task	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156864		Sr-90	1.74	0.59	pCi/g	
			Sr-90 MDA	0.62		pCi/g	
200068841	300166333	300156864	Sr-90	1.60	0.49	pCi/g	
			Sr-90 MDA	0.50		pCi/g	

A-18

**** FINAL REPORT ****

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 10002937

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200063689	300156912	Sr-90	27.3	2.27	pCi/g	38.2	1.14	pCi/g	OUT OF CONTROL

A-19

OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.36592	300166335	Sr-90	507.9	104.4	pCi/L	499.5	15.98	pCi/L	IN CONTROL

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation

**** FINAL REPORT ****

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100029377

Analyst	Review	Team Leader	QA Officer
Eng	STG	GB	NK
8-12-98	8/14/98	8/14/98	08/14/98
Date	Date	Date	Date

08-A

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029377

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	7C2000M34A02106CA3	**Due Date:**	12-AUG-98
Requester Group:	ESH-20	**Logged Date:**	11-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156865	#3	Am-241	0.0165	0.0023	pCi/g	
			Am-243T Recovery	54.49		%	
200063681	300156871	#4	Am-241	0.15	0.02	pCi/g	
			Am-243T Recovery	51.66		%	
200063682	300156877	#5	Am-241	0.0067	0.0014	pCi/g	
			Am-243T Recovery	66.13		%	
200063683	300156883	#7B	Am-241	0.0162	0.0021	pCi/g	
			Am-243T Recovery	66.47		%	
200063684	300156887	#7A	Am-241	0.0072	0.0015	pCi/g	
			Am-243T Recovery	61.56		%	
200063685	300156895	#1	Am-241	0.0091	0.0016	pCi/g	
			Am-243T Recovery	60.43		%	
200063686	300156902	#2	Am-241	0.0067	0.0016	pCi/g	
			Am-243T Recovery	48.04		%	
200063687	300156907	#8	Am-241	0.0078	0.0014	pCi/g	
			Am-243T Recovery	71.96		%	

**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029377

DUPLICATE TASKS

Sample Id	Task Id	Original Task	Component	Result Value	Uncertainty	Units	Qualifier
200063676	300156865		Am-241	0.0165	0.0023	pCi/g	
			Am-243T Recovery	54.49		%	
200072634	300173320	300156865	Am-241	0.0226	0.0024	pCi/g	
			Am-243T Recovery	70.93		%	

A-22

**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029377

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200063688	300156911	Am-241	0.6701	0.0190	pCi/g	0.67	0.03	pCi/g	IN CONTROL

A-23

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.22776	300173321	Am-241	0.0027	0.0009	pCi/g	0.0	0.0	pCi/g	WARNING 2-3SIG

**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029377

RJP	SJG		NK
Analyst	Review	Team Leader	QA Officer
9 Sept 98	9/10/98	9/10/98	09/10/98
Date	Date	Date	Date

42-24

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

CHAIN-OF-CUSTODY RECORD

Soils

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Soils and Foodstuffs (~~7C20 WESO~~) M34A 02106 CA3
P.I.# (505) 667-0815
ESH-20 MS M887

Project Name	Request the following analysis:	number of containers	Sample Location/Remarks
Area G - Soils	^{3}H, ^{238}Pu, ^{239}Pu, ^{90}Sr, ^{241}Am, ^{137}Cs, tot U		
Samplers (signatures) [signatures]			

Date	Time	Sample Name/Number	number of containers	Sample Location/Remarks
6/10/98	8:50	#3		east of active west pit inside fence
↓	10:30	4		N of TRU pad outside the fence
	10:45	5		TRU pad #2
	11:05	7b		over pits 6, 7 and 24 (east end)
	11:30	7a		over pits #17 and #18 (SE end)
	11:35	1		S of ³H shafts outside fence
	11:45	2		W of ³H shafts outside fence
6/11/98	10:30	8		expansion area (W of area G outside fence. (0.7 miles)
				Note: no #9; use Reg. background from ESP. and #6 was being dismantled; therefore no samples were collected this year.

Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
[signature]	6-11-98 2:45	[signature]			
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)

Relinquished by: (signature)	Date/Time	Received for Lab. by: (signature)	Date/Time	Remarks:

A-25

APPENDIX B

CST ANALYTICAL REPORTS OF RADIONUCLIDES IN UNWASHED VEGETATION SAMPLES AT AREA G

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: H-3 LS ENV **Method Area:** EH-ALPHA **Submission Id :** 100029559

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	7C2000M34A02106CA3	**Due Date:**	19-AUG-98
Requester Group:	ESH-20	**Logged Date:**	19-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	DDECKER
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064237	300157806	1 OS	H-3	1460000	41000	pCi/L	
			H-3 MDA	1000		pCi/L	
200064238	300157807	1 US	H-3	1974000	55000	pCi/L	
			H-3 MDA	1000		pCi/L	
200064239	300157808	2 OS	H-3	8740000	240000	pCi/L	
			H-3 MDA	510		pCi/L	
200064240	300157809	2 US	H-3	2624000	72000	pCi/L	
			H-3 MDA	1000		pCi/L	
200064241	300157810	8 OS	H-3	1640	770	pCi/L	
			H-3 MDA	560		pCi/L	
200064242	300157811	8 US	H-3	2120	800	pCi/L	
			H-3 MDA	580		pCi/L	
200064243	300157812	9 OS	H-3	1840	780	pCi/L	
			H-3 MDA	570		pCi/L	
200064244	300157813	9 US	H-3	2830	840	pCi/L	
			H-3 MDA	640		pCi/L	
200064245	300157814	3 OS	H-3	6700	1000	pCi/L	
			H-3 MDA	600		pCi/L	

**** FINAL REPORT ****

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id : 100029559

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064246	300157815	3 US	H-3	5580	990	pCi/L	
			H-3 MDA	540		pCi/L	
200064247	300157816	4 OS	H-3	9600	1200	pCi/L	
			H-3 MDA	600		pCi/L	
200064248	300157817	4 US	H-3	13600	1300	pCi/L	
			H-3 MDA	600		pCi/L	
200064249	300157818	5 US	H-3	5600000	150000	pCi/L	
			H-3 MDA	510		pCi/L	
200064250	300157819	7B US	H-3	23000	1700	pCi/L	
			H-3 MDA	600		pCi/L	
200064251	300157820	7A US	H-3	17600	1500	pCi/L	
			H-3 MDA	600		pCi/L	

B-2

**** FINAL REPORT ****

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id : 100029559

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200064252	300157821	H-3	17400	1500	pCi/L	13100	490	pCi/L	WARNING 2-3SIG

8-3

47

**** FINAL REPORT ****

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id : 100029559

Analyst	Review	Team Leader	QA Officer
7/16/98	7-17-98	7/17/98	07/20/98
Date	Date	Date	Date

4-8

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: PU RAS ENV **Method Area:** EH-ALPHA **Submission Id :** 100029609

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	000000M34A02106CA3	**Due Date:**	24-AUG-98
Requester Group:	ESH-20	**Logged Date:**	23-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

B-5

CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064570	300158266	#3 OS	Pu-238	0.0143	0.0046	pCi/g	
			Pu-239	0.1037	0.0106	pCi/g	
			Pu-242T Recovery	39.14		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	31.44		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	34.		counts	
			Pu-238 Background Counts	10.6		counts	
			Pu-239 Gross Counts	182.		counts	
			Pu-239 Background Counts	12.0		counts	
200064576	300158292	#3 US	Pu-238	0.0035	0.0041	pCi/g	
			Pu-239	0.0343	0.0069	pCi/g	
			Pu-242T Recovery	45.43		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	

**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064576	300158292	#3 US	Efficiency	29.02		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	24.		counts	
			Pu-238 Background Counts	17.8		counts	
			Pu-239 Gross Counts	74.		counts	
			Pu-239 Background Counts	13.8		counts	
200064577	300158322	4 OS	Pu-238	0.0148	0.0034	pCi/g	
			Pu-239	0.0867	0.0081	pCi/g	
			Pu-242T Recovery	51.38		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	29.94		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	38.		counts	
			Pu-238 Background Counts	7.6		counts	
			Pu-239 Gross Counts	184.		counts	
			Pu-239 Background Counts	6.4		counts	
200064578	300158327	4 US	Pu-238	0.0419	0.0050	pCi/g	
			Pu-239	0.1451	0.0099	pCi/g	
			Pu-242T Recovery	52.16		%	
			Analysis Date	10/09/98		MM/DD/YY	
			Instrument	96 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	36.93		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	125.		counts	
			Pu-238 Background Counts	17.4		counts	
			Pu-239 Gross Counts	385.		counts	
			Pu-239 Background Counts	12.8		counts	
200064579	300158332	5 US	Pu-238	0.0021	0.0016	pCi/g	

**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064579	300158332	5 US	Pu-239	0.0139	0.0028	pCi/g	
			Pu-242T Recovery	60.76		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	33.24		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	10.		counts	
			Pu-238 Background Counts	4.4		counts	
			Pu-239 Gross Counts	43.		counts	
			Pu-239 Background Counts	5.6		counts	
200064580	300158342	7B US	Pu-238	0.0017	0.0030	pCi/g	
			Pu-239	0.0462	0.0058	pCi/g	
			Pu-242T Recovery	50.79		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.58		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	10.		counts	
			Pu-238 Background Counts	6.4		counts	
			Pu-239 Gross Counts	101.		counts	
			Pu-239 Background Counts	5.4		counts	
200064581	300158337	7A US	Pu-238	0.0091	0.0037	pCi/g	
			Pu-239	0.0732	0.0083	pCi/g	
			Pu-242T Recovery	40.60		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.46		%	
			Pu-242T Spike	2.05		pCi	

7-8

**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064581	300158337	7A US	Pu-238 Gross Counts	20.		counts	
			Pu-238 Background Counts	5.0		counts	
			Pu-239 Gross Counts	125.		counts	
			Pu-239 Background Counts	4.4		counts	
200064582	300158302	1 OS	Pu-238	0.0067	0.0021	pCi/g	
			Pu-239	0.0642	0.0059	pCi/g	
			Pu-242T Recovery	71.54		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.92		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	26.		counts	
			Pu-238 Background Counts	6.4		counts	
			Pu-239 Gross Counts	196.		counts	
			Pu-239 Background Counts	6.8		counts	
200064583	300158307	1 US	Pu-238	0.0041	0.0022	pCi/g	
			Pu-239	0.0108	0.0030	pCi/g	
			Pu-242T Recovery	50.40		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.32		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	11.		counts	
			Pu-238 Background Counts	2.6		counts	
			Pu-239 Gross Counts	26.		counts	
			Pu-239 Background Counts	4.0		counts	
200064584	300158312	2 OS	Pu-238	0.0015	0.0024	pCi/g	
			Pu-239	0.0161	0.0041	pCi/g	
			Pu-242T Recovery	41.14		%	

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**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064584	300158312	2 OS	Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	31.05		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	3.		counts	
			Pu-238 Background Counts	5.6		counts	
			Pu-239 Gross Counts	32.		counts	
			Pu-239 Background Counts	4.6		counts	
200064585	300158317	2 US	Pu-238	0.0023	0.0011	pCi/g	
			Pu-239	0.0079	0.0021	pCi/g	
			Pu-242T Recovery	94.03		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	27.73		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	11.		counts	
			Pu-238 Background Counts	3.0		counts	
			Pu-239 Gross Counts	34.		counts	
			Pu-239 Background Counts	6.6		counts	
200064586	300158347	8 OS	Pu-238	0.0033	0.0022	pCi/g	
			Pu-239	0.0032	0.0028	pCi/g	
			Pu-242T Recovery	47.25		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	33.15		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	0.		counts	
			Pu-238 Background Counts	6.8		counts	

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**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064586	300158347	8 OS	Pu-239 Gross Counts	13.		counts	
			Pu-239 Background Counts	6.4		counts	
200064587	300158352	8 US	Pu-238	0.0003	0.0030	pCi/g	
			Pu-239	0.0012	0.0025	pCi/g	
			Pu-242T Recovery	45.53		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.65		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	6.		counts	
			Pu-238 Background Counts	6.6		counts	
			Pu-239 Gross Counts	9.		counts	
			Pu-239 Background Counts	6.8		counts	
200064588	300158357	9 OS	Pu-238	0.0009	0.0011	pCi/g	
			Pu-239	0.0023	0.0015	pCi/g	
			Pu-242T Recovery	74.22		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	31.27		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	3.		counts	
			Pu-238 Background Counts	5.8		counts	
			Pu-239 Gross Counts	13.		counts	
			Pu-239 Background Counts	6.0		counts	
200064589	300158362	9 US	Pu-238	0.0027	0.0025	pCi/g	
			Pu-239	0.0019	0.0031	pCi/g	
			Pu-242T Recovery	41.84		%	
			Analysis Date	09/23/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	

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**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064589	300158362	9 US	Count Time	3000.00		min	
			Efficiency	33.21		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	12.		counts	
			Pu-238 Background Counts	7.0		counts	
			Pu-239 Gross Counts	9.		counts	
			Pu-239 Background Counts	5.4		counts	

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**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200064592	300158296	Pu-238	7.2145	0.2663	pCi/g	7.34	0.26	pCi/g	IN CONTROL
		Pu-239	1.7236	0.0831	pCi/g	1.79	0.06	pCi/g	IN CONTROL

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**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Analyst	Review	Team Leader	QA Officer
10/15/98	10-20-98	10/20/98	10/22/98
Date	Date	Date	Date

G1-9

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

Los Alamos
NATIONAL LABORATORY
memorandum
Chemical Science and Technology
Responsible Chemistry for America
CST-9/Inorganic Trace Analysis
Los Alamos, New Mexico 87545

To/MS: Phil Fresquez/M887
From/MS: *Edward R. Gonzales/K484*, CST-9
Phone/FAX: 7-9059/5-5982
Symbol: CST-9/94
Date: 10-20-98

Case Narration

Submission ID: 100029609
Analysis: Sr-90

Narration

Samples 200064579, 200064587, & 200064589 in submission 100029609 have chemical recoveries that are outside our usual acceptance criteria. Inspection of the data indicates the sample results are of acceptable quality for reporting. It is my opinion this does not reflect on the technical correctness of the sample data but is more indicative of the complexity of the sample matrix.

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100029609

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	000000M34A02106CA3	**Due Date:**	24-AUG-98
Requester Group:	ESH-20	**Logged Date:**	23-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

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CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064570	300158264	#3 OS	Sr-90	2.2	0.25	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200064576	300158290	#3 US	Sr-90	5.01	0.43	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200064577	300158320	4 OS	Sr-90	3.31	0.48	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200064578	300158325	4 US	Sr-90	5.81	0.48	pCi/g	
			Sr-90 MDA	2		pCi/g	
200064579	300158330	5 US	Sr-90	2.05	0.22	pCi/g	
			Sr-90 MDA	2		pCi/g	
200064580	300158340	7B US	Sr-90	2.43	0.42	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200064581	300158335	7A US	Sr-90	1.66	0.51	pCi/g	
			Sr-90 MDA	2		pCi/g	
200064582	300158300	1 OS	Sr-90	3.51	0.52	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200064583	300158305	1 US	Sr-90	4.12	0.49	pCi/g	
			Sr-90 MDA	2.00		pCi/g	

**** FINAL REPORT ****

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064584	300158310	2 OS	Sr-90	3.37	0.32	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200064585	300158315	2 US	Sr-90	2.93	0.49	pCi/g	
			Sr-90 MDA	2		pCi/g	
200064586	300158345	8 OS	Sr-90	1.89	0.31	pCi/g	
			Sr-90 MDA	2.0		pCi/g	
200064587	300158350	8 US	Sr-90	3.53	0.83	pCi/g	
			Sr-90 MDA	2.12		pCi/g	
200064588	300158355	9 OS	Sr-90	1.88	0.24	pCi/g	
			Sr-90 MDA	2.0		pCi/g	
200064589	300158360	9 US	Sr-90	2.98	0.61	pCi/g	
			Sr-90 MDA	2.0		pCi/g	

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**** FINAL REPORT ****

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100029609

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200064594	300158294	Sr-90	5.49	0.91	pCi/g	5.3	0.17	pCi/g	IN CONTROL

OPEN QC

4-1-9

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.36592	300181349	Sr-90	471.3	38.8	pCi/L	499.5	15.98	pCi/L	IN CONTROL

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.22784	300181348	Sr-90	0.11	0.17	pCi/g	0	0	pCi/g	IN CONTROL

**** FINAL REPORT ****

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100029609

Analyst	Review	Team Leader	QA Officer
10-20-98	10/21/98	10/21/98	10/22/98
Date	Date	Date	Date

10-9-98

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

Los Alamos
NATIONAL LABORATORY

memorandum

Chemical Science & Technology
Inorganic Trace Analysis, CST-9
MS K484
Los Alamos, New Mexico 87545
(505) 667-3269
FAX (505) 665-5982

To/MS: Phillip R. Fresquez, MS M887
From/MS: S. R. Garcia, CST-9, MS K484
Phone/FAX: 5-0270/**5-5982**
Symbol: CST-9-PRF-98-7
Date: August 20, 1998

SUBJECT: SUBMISSION 100029609 Cs-137 RESULTS IN VEGETATION ASH.

Please be advised that GENERIC GAMMA results for submission id 100029609 have been reported and entered into the SQL*LIMS database. Both open and blindQC's were *IN CONTROL.*

Should you have any questions concerning this submission, please feel free to call or send an e-mail message to me at....**garcia_s@lanl.gov**.

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LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

08

Method: GENERIC GAMMA Method Area: EH-GAMMA Submission Id : 100029609

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	000000M34A02106CA3	**Due Date:**	24-AUG-98
Requester Group:	ESH-20	**Logged Date:**	23-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

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CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064570	300158267	#3 OS	CS-137	0.11	0.17	pCi/g	
200064576	300158288	#3 US	CS-137	0.85	0.12	pCi/g	
200064577	300158318	4 OS	CS-137	0.40	0.09	pCi/g	
200064578	300158323	4 US	CS-137	0.40	0.08	pCi/g	
200064579	300158328	5 US	CS-137	[illegible]	0.30	pCi/g	
200064580	300158338	7B US	CS-137	[illegible]	0.11	pCi/g	
200064581	300158333	7A US	CS-137	0.74	1.11	pCi/g	
200064582	300158298	1 OS	CS-137	[illegible]	0.10	pCi/g	
200064583	300158303	1 US	CS-137	[illegible]	0.10	pCi/g	
200064584	300158308	2 OS	CS-137	[illegible]	0.30	pCi/g	
200064585	300158313	2 US	CS-137	[illegible]	0.11	pCi/g	
200064586	300158343	8 OS	CS-137	[illegible]	0.10	pCi/g	
200064587	300158348	8 US	CS-137	[illegible]	0.11	pCi/g	
200064588	300158353	9 OS	CS-137	[illegible]	0.17	pCi/g	
200064589	300158358	9 US	CS-137	[illegible]	0.10	pCi/g	

**** FINAL REPORT ****

09

Method: GENERIC GAMMA Method Area: EH-GAMMA Submission Id : 100029609

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200064591	300158293	CS-137	47.2	3.5	pCi/g	46.8	1.54	pCi/g	IN CONTROL

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OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.33380	300169905	CS-137	4.76	0.44	pCi/g	5.1000	0.1700	pCi/g	IN CONTROL

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.22785	300169904	CS-137	0.04	0.06	pCi/g	0.0	0.0	pCi/g	IN CONTROL

**** FINAL REPORT ****

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Method: GENERIC GAMMA Method Area: EH-GAMMA Submission Id : 100029609

Analyst	Review	Team Leader	QA Officer
8/20/98	8/21/98	8/24/98	08/24/98
Date	Date	Date	Date

8-22

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

Los Alamos
NATIONAL LABORATORY
memorandum
Chemical Science and Technology
Responsible Chemistry for America

CST-9/Inorganic Trace Analysis
Los Alamos, New Mexico 87545

To/MS: Philip R. Fresquez/MS 887
From/MS: Claudine Armenta, CST-9/K484
Phone/FAX: 7-3269/5-5982
Symbol: CST-9/98
Date: November 6, 1998

This is a Case Narrative for the following:

Submission Number : 100029609
Analysis : Americium in Biological Samples

I. Introduction
On June 23, 1998 (16) samples were received for analysis.

II. Analytical Results/Methodology
The analytical results are presented as indicated by the terms on the CST-3 Analytical Service Agreement. Each set of data will include sample identification information, the analytical results, and other information as required by ESH-20.

The analysis requested is: Isotopic Americium LA-10300-M, Vol. III, Americium in Environmental Matrices-Alpha Spectrometry, Method ER-121.

III. Quality Control
Laboratory control samples are prepared and analyzed with each sample request.

IV. Comments
Sixteen samples were analyzed for Americium-241. These samples were spiked with Americium-243. The following samples have low recoveries: 200064576, 20004580, 200064581, 200064582, 200064583, 200064584, 200064585, 200064587. The following are the recoveries respectively: 25.45%, 18.32%, 28.29%, 26.77%, 14.34%, 25.74%, 27.29%, 22.69%. We try to maintain standard percent recovery of 30%. These samples were run twice, in order to get better recoveries. The best of the two runs were reported. There may be a slight interference with the matrix causing the low recoveries. There was no activity in the Americium-241 area. The blind Q.C. 200064592 fell Under Control. Proves to me that the low recovery was isolated to the previous samples mentioned. The samples were exhausted in the re-run set B-66-98Am re-run.

I verify, to the best of my knowledge, that the listed results are and both complete and technically correct, with the exception of the items detailed above.

Claudine E. Armenta 11/09/98

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LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	000000M34A02106CA3	**Due Date:**	24-AUG-98
Requester Group:	ESH-20	**Logged Date:**	23-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

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CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064570	300158265	#3 OS	Am-241	0.0417	0.0067	pCi/g	
			Am-243T Recovery	43.79		%	
			Analysis Date	10/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	31.92		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	85.		counts	
			Am-241 Background Counts	7.4		counts	
200064576	300158291	#3 US	Am-241	0.0294	0.0100	pCi/g	
			Am-243T Recovery	25.45		%	
			Analysis Date	10/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	29.05		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	46.		counts	
			Am-241 Background Counts	17.0		counts	

**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064577	300158321	4 OS	Am-241	0.0172	0.0038	pCi/g	
			Am-243T Recovery	53.78		%	
			Analysis Date	10/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	29.87		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	44.		counts	
			Am-241 Background Counts	7.2		counts	
200064578	300158326	4 US	Am-241	0.0618	0.0077	pCi/g	
			Am-243T Recovery	37.66		%	
			Analysis Date	09/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.53		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	99.		counts	
			Am-241 Background Counts	4.4		counts	
200064579	300158331	5 US	Am-241	0.0053	0.0029	pCi/g	
			Am-243T Recovery	39.47		%	
			Analysis Date	10/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.68		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	12.		counts	
			Am-241 Background Counts	3.4		counts	
200064580	300158341	7B US	Am-241	0.0347	0.0114	pCi/g	
			Am-243T Recovery	18.32		%	
			Analysis Date	09/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	

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**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064580	300158341	7B US	Count Time	3000.00		min	
			Efficiency	30.45		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	32.		counts	
			Am-241 Background Counts	6.2		counts	
200064581	300158336	7A US	Am-241	0.8731	0.0430	pCi/g	
			Am-243T Recovery	28.29		%	
			Analysis Date	09/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.53		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	1009.		counts	
			Am-241 Background Counts	4.6		counts	
200064582	300158301	1 OS	Am-241	0.0364	0.0081	pCi/g	
			Am-243T Recovery	26.77		%	
			Analysis Date	10/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.69		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	46.		counts	
			Am-241 Background Counts	6.2		counts	
200064583	300158306	1 US	Am-241	0.0190	0.0098	pCi/g	
			Am-243T Recovery	14.34		%	
			Analysis Date	09/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.37		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	14.		counts	

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**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064583	300158306	1 US	Am-241 Background Counts	3.0		counts	
200064584	300158311	2 OS	Am-241	0.0348	0.0079	pCi/g	
			Am-243T Recovery	25.74		%	
			Analysis Date	09/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.69		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	42.		counts	
			Am-241 Background Counts	5.4		counts	
200064585	300158316	2 US	Am-241	0.0040	0.0034	pCi/g	
			Am-243T Recovery	27.29		%	
			Analysis Date	09/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	27.76		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	7.		counts	
			Am-241 Background Counts	3.0		counts	
200064586	300158346	8 OS	Am-241	0.0106	0.0048	pCi/g	
			Am-243T Recovery	34.76		%	
			Analysis Date	09/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	33.16		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	23.		counts	
			Am-241 Background Counts	6.8		counts	
200064587	300158351	8 US	Am-241	0.0028	0.0070	pCi/g	
			Am-243T Recovery	22.69		%	
			Analysis Date	09/28/98		MM/DD/YY	

**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064587	300158351	8 US	Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.77		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	9.		counts	
			Am-241 Background Counts	6.4		counts	
200064588	300158356	9 OS	Am-241	[redacted]	0.0035	pCi/g	
			Am-243T Recovery	34.76		%	
			Analysis Date	10/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	32.97		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	4.		counts	
			Am-241 Background Counts	7.0		counts	
200064589	300158361	9 US	Am-241	0.0055	0.0021	pCi/g	
			Am-243T Recovery	71.67		%	
			Analysis Date	09/28/98		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	33.26		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	24.		counts	
			Am-241 Background Counts	6.6		counts	

8-28-98

**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200064592	300158297	Am-241	5.2878	0.1614	pCi/g	5.02	0.23	pCi/g	IN CONTROL

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.22784	300186335	Am-241	0.0031	0.0043	pCi/g	0	0	pCi/g	IN CONTROL

**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100029609

Analyst	Review	Team Leader	QA Officer
11/06/98	11/10/98	11/13/98	11/16/98
Date	Date	Date	Date

8-30

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100029609

Requester Name:	PHIL FRESQUEZ	**Customer Cost Code:**	000000M34A02106CA3	**Due Date:**	24-AUG-98
Requester Group:	ESH-20	**Logged Date:**	23-JUN-1998	**Screening Data:**	NO SCREENING DATA REQUIRED
Mail Stop:	M887	**Study:**	ESH20 BIOLOGICALS		
Requester Phone:	667-0815			**Logged by:**	LBRANCH
Requester Fax #:	667-0731	**Analytical Service Agreement #:**			

CUSTOMER SAMPLES

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200064570	300158268	#3 OS	U	2.24	0.22	ug/g	
200064576	300158289	#3 US	U	1.16	0.12	ug/g	
200064577	300158319	4 OS	U	1.03	0.10	ug/g	
200064578	300158324	4 US	U	1.40	0.14	ug/g	
200064579	300158329	5 US	U	0.68	0.07	ug/g	
200064580	300158339	7B US	U	1.03	0.10	ug/g	
200064581	300158334	7A US	U	0.70	0.07	ug/g	
200064582	300158299	1 OS	U	1.31	0.13	ug/g	
200064583	300158304	1 US	U	0.61	0.06	ug/g	
200064584	300158309	2 OS	U	0.84	0.08	ug/g	
200064585	300158314	2 US	U	0.53	0.05	ug/g	
200064586	300158344	8 OS	U	0.88	0.09	ug/g	
200064587	300158349	8 US	U	0.94	0.09	ug/g	
200064588	300158354	9 OS	U	0.60	0.06	ug/g	
200064589	300158359	9 US	U	0.38	0.04	ug/g	

**** FINAL REPORT ****

8 of 33

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100029609

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200064593	300158295	U	0.49	0.05	ug/g	0.47	0.047	ug/g	IN CONTROL

OPEN QC

8-32

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.38058	300172023	U	10.39	1.04	ug/L	10.1	1.0	ug/L	IN CONTROL

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.22784	300172024	U	0.00	0.01	ug/g	0	0	ug/g	IN CONTROL

**** FINAL REPORT ****

90-33

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100029609

Analyst	Review	Team Leader	QA Officer
9/2/98	9-4-98	9/8/98	09/09/98
Date	Date	Date	Date

90-33

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. 19-29.

"The reported uncertainties are at the 1 sigma confidence level unless otherwise stated."

**** FINAL REPORT ****

Plants 2 of 2

CHAIN-OF-CUSTODY RECORD

Los Alamos

Los Alamos National Laboratory

Los Alamos, New Mexico 87545

Phil Fresquez

Soils and Foodstuffs (~~7C20 WE6C~~) M34A 02106 CA3

P.I.# (505) 667-0815

ESH-20 MS M887

B-34

Project Name: Area G - Vegetation	Request the following analysis: ^3H	number of containers	Sample Location/Remarks
Samplers (signatures): Melanie / Phil Fresquez / Jenny Dewart			OS = overstory US = understory

Date	Time	Sample Name/Number	number of containers	Sample Location/Remarks
6/~~8~~/10/98	8:50	#3 ~~OS~~ OS		east of active waste pit inside fence
↓		#3 US		
	10:30	4 OS		North of TRU waste pads just
		4 US		outside the fence
		~~5 OS~~		TRU Waste Pad #2
	10:45	5 US		
	11:05	7b US		Pits 6, 7 and 24
				(~~eastern~~ eastern end)
	11:30	7a US		over pits #17 and #18
				(southeastern end)

Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
Melanie Martinez	6.19.98 11:30	Jenny McDeard			
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)

Relinquished by: (signature)	Date/Time	Received for Lab. by: (signature)	Date/Time	Remarks:

CHAIN-OF-CUSTODY RECORD

Phil Fresquez

Soils and Foodstuffs (~~7C20 WE6G~~) M34A 02106 CA3

P.I.# (505) 667-0815

ESH-20 MS M887

Los Alamos

Los Alamos National Laboratory

Los Alamos, New Mexico 87545

B-35

Project Name: Area G - Vegetation

Samplers (signatures): [illegible] Fresquez / Melanie [illegible] / [illegible]

Request the following analysis: ^3H

Sample Location/Remarks: OS = overstory; US = understory

Date	Time	Sample Name/Number	number of containers	Sample Location/Remarks
6-10-98	11:35	1 OS		S of ^3H shafts outside fence
		1 US		
	11:45	2 OS		W of ^3H shafts outside fence
		2 US		
6/11/98	10:30	8 OS		expansion area (.7 mi from Area G fence)
6/11/98		8 US		
6/11/98	9:30	9 OS		S and upwind of LANL on BNM
		9 US		

Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
Melanie [illegible]	6-19-98 11:30	Jenny [illegible]			
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)

Relinquished by: (signature)	Date/Time	Received for Lab. by: (signature)	Date/Time	Remarks:

CHAIN-OF-CUSTODY RECORD

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Soils and Foodstuffs (~~7C20 WE6G~~) M34A ~~01206~~ 02106 CA3
P.I.# (505) 667-0815
ESH-20 MS M887

B-36

Project Name: Area 6 - Vegetation

Samplers (signatures): [signatures]

Request the following analysis: 90Sr 241Am 238Pu 239Pu totU 137Cs

Sample Location/Remarks: OS= overstory US= understory

Date	Time	Sample Name/Number	number of containers	Sample Location/Remarks
6-10-98	11:35	1 OS		S of 3H shafts outside fence
		1 US		
	11:45	2 OS		W of 3H shafts outside fence
		2 US		
6/11/98	10:30	8 OS		expansion area (0.7 mi from Area 6 fence)
6/11/98		8 US		
6/11/98	9:30	9 OS		S and upwind of LANL on BNM
		9 US		

Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
[signature]	6-23-98 11:05am	[signature]			
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)

Relinquished by: (signature)	Date/Time	Received for Lab. by: (signature)	Date/Time	Remarks:

CHAIN-OF-CUSTODY RECORD

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Soils and Foodstuffs (~~7C20 WEGG~~) M34A ~~Q1206~~ CA3 02106
P.I.# (505) 667-0815
ESH-20 MS M887

Project Name: Area G - Vegetation	Request the following analysis: ^{90}Sr ^{241}Am ^{239}Pu ^{239}Pu tot U ^{137}Cs	number of containers	Sample Location/Remarks: OS = Overstory, US = understory
Samplers (signatures): [signature] / [signature]			
Date / Time	Sample Name/Number		
6/23/98 8:50	#3 ~~OS~~ OS		east of active waste pit inside fence
	#3 US		
10:30	4 OS		North of TRU waste pads just outside ots fence
	4 US		
	~~5 OS~~		TRU Waste Pad #2
10:45	5 US		
11:05	7b ~~OS~~		Pits (western end)
11:30	7a US		over pits #17 and #18 (Southeastern end)

Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
[signature]	6-23-98 11:05AM	[signature] Lab Quality Branch			
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
Relinquished by: (signature)	Date/Time	Received for Lab. by: (signature)	Date/Time	Remarks:	