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*Pinon Pine Tree Study,
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PINON PINE TREE STUDY, LOS ALAMOS NATIONAL LABORATORY: SOURCE DOCUMENT

by

P.R. Fresquez, J.D. Huchton, M.A. Mullen and L. Naranjo, Jr.

ABSTRACT

One of the dominant tree species growing within and around Los Alamos National Laboratory (LANL), Los Alamos, NM, lands is the pinon pine (*Pinus edulis*) tree. Pinon pine is used for firewood, fence posts, and building materials and is a source of nuts for food—the seeds are consumed by a wide variety of animals and are also gathered by people in the area and eaten raw or roasted. This study investigated the (1) concentration of ^3H , ^{137}Cs , ^{90}Sr , $^{\text{tot}}\text{U}$, ^{238}Pu , $^{239,240}\text{Pu}$, and ^{241}Am in soils (0- to 12-in. [31 cm] depth underneath the tree), pinon pine shoots (PPS), and pinon pine nuts (PPN) collected from LANL lands and regional background (BG) locations, (2) concentrations of radionuclides in PPN collected in 1977 to present data, (3) committed effective dose equivalent (CEDE) from the ingestion of nuts, and (4) soil to PPS to PPN concentration ratios (CRs). Most radionuclides, with the exception of ^3H in soils, were not significantly higher ($p < 0.10$) in soils, PPS, and PPN collected from LANL as compared to BG locations, and concentrations of most radionuclides in PPN from LANL have decreased over time. The maximum net CEDE (the CEDE plus two sigma minus BG) at the most conservative ingestion rate (10 lb [4.5 kg]) was 0.0018 mrem (0.018 μSv). Soil-to-nut CRs for most radionuclides were within the range of default values in the literature for common fruits and vegetables.

I. INTRODUCTION

Pinon-juniper woodlands occupy over 50 million acres in the western United States, primarily in NV, UT, AZ, CO, and NM (Buckman and Wolters 1987). Pinon pine (*Pinus edulis*) trees, in particular, have been used by humans for firewood, fence posts, and building materials. The woodlands also provide wildlife habitat, and the seeds (≈ 1 cm long) of the tree are consumed by a wide variety of animals, including ground squirrels, chipmunks, porcupines, deer, elk, black bears, and turkeys. The seeds are also

gathered by people and eaten raw or roasted and are an economic commodity of the area (Tidwell 1987; Van Hooser and Casey 1987).

Pinon pine trees are the dominant overstory tree species in the middle to lower half of the Pajarito Plateau in north-central New Mexico. This area includes Los Alamos National Laboratory (LANL) lands. Over half of LANL's 43 sq mi (27,500 acres) contain the pinon pine tree (Dunham 1994). LANL, a nuclear weapons design, development, and testing facility, handles and/or produces liquids, solids, and gases that contain radioactive materials (USDOE 1979). Although LANL makes great effort to minimize radioactive material releases to the environment, trace amounts of radioactive isotopes have been detected in various biotic and abiotic materials within LANL boundaries (ESP 1998).

As part of the Environmental Surveillance Program (ESP) at LANL, many wild and domestic foodstuffs have been assessed within and around the Laboratory for potential radiological contamination (ESP 1996a, 1996b, 1997, 1998, 1999). Only one study to date, however, has investigated the potential contamination levels in the nuts of pinon pine trees within the LANL environ; and, that study was conducted in the late-1970s (Salazar 1979). Because pinon pine nuts (PPN) are produced irregularly in nonannual cycles about every seven to ten years (Dunham 1994), the ESP has been using radionuclide concentration data determined directly from the foliage of pinon pine trees as input parameters to estimate the doses to people from the ingestion of PPN (ESP 1998, 1999). There are no direct conversion factors that exist in the literature for the conversion of radionuclide concentrations in pinon pine tree foliage to PPN, albeit it is generally known that the nonedible portions (roots, stems, and leaves) contain higher radionuclide concentrations than the edible tissue portions (Menzel 1965); and thus, the use of pinon pine tree foliage to estimate the dose for the ingestion of PPN may be an overestimation of risk.

The objectives of this study were to (1) determine radionuclide concentrations in soils, pinon pine shoots (PPS), and PPN collected from LANL and regional background (BG) areas, (2) compare radionuclide concentrations in PPN collected in 1977 to present data, (3) estimate the committed effective dose equivalent (CEDE) to people that consume PPN from LANL lands, and (4) establish soil to PPS to PPN transfer

coefficients (concentration ratios [CR]) so that soil or PPS could be sampled and analyzed in the future, and—based on the transfer coefficients—the radionuclide concentrations could be estimated for PPN on any given year.

II. METHODS AND MATERIALS

Samples of soil, PPS, and PPN were collected from two study sites: (1) LANL (Technical Areas [TA] 15, 36, 39, and 49) and (2) regional BG (Tres Piedras, Jemez, and Coyote, NM) (Figure 1). PPS were also collected from the following perimeter areas for comparison: Los Alamos townsite to the northeast, San Ildefonso lands to the east, and White Rock/Pajarito Acres townsite to the southeast. (Note: there was no pinon nut crop in the perimeter areas of LANL in the year of this study.)

At each sample site, a composite soil sample (three subsamples) was collected with a bucket auger at the 0- to 12-in. (31 cm) depth from around and within the drip line of a pinon pine tree. The three subsamples were combined and mixed thoroughly in a three-gallon Ziploc® bag and placed in a labeled 500-mL poly bottle. PPS samples consisted of the tips of tree shoots approximately 1 to 2 in. (2.5 to 5.1 cm) in length at a height of 4 to 5 ft (1.3 to 1.6 m). Personnel collecting PPS samples wore plastic gloves and used clean shears to clip vegetation; all tools were washed with soap and water between sampling locations to avoid cross contamination. Samples of clippings ranged from 2 to 3 lb (0.9 to 1.4 kg) of composited material and were placed in labeled Ziploc® plastic bags. Similarly, approximately 2 to 3 lb of PPN were picked by hand from beneath the pinon pine tree and placed into Ziploc® plastic bags. All soil and vegetative materials were transported to the laboratory in locked ice chests cooled to 4°C.

At the laboratory, subsamples (~100 wet g) of PPS and PPN (shelled) were placed into 1-L glass beakers and heated to collect distillate (water) for ^3H analysis. The remaining portions of each PPS and PPN sample were thoroughly washed and allowed to air dry before they were placed into tared 2-L glass beakers and weighed. The beaker contents were oven dried at 75°C for 120 h, weighed, and ashed incrementally to 500°C for 120 h. The sample ash was weighed, pulverized, homogenized, and transferred to labeled 500-mL poly bottles. All samples (soils and ashed PPS and PPN) were submitted

Figure 1. Locations of piñon sampling sites within and around Los Alamos National Laboratory.

with the distillate samples (PPS and PPN) under full chain-of-custody to a LANL chemistry laboratory for the analysis of ^3H , ^{238}Pu , ^{239}Pu , ^{137}Cs , ^{235}U , ^{241}Am , ^{90}Sr . All methods of radiochemical analyses for soils (Fresquez et al. 1998a) and vegetation (Fresquez et al. 1998b) have been described previously. Original analytical reports are included in Appendices A through C for future reference. Results are reported on a pCi mL⁻¹ (moisture) basis for ^3H and on an oven dry weight basis (g dry) for the rest of the elements. Moisture conversion factors (ash to dry) for PPS and PPN can be found in Fresquez and Ferenbaugh (1998). Variation in the mean radionuclide content in soils, PPS, and PPN between samples collected from LANL and regional BG lands were assessed using a Wilcoxon Rank Sum Test at the 0.10 probability level (Gilbert 1987).

The CEDE was calculated following procedures recommended by the Department of Energy (USDOE 1991) and the Nuclear Regulatory Commission (NRC 1977). The general process for calculating radiological dose from ingestion of PPN was as follows. First, after converting from dry to wet weight concentrations (dry/wet weight ratio for PPN = 0.898) (Fresquez and Ferenbaugh 1998), the wet concentration of radionuclides in PPN was multiplied by a dose conversion factor that tells how much radiological dose occurs per unit of food ingested (USDOE 1988). Where different dose conversion factors are provided for a radionuclide, the most conservative (highest) factor was used. The final dose was calculated by multiplying the dose per unit ingested by the total number of units ingested. The dose calculated is the 50-year CEDE. Even though this dose would be received over a 50-year period, the entire dose was reported as though it occurred in the year the nuts were ingested. Three calculations were performed: dose per lb of nuts consumed, dose per average consumption rate (3 lb of nuts), and dose per maximum consumption rate (10 lb of nuts). The dose per lb of nuts consumed was reported so that individuals may calculate their own doses based on their knowledge of their actual consumption rates.

III. RESULTS

Soils Underneath Trees

Most radionuclides in soils collected underneath pinon pine trees at most TA sites on LANL lands were within regional statistical reference levels (RSRLs) (Table 1).

RSRLs are the mean + two standard deviations (the 95% confidence interval) of soil surface (0- to 2-in. depth) samples collected from BG (non-LANL) locations from 1993 through 1997 as part of the ESP (ESP 1999). Soil samples from LANL and reference sites are collected from the top two inches of material because radionuclides are most common at that depth. The only radionuclides that were higher than the RSRLs were ^{90}Sr in soils at all of the sites, including BG, and ^{235}U in a soil sample collected from TA-15. The higher ^{90}Sr levels in all of the soils collected from LANL and BG sites as compared to the RSRL may be a result of the depth of sampling and/or an analytical anomaly, as the concentrations in soils collected from LANL and BG sites were not significantly different ($p < 0.05$) from one another. Higher concentrations of ^{235}U detected in a soil sample collected from TA-15 (near the Pulsed High Energy Radiation Machine Emitting X-ray [PHERMEX] testing facility) as compared to BG, on the other hand, may be more a reflection of LANL operations than any other factor. Operations at TA-15, for example, involve testing of high explosives with depleted and natural U, and significantly higher concentrations of ^{235}U in the soil surface (average ^{235}U concentration was $1,210 \mu\text{g g}^{-1}$) around PHERMEX have been found in past surveys (Fresquez 1994). As a group, most radionuclides, with the exception of ^3H ($p = 0.06$), in soils collected from LANL lands were not significantly higher ($p < 0.10$) than soils collected from regional BG locations. The differences in ^3H concentrations between sites, however, were very small, and concentrations of ^3H in soils collected at specific sites within LANL in the present study (0.08 pCi mL^{-1}) correspond very well to more recent soil survey results conducted on a wider scale throughout LANL lands (0.07 pCi mL^{-1}) (ESP 1999); and, all indications are that ^3H concentrations in soils at LANL are in a declining mode (Fresquez et al. 1998a).

PPS and PPN

In general, radionuclides in PPS (Table 2) were significantly higher ($p < 0.10$) than in PPN (Table 3) collected from LANL and BG areas. These results lend credence to the fact that nonedible tissues (roots, stems, and leaves) tend to accumulate more radionuclides than the fruiting bodies of the same plant species (Menzel 1965). Comparing radionuclides in PPS and PPN collected on LANL lands with PPS and PPN collected from regional BG areas show that all radionuclides in PPS and PPN from

LANL sites were not significantly higher ($p < 0.10$) than radionuclides in PPS and PPN from regional BG locations. In fact, ^{238}Pu in PPS from BG (and perimeter locations) was significantly higher than in PPS collected from LANL areas. Comparing radionuclide concentrations in PPN collected from LANL lands in 1977 ($n = 6$ sites) (Salazar 1979) with PPN collected in the present study show that most of the radionuclides, with the exception of ^{137}Cs , in PPN collected in this study were lower than PPN collected over 20 years ago. (Note: Salazar's radionuclide data, with the exception of ^3H , were incorrectly presented as being on a dry weight basis—those data were really listed in units per ash weight. We converted the data to a dry weight basis by multiplying the average by the ash/dry weight ratio of PPN [0.026] for comparison to the present study.) The average concentration of ^3H decreased slightly from 13 to 10 pCi mL^{-1} , ^{90}Sr from 0.009 to -0.012 pCi g^{-1} dry, ^{238}Pu from -0.0009360 to -0.0000026 pCi g^{-1} dry, and ^{239}Pu from 0.0009022 to 0.0000312 pCi g^{-1} dry. In contrast, the average concentration of ^{137}Cs in PPN from LANL in 1977 slightly increased from 0.0002 to 0.0040 pCi g^{-1} dry in 1998.

Concentration Ratios

CRs, or transfer factors, from soil to PPS to PPN for each radionuclide measured can be found in Table 4. In general, with the exception of ^{238}Pu and ^{137}Cs , all other CRs derived from the radionuclides measured in nonedible tissues (PPS) from pinon pine trees collected from LANL and BG regions were dissimilar to CRs commonly reported in the literature (Kennedy and Strenge 1992, Baes et al. 1984, IAEA 1994); ^{90}Sr was lower, and the Pu isotopes and ^{241}Am were very much higher. This was expected for the most part because most CRs in the literature were derived from common fruits and vegetables and no data exists for pinon pine trees; thus, the reason for this study. In contrast, most of the CRs, including those derived for the Pu isotopes and ^{241}Am , for edible tissue (PPN) were within values reported in the literature. CRs for ^3H in both PPN and PPS were reported on a range basis because results between LANL and BG varied widely.

Committed Effective Dose Equivalent

The CEDE to a hypothetical 50-year resident consuming PPN in various quantities collected from LANL and BG lands may be found in Table 5. In general, the CEDEs between the two sites are very similar to one another. Based on the “worst case scenario,” the maximum net CEDE (the CEDE plus two sigma minus BG) from the ingestion of 10 lb (the maximum consumption rate per person per year) of PPN from LANL was 0.0018 mrem (0.018 μ Sv). This dose is far below the International Commission on Radiological Protection (ICRP) permissible dose limit (PDL) of 100 mrem (1000 μ Sv) for all pathways above that received from natural background (ICRP, 1978). The majority of the doses at LANL from the ingestion of PPN was due to ^{90}Sr (49%) and ^{241}Am (23%) activity.

IV. CONCLUSIONS

Most radionuclides in soils, PPS, and PPN collected from LANL lands were not significantly higher ($p < 0.10$) than counterparts from regional BG locations. PPN collected in the present study contained radionuclide contents lower than PPN collected in the late-1970s. Radiological doses to people who consume nuts from pinon pine trees growing on Laboratory lands were not significant; in fact, the “worst case senario” resulted in a net CEDE of $<0.002\%$ of the ICRP PDL.

V. ACKNOWLEDGMENTS

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Table 1. Radionuclide concentrations ($\pm$ counting uncertainty) in soils (0- to 12-in. depth) collected underneath pinon pine trees from LANL and BG locations.

	³ H	¹³⁷ Cs	⁹⁰ Sr	²³⁸ U	²³⁸ Pu	^{239,240} Pu	²⁴¹ Am
Location	pCi mL	pCi g dry	pCi g dry	µg g dry	pCi g dry	pCi g dry	pCi g dry
LANL TA-15	0.26 (0.67)	0.48 (0.06)	1.52 (0.37)	4.81 (0.48)	0.002 (0.001)	0.016 (0.002)	0.011 (0.002)
LANL TA-36	0.06 (0.66)	0.10 (0.02)	2.55 (0.41)	1.91 (0.19)	0.001 (0.001)	0.004 (0.001)	0.005 (0.001)
LANL TA-39	0.01 (0.66)	0.14 (0.03)	1.98 (0.40)	2.63 (0.26)	0.001 (0.001)	0.006 (0.001)	0.004 (0.001)
LANL TA-49	-0.02 (0.66)	-0.01 (0.08)	4.85 (0.79)	2.75 (0.28)	0.003 (0.001)	0.004 (0.001)	0.006 (0.002)
Mean ($\pm$ SD)	0.08 (0.13)a ¹	0.18 (0.21)a	2.73 (1.48)a	3.03 (1.25)a	0.002 (0.001)a	0.008(0.006)a	0.007 (0.003)a
BG-Coyote	-0.35 (0.63)	0.26 (0.04)	1.32 (0.26)	1.49 (0.15)	0.001 (0.001)	0.008 (0.001)	0.004 (0.001)
BG-Tres Piedr	-0.19 (0.64)	0.05 (0.01)	0.95 (0.28)	1.31 (0.13)	0.001 (0.001)	0.002 (0.001)	0.003 (0.001)
BG-Jemez	-0.05 (0.65)	0.19 (0.03)	2.36 (0.37)	2.93 (0.29)	0.001 (0.001)	0.007 (0.001)	0.009 (0.004)
Mean ($\pm$ SD)	-0.20 (0.15)b	0.17 (0.11)a	1.54 (0.73)a	1.91 (0.89)a	0.001 (0.000)a	0.006 (0.003)a	0.005 (0.003)a
RSRL ²	1.06	0.60	0.71	3.16	0.010	0.021	0.011

¹Means within the same column followed by the same letter are not significantly different at the 0.10 probability level using a nonparametric Wilcoxon Rank Sum Test.

²RSRL; this is the upper (95%) limit background concentration (mean + 2 std dev) based on soil surface (0-to 2-in. depth) data from 1993 to 1997 (ESP 1999).

Table 2. Radionuclide concentrations in PPS from LANL, Perimeter (P), and BG locations.

Location	³ H pCi mL	¹³⁷ Cs 10 ⁻³ pCi g dry	⁹⁰ Sr 10 ⁻³ pCi g dry	¹⁰⁶ U ng g dry	²³⁸ Pu 10 ⁻⁵ pCi g dry	^{239,240} Pu 10 ⁻⁵ pCi g dry	²⁴¹ Am 10 ⁻⁵ pCi g dry
LANL TA-15	0.03 (0.65)	36.0 (53.6)	233.6 (28.8)	269.6 (27.2)	3.2 (18.4)	36.8 (21.6)	4.8 (32.0)
LANL TA-36	0.07 (0.65)	14.4 (21.6)	252.8 (37.6)	56.0 (5.6)	-0.8 (9.6)	31.2 (19.2)	79.2 (35.2)
LANL TA-39	0.52 (0.68)	120.8 (180.8)	408.0 (60.0)	55.2 (5.6)	-21.6 (21.6)	34.4 (55.2)	104.0 (44.8)
LANL TA-49	0.06 (0.65)	28.0 (41.6)	258.4 (26.4)	40.0 (4.0)	5.6 (11.2)	27.2 (14.4)	29.6 (42.4)
Mean (± SD)	0.17 (0.23)a ¹	49.8 (48.2)a	288.2 (80.6)a	105.2 (109.8)a	-3.4 (12.4)b	32.4 (4.2)b	54.4 (45.3)a
P-LA ²	0.07 (0.71)	4.8 (7.2)	128.8 (59.2)	48.8 (4.8)	16.8 (13.6)	55.2 (21.6)	45.6 (27.2)
P-WR/PA	-0.18 (0.69)	14.4 (21.6)	148.0 (64.8)	28.8 (3.2)	7.2 (13.6)	64.8 (24.8)	83.2 (34.4)
P-SI	-0.21 (0.69)	18.4 (27.2)	169.6 (65.6)	28.0 (3.2)	54.4 (24.8)	67.2 (25.6)	128.0 (72.0)
Mean (± SD)	-0.11 (0.15)a	12.5 (7.0)a	148.8 (20.4)b	35.2 (11.8)a	26.1 (24.9)a	62.4 (6.3)a	85.6 (41.3)a
BG-Coyote	0.21 (0.66)	40.0 (60.8)	258.4 (34.4)	40.0 (4.0)	27.2 (15.2)	23.2 (16.0)	79.2 (35.2)
BG-Tres Piedr	-0.30 (0.63)	99.2 (148.0)	297.6 (60.8)	29.6 (3.2)	21.6 (21.6)	32.8 (26.4)	75.2 (40.8)
BG-Jemez	0.34 (0.67)	16.0 (24.8)	273.6 (38.4)	47.2 (4.8)	52.8 (26.4)	0.0 (0.0)	69.6 (47.2)
BG-Jemez Spr	-0.45 (0.68)	-12.8 (8.8)	200.0 (68.0)	71.2 (7.2)	25.6 (24.8)	20.8 (16.0)	144.0 (58.4)
Mean (± SD)	-0.05 (0.38)a	35.6 (47.6)a	257.4 (41.5)a	47.0 (17.7)a	31.8 (14.2)a	19.2 (13.8)b	92.0 (34.9)a

¹Means within the same column followed by the same letter are not significantly different at the 0.10 probability level using a nonparametric Wilcoxon Rank Sum Test.

²LA = Los Alamos; WR/PA = White Rock/Pajarito Acres; SI = San Ildefonso Pueblo

Table 3. Radionuclide concentrations in PPN from LANL and BG locations.

Location	³ H pCi mL	¹³⁷ Cs 10 ⁻³ pCi g dry	⁹⁰ Sr 10 ⁻³ pCi g dry	^{tot} U ng g dry	²³⁸ Pu 10 ⁻⁵ pCi g dry	^{239,240} Pu 10 ⁻⁵ pCi g dry	²⁴¹ Am 10 ⁻⁵ pCi g dry
LANL TA-15	5.90 (0.99)	-3.9 (2.9)	-15.6 (13.3)	1.56 (0.26)	0.52 (2.1)	5.98 (3.4)	13.0 (5.2)
LANL TA-36	11.90 (1.30)	-4.7 (2.9)	-12.0 (6.8)	1.30 (0.26)	1.30 (1.8)	5.98 (2.9)	5.5 (4.7)
LANL TA-39	11.20 (1.20)	11.2 (2.1)	-11.2 (7.3)	1.04 (0.26)	-2.60 (3.1)	-3.64 (3.9)	12.7 (5.5)
LANL TA-49	11.00 (1.20)	13.5 (2.1)	-9.4 (8.6)	1.30 (0.26)	-0.26 (2.1)	4.16 (3.4)	7.8 (4.7)
Mean (± SD)	10.00 (2.78)a ¹	4.0 (9.7)a	-12.0 (2.6)a	1.30 (0.21)a	-0.26 (1.7)a	3.12 (4.6)a	9.8 (3.7)a
BG-Coyote	7.00 (1.00)	0.0 (2.9)	-14.6 (10.4)	1.04 (0.26)	1.30 (2.6)	5.72 (2.6)	13.8 (4.4)
BG-Tres Piedr	-0.01 (0.65)	12.0 (18.0)	-21.8 (8.1)	0.78 (0.26)	-1.30 (6.2)	4.42 (4.9)	8.3 (3.4)
BG-Jemez	0.61 (0.69)	17.4 (26.0)	-38.0 (11.4)	1.82 (0.26)	-2.60 (1.8)	0.78 (2.6)	4.9 (3.9)
Mean (± SD)	2.53 (3.88)a	9.8 (8.9)a	-24.8 (12.0)a	1.21 (0.54)a	-0.87 (2.0)a	3.64 (2.6)a	9.0 (4.5)a

¹Means within the same column followed by the same letter are not significantly different at the 0.10 probability level using a nonparametric Wilcoxon Rank Sum Test.

Table 4. CRs (dry basis) for radionuclides from soil (S) to PPS to PPN estimated from LANL and BG locations.¹

Location/ Matrix	³H	¹³⁷Cs	⁹⁰Sr	totU	²³⁸Pu	^{239,240}Pu	²⁴¹Am
PPS/S	0.95 to 1.82 ²	0.219	0.162	0.027	0.1542	0.0563	0.1548
PPN/S	0.03 to 335	0.059	0.000	0.001	0.0041	0.0085	0.0193
PPN/PPS	8.78 to 184	0.223	0.000	0.024	0.0413	0.1349	0.4480
Nonedible ³		0.130	1.600	0.020	0.0004	0.0004	0.0006
Edible ³		0.049	0.810	0.010	0.0002	0.0002	0.0004
Edible Range ⁴		0.001 to 5.0	0.002 to 14.0	8E10 ⁻⁴ to 0.1	1E10 ⁻⁶ to 0.1	1E10 ⁻⁶ to 0.1	1E10 ⁻⁵ to 0.2

¹With the exception of ³H, all other radionuclides were averaged (all negative numbers were converted to zero for averaging) from LANL and BG data.

²BG to LANL range.

³Nonedible and edible (fruit/vegetable) CRs (Kennedy and Streng 1992) relate to PPS/S and PPN/S, respectively.

⁴Edible CR range (IAEA 1994) relates to PPN/S.

Table 5. The CEDE for the ingestion of PPN collected from LANL and BG locations.

Location	mrem lb⁻¹ ($\pm 2SD$)	Average Consumption¹ mrem y⁻¹ ($\pm 2SD$)	Maximum Consumption² mrem y⁻¹ ($\pm 2SD$)
LANL	0.00048 (0.00097)	0.00144 (0.00292)	0.0048 (0.0097)
BG	0.00047 (0.00080)	0.00140 (0.00239)	0.0047 (0.0080)

¹Average consumption rate for PPN is 3 lb (1.4 kg) per person per year.

²Maximum consumption rate for PPN is 10 lb (4.5 kg) per person per year.

LITERATURE CITED

Baes, C.F., R.D. Sharp, A.L. Sjoreen, and R.W. Shor, "A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture," Oak Ridge National Laboratory report ORNL-5786 (1984).

Buckman, R.E., and G.L. Wolters, "Multi-Resource Management of Pinyon-Juniper Woodlands," pp. 2-4. In: Proceedings—Pinon-Juniper Conference, January 13-16, 1986, Reno, NV. United States Department of Agriculture, Forest Service, Intermountain Research Station general technical report INT-215 (1987).

Dunham, D., "Pinon Cone Production on Mesita del Buey, TAs-54 and -51 Los Alamos National Laboratory, Summer 1993," Los Alamos National Laboratory report (unpublished data) (1994).

ESP (Environmental Surveillance Program), "Environmental Surveillance at Los Alamos during 1994," Los Alamos National Laboratory report LA-13047-ENV (1996a).

ESP (Environmental Surveillance Program), "Environmental Surveillance at Los Alamos during 1995," Los Alamos National Laboratory report LA-13210-ENV (1996b).

ESP (Environmental Surveillance Program), "Environmental Surveillance and Compliance at Los Alamos during 1996," Los Alamos National Laboratory report LA-13343-ENV (1997).

ESP (Environmental Surveillance Program), "Environmental Surveillance at Los Alamos during 1997," Los Alamos National Laboratory report LA-13487-ENV (1998).

ESP (Environmental Surveillance Program), "Environmental Surveillance at Los Alamos during 1998," Los Alamos National Laboratory report LA-13633-ENV (1999).

Fresquez, P.R., "Results of the Soil Sampling Survey Conducted Over Active RCRA Firing Site TA-15-184 (PHERMEX)," Los Alamos National Laboratory memorandum ESH-8/EFM-94-111 (1994).

Fresquez, P.R., D.R. Armstrong, and M.A. Mullen, "Radionuclides and Radioactivity in Soils Collected from Within and Around Los Alamos National Laboratory: 1974-1996," *Journal of Environmental Science and Health*, A33 (2) 263-278 (1998a).

Fresquez, P.R., D.R. Armstrong, M.A. Mullen, and L. Naranjo, Jr., "The Uptake of Radionuclides by Beans, Squash, and Corn Growing in Contaminated Alluvial Soils at Los Alamos National Laboratory," *Journal of Environmental Science and Health* B33 (1) 99-115 (1998b).

Fresquez, P.R., and J.K. Ferenbaugh, "Moisture Conversion Ratios for the Foodstuffs and Biota Environmental Surveillance Programs at Los Alamos National Laboratory," Los Alamos National Laboratory report LA-UR-98-1054 (1998).

Gilbert, R.O., *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York, NY (1987).

IAEA (International Atomic Energy Agency), "Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Temperate Environments," Technical Report Series 364, Vienna (1994).

ICRP (International Commission on Radiological Protection), "Limits of Intakes of Radionuclides by Workers," International Commission on Radiological Protection Publication 30, Pergamon Press, New York, NY (1978).

Kennedy, W.E., Jr., and D.L. Streng, "Residual Radioactive Contamination from Decommissioning: Technical Basis for Translating Contamination Levels to Annual

Total Effective Dose Equivalent,” NUREG/CR-5512, PNL-7994, U.S. Nuclear Regulatory Commission, Washington, D.C. (1992).

Menzel, R.J., “Soil-Plant Relationships of Radioactive Elements,” *Health Physics*, 11: 1325–1332 (1965).

NRC (Nuclear Regulatory Commission), “Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50,” Appendix I, NRC Report, Regulatory Guide 1.109 (1977).

Salazar, J.G., “Radionuclide Content of Pinon Nuts in the Vicinity of the Los Alamos Scientific Laboratory,” Los Alamos Scientific Laboratory report LA-UR-79-238 (1979).

Tidwell, D.P., “Multi-Resource Management of Pinyon-Juniper Woodlands: Times Have Changed, But do We Know It?,” pp. 5–8. In: *Proceedings—Pinon-Juniper Conference*, January 13-16, 1986, Reno, NV. United States Department of Agriculture, Forest Service, Intermountain Research Station general technical report INT-215 (1987).

USDOE, “Final Environmental Impact Statement,” United States Department of Energy report DOE/ETS-0018, Washington, D.C. (1979).

USDOE (U.S. Department of Energy), “Internal Dose Conversion Factors for Calculation of Dose to the Public,” USDOE report DOE/EP-0071 (1988).

USDOE (U.S. Department of Energy), “Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance,” USDOE report DOE/EH-0173T (1991).

Van Hooser, D.D. and O.E. Casey, “PJ—A Commercial Resource,” pp. 203–206. In: *Proceedings—Pinon-Juniper Conference*, January 13-16, 1986, Reno, NV. United States

Department of Agriculture, Forest Service, Intermountain Research Station general technical report INT-215 (1987).

APPENDIX A

ANALYTICAL DATA REPORTS OF RADIONUCLIDE CONCENTRATIONS IN SOILS COLLECTED FROM LANL AND BG SITES

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: H-3 LS ENV

Method Area: EH-ALPHA

Submission Id : 100033139

Requester Name: PHIL FRESQUEZ
Requester Group: ESH-20

Customer Cost Code: 7C2000WE6G20000000
Logged Date: 20-OCT-1998

Due Date: 23-DEC-98
Screening Data: NO SCREENING DATA REQUIRED

Mail Stop: M887
Requester Phone: 667-0815
Requester Fax #: 667-0731

Study: ESH20 BIOLOGICALS
Analytical Service Agreement #:

Logged by: LBRANCH

CUSTOMER SAMPLES

A-1

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200077877	300182927	TA-36	H-3	60 ✓	660 ✓	pCi/L	0.06 (0.66)
			H-3 MDA	480		pCi/L	
200077879	300182933	TA-49	H-3	20 ✓	660	pCi/L	-0.02 (0.66)
			H-3 MDA	480		pCi/L	
200077880	300182939	TA-39	H-3	10 ✓	660 ✓	pCi/L	-0.01 (0.66)
			H-3 MDA	470		pCi/L	-0.19 (0.64)
200077881	300182945	TP	H-3	100 ✓	640 ✓	pCi/L	-0.26 (0.67)
			H-3 MDA	480		pCi/L	
200077882	300182951	TA-15	H-3	260	670	pCi/L	-0.35 (0.63)
			H-3 MDA	480 ✓		pCi/L	
200077883	300182957	COYOTE	H-3	250 ✓	630 ✓	pCi/L	-0.05 (0.65)
			H-3 MDA	480 ✓		pCi/L	
200077884	300182963	JEMEZ	H-3	50 ✓	650 ✓	pCi/L	
			H-3 MDA	470		pCi/L	

÷ 1000

50

**** FINAL REPORT ****

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id: 100033139

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units pCi/L	QC Value	QC Uncertainty	QC units pCi/L	QC Evaluation IN CONTROL
200077898	300182974	H-3	1670	760	pCi/L	2300	60		

OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units uCi/L	QC Value	QC Uncertainty	QC units uCi/L	QC Evaluation IN CONTROL
00.38287	300185544	H-3	-0.00040	0.00063	uCi/L	0	0		
00.39929	300185545	H-3	0.0118	0.0013	uCi/L	0.01427	0.00143		

A-2

90

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

Method: H-3 LS ENV

Method Area: EH-ALPHA

Submission Id : 100033139

Clip
Analyst

Eug
Review

OS
Team Leader

NK for PCL
QA Officer

11/4/98
Date

11/5/98
Date

11/5/98
Date

11/6/98
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

69

Method: GENERIC GAMMA Method Area: EH-GAMMA Submission Id: 100033139

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G20000000	Due Date:	23-DEC-98
Requester Group:	ESH-20	Logged Date:	20-OCT-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

A-4

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077877	300182930	TA-36	CS-137	0.10	0.02	pCi/g	
200077879	300182936	TA-49	CS-137	0.01	0.08	pCi/g	
200077880	300182942	TA-39	CS-137	0.14	0.03	pCi/g	
200077881	300182948	TP	CS-137	0.05	0.01	pCi/g	
200077882	300182954	TA-15	CS-137	0.48	0.06	pCi/g	
200077883	300182960	COYOTE	CS-137	0.26	0.04	pCi/g	
200077884	300182966	JEMEZ	CS-137	0.19	0.03	pCi/g	

DUPLICATE TASKS

<u>Sample Id</u>	<u>Task Id</u>	<u>Original Task</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077877	300182930		CS-137	0.10	0.02	pCi/g	
200083932	300193404	300182930	CS-137	0.13	0.02	pCi/g	

**** FINAL REPORT ****

Method: GENERIC GAMMA

Method Area: EH-GAMMA

Submission Id: 100033139

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units pCi/g	QC Value	QC Uncertainty	QC units pCi/g	QC Evaluation IN CONTROL
200077888	300182973	CS-137	17.0	1.2	pCi/g	18.2	.6		
200076736	300181123	CS-137	24.7	1.7	pCi/g	27.3	.9		

OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units pCi/g	QC Value	QC Uncertainty	QC units pCi/g	QC Evaluation IN CONTROL
00.33404	300193403	CS-137	4.57	0.36	pCi/g	4.9800	0.1600		

METHOD BLANK

Customer Id	Task Id	Component	Result Value	Uncertainty	Units pCi/g	QC Value	QC Uncertainty	QC units pCi/g	QC Evaluation IN CONTROL
00.22776	300193402	CS-137	0.02	0.03	pCi/g	0.0	0.0		

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

A-5

Method: GENERIC GAMMA

Method Area: EH-GAMMA

Submission Id : 100033139

Analyst
Review
Team Leader
QA Officer
Date
Date
Date
Date

A-6

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: SR-90 LS ENV

Method Area: EH-ALPHA

Submission Id : 100033139

Requester Name: PHIL FRESQUEZ
Requester Group: ESH-20Customer Cost Code: 7C2000WE6G20000000
Logged Date: 20-OCT-1998Due Date: 23-DEC-98
Screening Data: NO SCREENING DATA REQUIREDMail Stop: M887
Requester Phone: 667-0815
Requester Fax #: 667-0731Study: ESH20 BIOLOGICALS
Analytical Service Agreement #:

Logged by: LBRANCH

CUSTOMER SAMPLES

4-7

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077877	300182928	TA-36	Sr-90	2.55	0.41	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200077879	300182934	TA-49	Sr-90	4.85	0.79	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200077880	300182940	TA-39	Sr-90	1.98	0.40	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200077881	300182946	TP	Sr-90	0.95	0.28	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200077882	300182952	TA-15	Sr-90	1.52	0.37	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200077883	300182958	COYOTE	Sr-90	1.32	0.26	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200077884	300182964	JEMEZ	Sr-90	2.36	0.37	pCi/g	
			Sr-90 MDA	2.00		pCi/g	

**** FINAL REPORT ****

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id: 100033139

DUPLICATE TASKS

<u>Sample Id</u>	<u>Task Id</u>	<u>Original Task</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077879	300182934		Sr-90	4.85	0.79	pCi/g	
			Sr-90 MDA	2.00		pCi/g	
200085086	300195416	300182934	Sr-90	1.66	0.35	pCi/g	
			Sr-90 MDA	2.00		pCi/g	

A-8

**** FINAL REPORT ****

Method: SR-90 LS ENV

Method Area: EH-ALPHA

Submission Id : 100033139

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200077886	300182970	Sr-90	35.73	2.30	pCi/g	40.0	1.20	pCi/g	IN CONTROL

OPEN QC

A-9

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.36592	300195418	Sr-90	477.94	39.04	pCi/L	499.5	15.98	pCi/L	IN CONTROL

METHOD BLANK

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.22778	300195417	Sr-90	0.05	0.15	pCi/g	0.0	0.0	pCi/g	IN CONTROL

**** FINAL REPORT ****

Method: SR-90 LS ENV

Method Area: EH-ALPHA

Submission Id : 100033139

Ery
Analyst

STG
Review

CS
Team Leader

NK for PCL
QA Officer

1/11/99
Date

1/12/99
Date

1/13/99
Date

1/14/99
Date

A-10

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

50420

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100033139

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G20000000	Due Date:	23-DEC-98
Requester Group:	ESH-20	Logged Date:	20-OCT-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

4-11

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077877	300182929	TA-36	U	1.91	0.19	ug/g	
200077879	300182935	TA-49	U	2.75	0.28	ug/g	
200077880	300182941	TA-39	U	2.63	0.26	ug/g	
200077881	300182947	TP	U	1.31	0.13	ug/g	
200077882	300182953	TA-15	U	4.81	0.48	ug/g	
200077883	300182959	COYOTE	U	1.49	0.15	ug/g	
200077884	300182965	JEMEZ	U	2.93	0.29	ug/g	

DUPLICATE TASKS

<u>Sample Id</u>	<u>Task Id</u>	<u>Original Task</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077879	300182935		U	2.75	0.28	ug/g	
200080199	300187153	300182935	U	2.58	0.26	ug/g	

**** FINAL REPORT ****

Method: GENERIC KPA

Method Area: EH-ALPHA

Submission Id : 100033139

60420

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200077885	300182969	U	1.12	0.11	ug/g	1.11	0.02	ug/g	IN CONTROL

OPEN QC

A-12

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.38058	300187151	U	10.65	1.07	ug/L	10.1	1.0	ug/L	IN CONTROL

METHOD BLANK

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.22776	300187152	U	0.00	0.01	ug/g	0	0	ug/g	IN CONTROL

**** FINAL REPORT ****

70220

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100033139

ml
Analyst

STC
Review

ts
Team Leader

NK for PCH
QA Officer

11/12/98
Date

11/13/98
Date

11/13/98
Date

11/16/98
Date

A-13

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 : 100033139

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G20000000	Due Date:	23-DEC-98
Requester Group:	ESH-20	Logged Date:	20-OCT-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

4-14

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200077877	300182932	TA-36	Pu-238	0.0009	0.0007	pCi/g	
			Pu-239	0.0043	0.0011	pCi/g	
			Pu-242T Recovery	70.84		%	
200077879	300182938	TA-49	Pu-238	0.0026	0.0009	pCi/g	
			Pu-239	0.0043	0.0011	pCi/g	
			Pu-242T Recovery	74.80		%	
200077880	300182944	TA-39	Pu-238	0.0005	0.0005	pCi/g	
			Pu-239	0.0057	0.0012	pCi/g	
			Pu-242T Recovery	89.82		%	
200077881	300182950	TP	Pu-238	0.0014	0.0006	pCi/g	
			Pu-239	0.0017	0.0007	pCi/g	
			Pu-242T Recovery	88.94		%	
200077882	300182956	TA-15	Pu-238	0.0019	0.0007	pCi/g	
			Pu-239	0.0155	0.0018	pCi/g	
			Pu-242T Recovery	88.23		%	
200077883	300182962	COYOTE	Pu-238	0.0008	0.0005	pCi/g	
			Pu-239	0.0082	0.0013	pCi/g	
			Pu-242T Recovery	88.34		%	

001/2/98

**** FINAL REPORT ****

Method: PU RAS ENV

Method Area: EH-ALPHA

Submission Id : 100033139

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077884	300182968	JEMEZ	Pu-238	0.0014	0.0005	pCi/g	
			Pu-239	0.0069	0.0012	pCi/g	
			Pu-242T Recovery	89.73		%	

DUPLICATE TASKS

<u>Sample Id</u>	<u>Task Id</u>	<u>Original Task</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077880	300182944		Pu-238	0.0005	0.0005	pCi/g	
			Pu-239	0.0057	0.0012	pCi/g	
			Pu-242T Recovery	89.82		%	
200082056	300190351	300182944	Pu-238	0.0003	0.0006	pCi/g	
			Pu-239	0.0031	0.0009	pCi/g	
			Pu-242T Recovery	79.12		%	

**** FINAL REPORT ****

CC 10720

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100033139

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200077887	300182971	Pu-238	0.6815	0.0210	pCi/g	0.72	0.025	pCi/g	IN CONTROL
		Pu-239	0.3707	0.0127	pCi/g	0.38	0.01	pCi/g	IN CONTROL

A-16
METHOD BLANK

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.22776	300190352	Pu-238	-0.0001	0.0002	pCi/g	0.0	0.0	pCi/g	IN CONTROL
		Pu-239	0.0000	0.0003	pCi/g	0.0	0.0	pCi/g	IN CONTROL

**** FINAL REPORT ****

000007

Method: PU RAS ENV Method Area: EH-ALPHA Submission ID: 100033139

212
Analyst

SB
Review

DS
Team Leader

424
QA Officer

2 Dec 98
Date

12/8/98
Date

12/8/98
Date

12/9/98
Date

The control status of the preceding 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 ****

00100000

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: AM RAS ENV

Method Area: EH-ALPHA

Submission Id : 100033139

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G20000000	Due Date:	23-DEC-98
Requester Group:	ESH-20	Logged Date:	20-OCT-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815				
Requester Fax #:	667-0731	Analytical Service Agreement #:			

CUSTOMER SAMPLES

A-18

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077877	300182931	TA-36	Am-241	0.0047 ✓	0.0012 ✓	pCi/g	
			Am-243T Recovery	54.36		%	
200077879	300182937	TA-49	Am-241	0.0057 ✓	0.0016 ✓	pCi/g	
			Am-243T Recovery	39.54		%	
200077880	300182943	TA-39	Am-241	0.0040 ✓	0.0010 ✓	pCi/g	
			Am-243T Recovery	66.76		%	
200077881	300182949	TP	Am-241	0.0033 ✓	0.0012 ✓	pCi/g	
			Am-243T Recovery	63.51		%	
200077882	300182955	TA-15	Am-241	0.0113 ✓	0.0024 ✓	pCi/g	
			Am-243T Recovery	37.87		%	
200077883	300182961	COYOTE	Am-241	0.0035 ✓	0.0011 ✓	pCi/g	
			Am-243T Recovery	54.69		%	
200077884	300182967	JEMEZ	Am-241	0.009 ✓	0.004 ✓	pCi/g	
			Am-243T Recovery	53.08		%	

1/29/99
2/

000000

**** FINAL REPORT ****

Method: AM RAS ENV

Method Area: EH-ALPHA

Submission Id: 100033139

DUPLICATE TASKS

<u>Sample Id</u>	<u>Task Id</u>	<u>Original Task</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077880	300182943		Am-241	0.0040	0.0010	pCi/g	
			Am-243T Recovery	66.76		%	
200083573	300192849	300182943	Am-241	0.0034	0.0008	pCi/g	
			Am-243T Recovery	68.28		%	

A-19

**** FINAL REPORT ****

000000

Method: AM RAS ENV

Method Area: EH-ALPHA

Submission Id : 100033139

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200077887	300182972	Am-241	0.8620	0.0243	pCi/g	0.86	0.04	pCi/g	IN CONTROL

METHOD BLANK

A-20

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.22776	300192850	Am-241	0.0019	0.0009	pCi/g	0.0	0.0	pCi/g	WARNING 2-3SIG

0019037

**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id: 100033139

RJP
Analyst

STG
Review

STG
Team Leader

NK
QA Officer

22 Dec 98
Date

12/24/98
Date

12/24/98
Date

12/24/98
Date

The control status of the preceding 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 ****

000000

A-21

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: GENERIC MOISTURE Method Area: EH-ALPHA Submission Id : 100033139

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G20000000	Due Date:	23-DEC-98
Requester Group:	ESH-20	Logged Date:	20-OCT-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

A-22

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200077877	300182988	TA-36	MOISTURE	5.50	0.30	%	
200077879	300182987	TA-49	MOISTURE	8.30	0.40	%	
200077880	300182993	TA-39	MOISTURE	6.00	0.30	%	
200077881	300182990	TP	MOISTURE	2.60	0.10	%	
200077882	300182989	TA-15	MOISTURE	5.50	0.30	%	
200077883	300182992	COYOTE	MOISTURE	11.00	0.50	%	
200077884	300182998	JEMEZ	MOISTURE	6.10	0.30	%	

05

**** FINAL REPORT ****

Method: GENERIC MOISTURE Method Area: EH-ALPHA

Submission Id : 100033139

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

BLIND QC

Customer Id	Task Id	Component	Result	QC	QC	QC	QC	QC
200077898	300182975	MOISTURE	Value	Uncertainty	Units	Value	Uncertainty	units
			4.00	0.20	%	3.85	0.35	%
								IN CONTROL

METHOD BLANK

Customer Id	Task Id	Component	Result	QC	QC	QC	QC	QC
00.22776	300184528	MOISTURE	Value	Uncertainty	Units	Value	Uncertainty	units
			0.00	0.05	%	0.0	0.0	%
								IN CONTROL

A-23

**** FINAL REPORT ****

Method: GENERIC MOISTURE Method Area: EH-ALPHA Submission Id: 100033139

Ajp
Analyst

Euy
Review

CP
Team Leader

NK for PCL
QA Officer

10/28/98
Date

10-27-98
Date

10/29/98
Date

10/29/98
Date

A-24

20

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

Los Alamos

Soils and Foodstuffs (7C20 WE6G) 2000

Los Alamos National Laboratory

P.L.# (505) 667-0815

Los Alamos, New Mexico 87545

ESII-20 MS M887

Project Name		Request the following analysis:		Number of Samples	Sample Location/Remarks
Samples (signature)					
Pinon Project Soils		34, 90Sr, 137Cs, 238Pu		10	
Karin Nalony, Leonard J. Lombard Blanca G. Robles		239Pu, 241Am, total U			
Date	Time	Sample Name/Number			
9-25	10:30	TA-36			TA-36 .4 mile east of ^{main} entrance to TA-36
		#			
9-30	2:30	TA-49			TA-49 - on the road to DT Well #9
9-30	10:30	TA-39			TA-39 - off SR #4 .5 mile west of main entrance to Bandelier National Park.
10-1	11:00	TP			Tres Piedras, SR #285 North, 1 mile south of Scuri Cliff.
10-5	1:30	TA-15			Pharmex, 100yds south of firing site.
10-6	10:00	Coyote			Coyote, off SR #96, south on Forest Rd. 172, about 1.2 miles on the right hand side of Rd. 172.
10-8	10:45	Jemez			Jemez, SR-290 to Ponderosa, Forest Rd 10, to Forest Rd. 129 to Borego mesa.
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
Karin Nalony	10/14/98 1:35	Blanca G. Robles			
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

ANALYTICAL DATA REPORTS OF RADIONUCLIDE CONCENTRATIONS IN PINON PINE SHOOTS FROM LANL AND BG SITES

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id: 100034514

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G30000000	Due Date:	24-FEB-99
Requester Group:	ESH-20	Logged Date:	11-DEC-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

B-1

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200083448	300192687	TA-36	H-3	70	650	pCi/L	
			H-3 MDA	480		pCi/L	
200083449	300192688	TA-49	H-3	60	650	pCi/L	
			H-3 MDA	470		pCi/L	
200083450	300192689	TA-39	H-3	520	680	pCi/L	
			H-3 MDA	490		pCi/L	
200083451	300192690	TP	H-3	-300	630	pCi/L	
			H-3 MDA	470		pCi/L	
200083452	300192691	TA-15	H-3	30	650	pCi/L	
			H-3 MDA	480		pCi/L	
200083453	300192692	C	H-3	210	660	pCi/L	
			H-3 MDA	480		pCi/L	
200083454	300192693	J	H-3	340	670	pCi/L	
			H-3 MDA	510		pCi/L	

CO

**** FINAL REPORT ****

Method: H-3 LS ENV

Method Area: EH-ALPHA

Submission Id : 100034514

DUPLICATE TASKS

<u>Sample Id</u>	<u>Task Id</u>	<u>Original Task</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200083452	300192691		H-3	30	650	pCi/L	
			H-3 MDA	480		pCi/L	
200084543	300194572	300192691	H-3	130	660	pCi/L	
			H-3 MDA	470		pCi/L	

**** FINAL REPORT ****

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id: 100034514

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200083455	300197694	H-3	11900	1300	pCi/L	12800	480	pCi/L	IN CONTROL

OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
00.38286	300194570	H-3	-0.00032	0.00063	uCi/L	0	0	uCi/L	IN CONTROL
00.39930	300194571	H-3	0.0119	0.0013	uCi/L	0.01427	0.00143	uCi/L	IN CONTROL

B-3

**** FINAL REPORT ****

Method: H-3 LS ENV

Method Area: EH-ALPHA

Submission Id : 100034514

[Signature]

Analyst

[Signature]

Review

[Signature]

Team Leader

[Signature]

QA Officer

1/5/99

Date

1/6/99

Date

1/6/99

Date

1/6/99

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

36

Method: GENERIC GAMMA

Method Area: EH-GAMMA

Submission Id : 100034696

Requester Name: PHIL FRESQUEZ

Customer Cost Code: 7C2000WE6G30000000

Due Date: 03-MAR-99

Requester Group: ESH-20

Logged Date: 22-DEC-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

6-5

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084100	300193663	TA-36	CS-137	0.18	0.27	pCi/g	
200084101	300193668	TA-49	CS-137	0.35	0.52	pCi/g	
200084102	300193673	TA-39	CS-137	1.51	2.26	pCi/g	
200084103	300193678	TP	CS-137	1.24	1.85	pCi/g	
200084104	300193683	TA-15	CS-137	0.45	0.67	pCi/g	
200084105	300193688	COYOTE	CS-137	0.50	0.76	pCi/g	
200084106	300193692	JEMEZ	CS-137	0.20	0.31	pCi/g	

**** FINAL REPORT ****

Method: GENERIC GAMMA Method Area: EH-GAMMA Submission Id: 100034696

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200084111	300193697	CS-137	32.6	2.5	pCi/g	34.6	1.1	pCi/g	IN CONTROL

OPEN QC

B-6

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.33380	300200291	CS-137	5.82	0.56	pCi/g	5.1000	0.1700	pCi/g	IN CONTROL
00.33742	300200292	CS-137	28.2	2.2	pCi/g	30	1	pCi/g	IN CONTROL

METHOD BLANK

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.22785	300200290	CS-137	-0.01	0.11	pCi/g	0.0	0.0	pCi/g	IN CONTROL

**** FINAL REPORT ****

Method: GENERIC GAMMA

Method Area: EH-GAMMA

Submission Id: 100034696

[Signature]
Analyst

[Signature]
Review
8/2/99

[Signature]
Team Leader

[Signature]
QA Officer

2/19/99
Date

2/22/99
Date

2/22/99
Date

2/22/99
Date

B-7

The control status of the preceding 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: SR-90 LS ENV Method Area: EH-ALPHA Submission Id: 100034696

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G30000000	Due Date:	03-MAR-99
Requester Group:	ESH-20	Logged Date:	22-DEC-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815				
Requester Fax #:	667-0731	Analytical Service Agreement #:			

CUSTOMER SAMPLES

200

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084100	300193666	TA-36	Sr-90	3.16	0.47	pCi/g	ash
			Sr-90 MDA	1.8		pCi/g	
200084101	300193671	TA-49	Sr-90	3.23	0.33	pCi/g	
			Sr-90 MDA	1.02		pCi/g	
200084102	300193676	TA-39	Sr-90	5.1	0.75	pCi/g	
			Sr-90 MDA	2.82		pCi/g	
200084103	300193681	TP	Sr-90	3.72	0.76	pCi/g	
			Sr-90 MDA	3.23		pCi/g	
200084104	300193686	TA-15	Sr-90	2.92	0.36	pCi/g	
			Sr-90 MDA	1.22		pCi/g	
200084105	300193691	COYOTE	Sr-90	3.23	0.43	pCi/g	
			Sr-90 MDA	1.54		pCi/g	
200084106	300193695	JEMEZ	Sr-90	3.42	0.48	pCi/g	
			Sr-90 MDA	1.77		pCi/g	

**** FINAL REPORT ****

Method: SR-90 IS ENV Method Area: EH-ALPHA Submission Id: 100034696

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC</u>	<u>QC</u>	<u>QC</u>
200084112	300193698	Sr-90	<u>Value</u>	0.95	pCi/g	<u>Value</u>	<u>Uncertainty</u>	<u>units</u>
			6.88			6.99	0.22	pCi/g
								<u>Evaluation</u>
								IN CONTROL

OPEN QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC</u>	<u>QC</u>	<u>QC</u>
00.36592	300213552	Sr-90	<u>Value</u>	33.8	pCi/L	<u>Value</u>	<u>Uncertainty</u>	<u>units</u>
			509.2			499.5	15.98	pCi/L
								<u>Evaluation</u>
								IN CONTROL

B-9

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

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100034696

Eig
Analyst

STB
Review

BT
Team Leader

NK for PCL
QA Officer

5-3-99
Date

5/5/99
Date

5/5/99
Date

5/6/99
Date

B-10
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 : 100034696

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G30000000	Due Date:	03-MAR-99
Requester Group:	ESH-20	Logged Date:	22-DEC-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

11-8

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084100	300193662	TA-36	U	0.70	0.07	ug/g	ash
			Analysis Date	05-MAR-1999		DD-MON-YYYY	
			Comments	NONE		NONE	
200084101	300193667	TA-49	U	0.50	0.05	ug/g	
			Analysis Date	05-MAR-1999		DD-MON-YYYY	
			Comments	NONE		NONE	
200084102	300193672	TA-39	U	0.69	0.07	ug/g	
			Analysis Date	05-MAR-1999		DD-MON-YYYY	
			Comments	NONE		NONE	
200084103	300193677	TP	U	0.37	0.04	ug/g	
			Analysis Date	05-MAR-1999		DD-MON-YYYY	
			Comments	NONE		NONE	
200084104	300193682	TA-15	U	3.37	0.34	ug/g	
			Analysis Date	05-MAR-1999		DD-MON-YYYY	
			Comments	NONE		NONE	
200084105	300193687	COYOTE	U	0.50	0.05	ug/g	
			Analysis Date	05-MAR-1999		DD-MON-YYYY	
			Comments	NONE		NONE	

**** FINAL REPORT ****

15-Mar-1999 08:10

Page 2 of 4

715-109

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100034696

<u>Sample Id</u> 200084106	<u>Task Id</u> 300193696	<u>Customer Id</u> JEMEZ	<u>Component</u> U	<u>Result Value</u> 0.59	<u>Uncertainty</u> 0.06	<u>Units</u> ug/g	<u>Qualifier</u> DD-MON-YYYY NONE
			Analysis Date Comments	05-MAR-1999 NONE			

B-12

**** FINAL REPORT ****

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id: 100034696

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units ug/g	QC Value	QC Uncertainty	QC units ug/g	QC Evaluation IN CONTROL
200084113	300193699	U	0.56	0.06		0.46	0.046		

OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units ug/L	QC Value	QC Uncertainty	QC units ug/L	QC Evaluation IN CONTROL
00.38058	300203955	U	10.26	1.03		10.1	1.0		

B-13

**** FINAL REPORT ****

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id : 100034696

NK for PCL
QA Officer

TS
Team Leader

STG
Review

ml
Analyst

3/15/99
Date

3/15/99
Date

3/15/99
Date

3/15/99
Date

B-14

The control status of the preceding 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 ****

80274

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100034696

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G30000000	Due Date:	03-MAR-99
Requester Group:	ESH-20	Logged Date:	22-DEC-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
13-15 200084100	300193664	TA-36	Pu-238	-0.0001	0.0012	pCi/g	ash
			Pu-238 DL	0.0043		pCi/g	
			Pu-239	0.0039	0.0024	pCi/g	
			Pu-239 DL	0.0074		pCi/g	
			Pu-242T Recovery	87.90		%	
			Analysis Date	04-APR-1999		DD-MON-YYYY	
			Comments	OK		NONE	
			Analysis Date	04/16/99		MM/DD/YY	
			Pu-238 MDA	0.0043		pCi/g	
			Pu-239 MDA	0.0074		pCi/g	
200084101	300193669	TA-49	Pu-238	0.0007	0.0014	pCi/g	
			Pu-238 DL	0.0067		pCi/g	
			Pu-239	0.0034	0.0018	pCi/g	
			Pu-239 DL	0.0054		pCi/g	
			Pu-242T Recovery	80.69		%	
			Analysis Date	04-APR-1999		DD-MON-YYYY	
			Comments	OK		NONE	
200084102	300193674	TA-39	Pu-238	-0.0027	0.0027	pCi/g	

**** FINAL REPORT ****

Method: PU RAS ENV

Method Area: EH-ALPHA

Submission Id : 100034696

B-16

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084102	300193674	TA-39	Pu-238 DL	0.0208		pCi/g	
			Pu-239	0.0043	0.0069	pCi/g	
			Pu-239 DL	0.0167		pCi/g	
			Pu-242T Recovery	32.76		%	
			Analysis Date	16-APR-1999		DD-MON-YYYY	
			Comments	OK		NONE	
200084103	300193679	TP	Pu-238	0.0027	0.0027	pCi/g	
			Pu-238 DL	0.0087		pCi/g	
			Pu-239	0.0041	0.0033	pCi/g	
			Pu-239 DL	0.0114		pCi/g	
			Pu-242T Recovery	87.22		%	
			Analysis Date	16-APR-1999		DD-MON-YYYY	
			Comments	OK		NONE	
200084104	300193684	TA-15	Pu-238	0.0004	0.0023	pCi/g	
			Pu-238 DL	0.0096		pCi/g	
			Pu-239	0.0046	0.0027	pCi/g	
			Pu-239 DL	0.0063		pCi/g	
			Pu-242T Recovery	76.84		%	
			Analysis Date	16-APR-1999		DD-MON-YYYY	
			Comments	OK		NONE	
200084105	300193689	COYOTE	Pu-238	0.0034	0.0019	pCi/g	
			Pu-238 DL	0.0059		pCi/g	
			Pu-239	0.0029	0.0020	pCi/g	
			Pu-239 DL	0.0040		pCi/g	
			Pu-242T Recovery	84.47		%	
			Analysis Date	16-APR-1999		DD-MON-YYYY	
			Comments	OK		NONE	
200084106	300193693	JEMEZ	Pu-238	0.0066	0.0033	pCi/g	
			Pu-238 DL	0.0073		pCi/g	
			Pu-239	0.0000	0.0000	pCi/g	
			Pu-239 DL	0.0081		pCi/g	

**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100034696

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084106	300193693	JEMEZ	Pu-242T Recovery	82.55		%	
			Analysis Date	16-APR-1999		DD-MON-YYYY	
			Comments	OK		NONE	

B-17

**** FINAL REPORT ****

Method: PU RAS ENV

Method Area: EH-ALPHA

Submission Id : 100034696

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result</u> <u>Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC</u> <u>Value</u>	<u>QC</u> <u>Uncertainty</u>	<u>QC</u> <u>units</u>	<u>QC</u> <u>Evaluation</u>
200084114	300193700	Pu-238	1.5324	0.1415	pCi/g	1.71	0.06	pCi/g	IN CONTROL
		Pu-239	8.6480	0.6247	pCi/g	9.49	0.30	pCi/g	IN CONTROL

**** FINAL REPORT ****

Method: PU RAS ENV

Method Area: EH-ALPHA

Submission Id : 100034696

gmm
Analyst

STG
Review

B
Team Leader

NK for PCL
QA Officer

6/2/99
Date

6/7/99
Date

6/8/99
Date

6/11/99
Date

B-19

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 : 100034696

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G30000000	Due Date:	03-MAR-99
Requester Group:	ESH-20	Logged Date:	22-DEC-1998	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

13-20

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084100	300193665	TA-36	Am-241	0.0099	0.0044	pCi/g	ash
			Am-241 DL	0.0127		pCi/g	
			Am-243T Recovery	75.75		%	
			Analysis Date	18-MAY-1999		DD-MON-YYYY	
			Instrument	80 ALPHA		NONE	
			Count Time	1333.33		min	
			Efficiency	19.73		%	
200084101	300193670	TA-49	Am-241	0.0037	0.0053	pCi/g	
			Am-241 DL	0.0200		pCi/g	
			Am-243T Recovery	46.45		%	
			Analysis Date	18-MAY-1999		DD-MON-YYYY	
			Instrument	80 ALPHA		NONE	
			Count Time	1333.33		min	
			Efficiency	20.70		%	
200084102	300193675	TA-39	Am-241	0.0130	0.0056	pCi/g	
			Am-241 DL	0.0094		pCi/g	
			Am-243T Recovery	69.61		%	
			Analysis Date	18-MAY-1999		DD-MON-YYYY	

**** FINAL REPORT ****

6

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100034696

B-2/

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200084102	300193675	TA-39	Instrument	80 ALPHA		NONE	
			Count Time	1333.33		min	
			Efficiency	19.88		%	
200084103	300193680	TP	Am-241	0.0094	0.0051	pCi/g	
			Am-241 DL	0.0131		pCi/g	
			Am-243T Recovery	70.49		%	
			Analysis Date	18-MAY-1999		DD-MON-YYYY	
			Instrument	80 ALPHA		NONE	
			Count Time	1333.33		min	
			Efficiency	21.59		%	
200084104	300193685	TA-15	Am-241	0.0006	0.0040	pCi/g	
			Am-241 DL	0.0183		pCi/g	
			Am-243T Recovery	49.91		%	
			Analysis Date	18-MAY-1999		DD-MON-YYYY	
			Instrument	80 ALPHA		NONE	
			Count Time	1333.33		min	
			Efficiency	19.53		%	
200084105	300193690	COYOTE	Am-241	0.0099	0.0044	pCi/g	
			Am-241 DL	0.0127		pCi/g	
			Am-243T Recovery	69.63		%	
			Analysis Date	18-MAY-1999		DD-MON-YYYY	
			Instrument	80 ALPHA		NONE	
			Count Time	1333.33		min	
			Efficiency	19.37		%	
200084106	300193694	JEMEZ	Am-241	0.0087	0.0059	pCi/g	
			Am-241 DL	0.0158		pCi/g	
			Am-243T Recovery	29.43		%	
			Analysis Date	18-MAY-1999		DD-MON-YYYY	
			Instrument	80 ALPHA		NONE	
			Count Time	1333.33		min	
			Efficiency	20.48		%	

**** FINAL REPORT ****

Method: AM RAS ENV

Method Area: EH-ALPHA

Submission Id : 100034696

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200084114	300193701	Am-241	3.8454	0.1731	pCi/g	4.83	0.22	pCi/g	OUT OF CONTROL

METHOD BLANK

13-22

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.22784	300215999	Am-241	0.0048	0.0297	pCi/g	0	0	pCi/g	IN CONTROL

**** FINAL REPORT ****

8

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id : 100034696

MEB
Analyst

STG
Review

GB
Team Leader

NK for PC L
QA Officer

6/1/99
Date

6/7/99
Date

6/8/99
Date

6/11/99
Date

B-23
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 ****

9

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Soils and Foodstuffs (7C20 WE6C) 3000

P.I.# (505) 667-0815

ES11-20 MS M887

B-24

APPENDIX C

ANALYTICAL DATA REPORTS OF RADIONUCLIDE CONCENTRATIONS IN PINON PINE NUTS FROM LANL AND BG SITES

LOS ALAMOS NATIONAL LABORATORY
CST Analytical Chemistry
Analytical Results Report

Method: H-3 LS ENV

Method Area: EH-ALPHA

Submission Id : 100034576

Requester Name: PHIL FRESQUEZ

Customer Cost Code:

7C2000WE6G30000000

Due Date:

01-MAR-99

Requester Group: ESH-20

Logged Date:

16-DEC-1998

Screening Data:

NO SCREENING DATA REQUIRED

Mail Stop: M887

Study:

ESH20 BIOLOGICALS

Requester Phone: 667-0815

Logged by:

APODACA

Requester Fax #: 667-0731

Analytical Service Agreement #:

CUSTOMER SAMPLES

C-1

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200083626	300192971	TA-36-N	H-3	11900	1300	pCi/L	
			H-3 MDA	500		pCi/L	
200083628	300192972	TA-49-N	H-3	11000	1200	pCi/L	
			H-3 MDA	500		pCi/L	
200083629	300192973	TA-39-N	H-3	11200	1200	pCi/L	
			H-3 MDA	500		pCi/L	
200083630	300192974	TP-N	H-3	-10	650	pCi/L	
			H-3 MDA	480		pCi/L	
200083631	300192975	TA-15-N	H-3	5860	990	pCi/L	
			H-3 MDA	410		pCi/L	
200083632	300192976	C-N	H-3	7000	1000	pCi/L	
			H-3 MDA	500		pCi/L	
200083633	300192977	J-N	H-3	610	690	pCi/L	
			H-3 MDA	470		pCi/L	

005

**** FINAL REPORT ****

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id: 100034576

DUPLICATE TASKS

<u>Sample Id</u>	<u>Task Id</u>	<u>Original Task</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200083632	300192976		H-3	7000	1000	pCi/L	
			H-3 MDA	500		pCi/L	
200084552	300194623	300192976	H-3	5220	950	pCi/L	
			H-3 MDA	450		pCi/L	

C-2

900

**** FINAL REPORT ****

Method: H-3 LS ENV Method Area: EH-ALPHA Submission Id: 100034576

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

BLIND QC

Customer Id	Task Id	Component	Result	Uncertainty	Units	QC Value	QC Uncertainty	QC units	QC Evaluation
200083634	300192978	H-3	Value 16300	1400	pCi/L	17000	630	pCi/L	IN CONTROL

C-3

**** FINAL REPORT ****

Method: H-3 LS ENV

Method Area: EH-ALPHA

Submission Id : 100034576

C-4

[Signature]
Analyst

[Signature]
Review

[Signature]
Team Leader

[Signature]
QA Officer

1/5/99
Date

1/6/99
Date

1/6/99
Date

1/6/99
Date

008

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 GAMMA

Method Area: EH-GAMMA

Submission Id : 100034765

Requester Name: PHIL FRESQUEZ

Customer Cost Code: 7C2000WE6G30000000

Due Date: 08-MAR-99

Requester Group: ESH-20

Logged Date: 04-JAN-1999

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

C-5

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084511	300194526	TA-36	CS-137	-0.18	0.11	pCi/g	
			CS-137 MDA	0.05		pCi/g	
200084512	300194531	TA-49	CS-137	0.52	0.08	pCi/g	
			CS-137 MDA	0.05		pCi/g	
200084513	300194536	TA-39	CS-137	0.43	0.08	pCi/g	
			CS-137 MDA	0.05		pCi/g	
200084514	300194541	TP	CS-137	0.46	0.69	pCi/g	
			CS-137 MDA	0.05		pCi/g	
200084515	300194546	TA-15	CS-137	-0.15	0.11	pCi/g	
			CS-137 MDA	0.05		pCi/g	
200084516	300194551	C	CS-137	-0.00	0.11	pCi/g	
			CS-137 MDA	0.05		pCi/g	
200084517	300194555	J	CS-137	0.67	1.00	pCi/g	
			CS-137 MDA	0.05		pCi/g	

**** FINAL REPORT ****

Method: GENERIC GAMMA Method Area: EH-GAMMA Submission Id : 100034765

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200084518	300194557	CS-137	28.0	2.1	pCi/g	31.7	1.0	pCi/g	IN CONTROL

C-6
OPEN QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.33742	300206329	CS-137	29.3	2.2	pCi/g	30	1	pCi/g	IN CONTROL

METHOD BLANK

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.22785	300206328	CS-137	0.08	0.12	pCi/g	0.0	0.0	pCi/g	IN CONTROL

**** FINAL REPORT ****

Method: GENERIC GAMMA

Method Area: EH-GAMMA

Submission Id : 100034765

Analyst

STG
Review

Team Leader

NK for PCL
QA Officer

3/23/99
Date

3/24/99
Date

3/24/99
Date

3/26/99
Date

C-7

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: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100034765

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G30000000	Due Date:	08-MAR-99
Requester Group:	ESH-20	Logged Date:	04-JAN-1999	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084511	300194522	TA-36 - N	Sr-90	-0.46	0.26	pCi/g	ash
			Sr-90 MDA	0.82		pCi/g	
200084512	300194527	TA-49	Sr-90	-0.36	0.33	pCi/g	
			Sr-90 MDA	1.07		pCi/g	
200084513	300194532	TA-39	Sr-90	-0.43	0.28	pCi/g	
			Sr-90 MDA	0.87		pCi/g	
200084514	300194537	TP	Sr-90	-0.84	0.31	pCi/g	
			Sr-90 MDA	0.94		pCi/g	
200084515	300194542	TA-15	Sr-90	-0.60	0.51	pCi/g	
			Sr-90 MDA	1.62		pCi/g	
200084516	300194547	C	Sr-90	-0.56	0.4	pCi/g	
			Sr-90 MDA	1.26		pCi/g	
200084517	300194556	J	Sr-90	-1.46	0.44	pCi/g	
			Sr-90 MDA	1.30		pCi/g	

**** FINAL REPORT ****

Method: SR-90 LS ENV

Method Area: EH-ALPHA

Submission Id : 100034765

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200084519	300194558	Sr-90	8.96	1.34	pCi/g	8.31	0.27	pCi/g	IN CONTROL

OPEN QC

C-9

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.36592	300212931	Sr-90	490.5	39.8	pCi/L	499.5	15.98	pCi/L	IN CONTROL

**** FINAL REPORT ****

Method: SR-90 LS ENV Method Area: EH-ALPHA Submission Id : 100034765

Erg
Analyst

STG
Review

BS
Team Leader

NK for PCL
QA Officer

5-3-99
Date

5/5/99
Date

5/5/99
Date

5/6/99
Date

C-10

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

50-28

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id: 100034765

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G30000000	Due Date:	08-MAR-99
Requester Group:	ESH-20	Logged Date:	04-JAN-1999	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

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084511	300194525	TA-36 - N	U	0.05	0.01	ug/g	ash
			Analysis Date	05-MAR-1999			DD-MON-YYYY
			Comments	NONE			NONE
200084512	300194530	TA-49	U	0.05	0.01	ug/g	
			Analysis Date	05-MAR-1999			DD-MON-YYYY
			Comments	NONE			NONE
200084513	300194535	TA-39	U	0.04	0.01	ug/g	
			Analysis Date	05-MAR-1999			DD-MON-YYYY
			Comments	NONE			NONE
200084514	300194540	TP	U	0.03	0.01	ug/g	
			Analysis Date	05-MAR-1999			DD-MON-YYYY
			Comments	NONE			NONE
200084515	300194545	TA-15	U	0.06	0.01	ug/g	
			Analysis Date	05-MAR-1999			DD-MON-YYYY
			Comments	NONE			NONE
200084516	300194550	C	U	0.04	0.01	ug/g	
			Analysis Date	05-MAR-1999			DD-MON-YYYY
			Comments	NONE			NONE

**** FINAL REPORT ****

Method: GENERIC KPA

Method Area: EH-ALPHA

Submission Id : 100034765

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084517	300194554	J	U	0.07	0.01	ug/g	
			Analysis Date	05-MAR-1999		DD-MON-YYYY	
			Comments	NONE		NONE	

**** FINAL REPORT ****

Method: GENERIC KPA Method Area: EH-ALPHA Submission Id: 100034765

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

BLIND QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units ug/g	QC Value	QC Uncertainty	QC units ug/g	QC Evaluation IN CONTROL
200084521	300194561	U	0.39	0.04	ug/g	0.37	0.037		

OPEN QC

Customer Id	Task Id	Component	Result Value	Uncertainty	Units ug/L	QC Value	QC Uncertainty	QC units ug/L	QC Evaluation IN CONTROL
00.38058	300203970	U	10.35	1.04	ug/L	10.1	1.0		

**** FINAL REPORT ****

C-13

Q2228

Method: GENERIC KPA

Method Area: EH-ALPHA

Submission Id : 100034765

ml
Analyst

STG
Review

GB
Team Leader

NK for PCL
QA Officer

3/11/99
Date

3/15/99
Date

3/15/99
Date

3/15/99
Date

C-14

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: 100034765

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G30000000	Due Date:	08-MAR-99
Requester Group:	ESH-20	Logged Date:	04-JAN-1999	Screening Data:	NO SCREENING DATA REQUIRED
Mail Stop:	M887	Study:	ESH20 BIOLOGICALS	Logged by:	LBRANCH
Requester Phone:	667-0815	Analytical Service Agreement #:			
Requester Fax #:	667-0731				

CUSTOMER SAMPLES

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Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200084511	300194524	TA-36	Pu-238	0.0005	0.0007	pCi/g	
			Pu-239	0.0023	0.0011	pCi/g	
			Pu-242T Recovery	87.57		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	96 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	41.09		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	7.		counts	
			Pu-238 Background Counts	4.6		counts	
			Pu-239 Gross Counts	17.		counts	
			Pu-239 Background Counts	6.0		counts	
200084512	300194529	TA-49	Pu-238	-0.0001	0.0008	pCi/g	
			Pu-239	0.0016	0.0013	pCi/g	
			Pu-242T Recovery	87.14		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	96 ALPHA		NONE	
			Count Time	3000.00		min	

**** FINAL REPORT ****

Method: PU RAS ENV

Method Area: EH-ALPHA

Submission Id : 100034765

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<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084512	300194529	TA-49	Efficiency	40.65		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	7.		counts	
			Pu-238 Background Counts	7.4		counts	
			Pu-239 Gross Counts	22.		counts	
			Pu-239 Background Counts	14.6		counts	
200084513	300194534	TA-39	Pu-238	-0.0010	0.0012	pCi/g	
			Pu-239	-0.0014	0.0015	pCi/g	
			Pu-242T Recovery	91.54		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	96 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	34.59		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	16.		counts	
			Pu-238 Background Counts	20.2		counts	
			Pu-239 Gross Counts	23.		counts	
			Pu-239 Background Counts	29.0		counts	
200084514	300194539	TP	Pu-238	-0.0005	0.0024	pCi/g	
			Pu-239	0.0017	0.0019	pCi/g	
			Pu-242T Recovery	46.05		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	96 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	36.10		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	9.		counts	
			Pu-238 Background Counts	10.0		counts	
			Pu-239 Gross Counts	11.		counts	
			Pu-239 Background Counts	7.2		counts	
200084515	300194544	TA-15	Pu-238	0.0002	0.0008	pCi/g	

**** FINAL REPORT ****

Method: PU RAS ENV

Method Area: EH-ALPHA

Submission Id : 100034765

Sample Id	Task Id	Customer Id	Component	Result Value	Uncertainty	Units	Qualifier
200084515	300194544	TA-15	Pu-239	0.0023	0.0013	pCi/g	
			Pu-242T Recovery	102.34		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	96 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	34.38		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	7.		counts	
			Pu-238 Background Counts	6.2		counts	
			Pu-239 Gross Counts	26.		counts	
			Pu-239 Background Counts	15.4		counts	
200084516	300194549	C	Pu-238	0.0005	0.0010	pCi/g	
			Pu-239	0.0022	0.0010	pCi/g	
			Pu-242T Recovery	105.85		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	96 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	34.97		%	
			Pu-242T Spike	2.05		pCi	
			Pu-238 Gross Counts	8.		counts	
			Pu-238 Background Counts	5.6		counts	
			Pu-239 Gross Counts	18.		counts	
			Pu-239 Background Counts	7.2		counts	
200084517	300194553	J	Pu-238	-0.0010	0.0007	pCi/g	
			Pu-239	0.0003	0.0010	pCi/g	
			Pu-242T Recovery	98.92		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	96 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	35.76		%	
			Pu-242T Spike	2.05		pCi	

**** FINAL REPORT ****

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30-Mar-1999 13:29

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id: 100034765

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084517	300194553	J	Pu-238 Gross Counts	8.		counts	
			Pu-238 Background Counts	12.6		counts	
			Pu-239 Gross Counts	15.		counts	
			Pu-239 Background Counts	13.4		counts	

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**** FINAL REPORT ****

Method: PU RAS ENV Method Area: EH-ALPHA Submission Id : 100034765

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200084520	300194559	Pu-238	1.9145	0.0639	pCi/g	2.40	0.084	pCi/g	OUT OF CONTROL
		Pu-239	3.3985	0.1194	pCi/g	3.96	0.13	pCi/g	OUT OF CONTROL

OPEN QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.39798	300207191	Pu-238	4126	1290	pCi/L	4180	418	pCi/L	IN CONTROL

METHOD BLANK

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.22784	300207190	Pu-238	-0.0033	0.0029	pCi/g	0	0	pCi/g	IN CONTROL
		Pu-239	0.0012	0.0026	pCi/g	0	0	pCi/g	IN CONTROL

**** FINAL REPORT ****

Method: PU RAS ENV

Method Area: EH-ALPHA

Submission Id : 100034765

CEA
Analyst

Ery
Review

B
Team Leader

NK for PCL
QA Officer

4/1/99
Date

4-2-99
Date

4/2/99
Date

04/02/99
Date

C-20

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 : 100034765

Requester Name:	PHIL FRESQUEZ	Customer Cost Code:	7C2000WE6G30000000	Due Date:	08-MAR-99
Requester Group:	ESH-20	Logged Date:	04-JAN-1999	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

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
C-21 200084511	300194523	TA-36	Am-241	0.0021	0.0018	pCi/g	
			Am-243T Recovery	49.61		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.81		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	8.		counts	
			Am-241 Background Counts	3.8		counts	
			Am-241	0.0030	0.0018	pCi/g	
200084512	300194528	TA-49	Am-243T Recovery	58.43		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	32.69		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	13.		counts	
			Am-241 Background Counts	5.4		counts	

**** FINAL REPORT ****

Method: AM RAS ENV

Method Area: EH-ALPHA

Submission Id : 100034765

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084513	300194533	TA-39	Am-241	0.0049	0.0021	pCi/g	
			Am-243T Recovery	73.41		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.39		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	21.		counts	
			Am-241 Background Counts	6.4		counts	
200084514	300194538	TP	Am-241	0.0032	0.0013	pCi/g	
			Am-243T Recovery	90.23		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.65		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	17.		counts	
			Am-241 Background Counts	5.2		counts	
200084515	300194543	TA-15	Am-241	0.0050	0.0020	pCi/g	
			Am-243T Recovery	90.31		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	31.04		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	28.		counts	
			Am-241 Background Counts	9.2		counts	
200084516	300194548	C	Am-241	0.0053	0.0017	pCi/g	
			Am-243T Recovery	87.32		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	32 ALPHA		NONE	

**** FINAL REPORT ****

Method: AM RAS ENV

Method Area: EH-ALPHA

Submission Id: 100034765

<u>Sample Id</u>	<u>Task Id</u>	<u>Customer Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>Qualifier</u>
200084516	300194548	C	Count Time	3000.00		min	
			Efficiency	29.95		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	27.		counts	
			Am-241 Background Counts	8.6		counts	
200084517	300194552	J	Am-241	0.0019	0.0015	pCi/g	
			Am-243T Recovery	68.80		%	
			Analysis Date	03/25/99		MM/DD/YY	
			Instrument	32 ALPHA		NONE	
			Count Time	3000.00		min	
			Efficiency	30.01		%	
			Am-243T Spike	2.05		pCi	
			Am-241 Gross Counts	10.		counts	
			Am-241 Background Counts	4.8		counts	

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**** FINAL REPORT ****

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05-Apr-1999 16:40

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Method: AM RAS ENV

Method Area: EH-ALPHA

Submission Id : 100034765

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

BLIND QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
200084520	300194560	Am-241	9.0454	0.2296	pCi/g	9.89	0.44	pCi/g	IN CONTROL

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OPEN QC

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.41404	300207541	Am-241	0.0024	0.0001	pCi/L	0.0023	0.00023	pCi/L	IN CONTROL

METHOD BLANK

<u>Customer Id</u>	<u>Task Id</u>	<u>Component</u>	<u>Result Value</u>	<u>Uncertainty</u>	<u>Units</u>	<u>QC Value</u>	<u>QC Uncertainty</u>	<u>QC units</u>	<u>QC Evaluation</u>
00.22784	300207453	Am-241	-0.0022	0.0020	pCi/g	0	0	pCi/g	IN CONTROL

**** FINAL REPORT ****

Method: AM RAS ENV Method Area: EH-ALPHA Submission Id: 100034765

SEA
Analyst

Evy
Review

ES
Team Leader

WHL
QA Officer

4/1/99
Date

4-2-99
Date

4/2/99
Date

4/7/99
Date

C-25

The control status of the preceding 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

Los Alamos

Soils and Feedstuffs (7C20 WE6G) 3000

Los Alamos National Laboratory

P.L.# (505) 667-0815

Los Alamos, New Mexico 87545

ESII-20 MS M887

Project Name		Request the following analysis:		number of containers	Sample Location/Remarks
Signatures (signatures)					
Date	Time	Sample Name/Number			
Prison Nuts		3H			Prison Nuts. (shelled).
Samplers (signatures) Helen Nacey, Leonard F. Lindner Blanca G. Robles					
9-25-98	10:30	TA-36-N			TA-36 .4 mile east of ^{main} entrance to TA-36
9-30-98	2:30	TA-49-N			TA-49 - on the road to DT Well #9
9-30-98	10:30	TA-39-N			TA-39 - off SR #4 .5 mile west of main entrance to Bandelier National Park.
10-1-98	11:00	TP-N			Tes Pichas, by Sugar's Cape ~ 80 miles away from LAB
10-5-98	1:30	TA-15-N			Phonix, 100 yds south of firing site. TA-15
10-6-98	10:00	R-LOUETE C-N			Coyote, off SR #96, south on Forest Rd. 172, about 1.2 miles on the right hand side of Rd. 172.
10-8-98	10:45	R-JEINEZ J-N			JEINEZ, SR. 290 to pond area, Forest Rd. 10, to Forest Rd. 155 to Borego mesa.
Relinquished by: (signature)		Received by: (signature)		Relinquished by: (signature)	
Date/Time		Date/Time		Date/Time	
12/16/98 10:10		L. J. C. Brand			
Relinquished by: (signature)		Received by: (signature)		Relinquished by: (signature)	
Date/Time		Date/Time		Date/Time	
Relinquished by: (signature)		Received for Lab by: (signature)		Date/Time	
Date/Time		Date/Time		Remarks	

CHAIN-OF-CUSTODY RECORD

Los Alamos

Soils and Foodstuffs (7C20 WE6G) 3000

Los Alamos National Laboratory

P.I.# (505) 667-0815

Los Alamos, New Mexico 87545

ESII-20 MS M887

Project Name <i>Pinon Nuts</i>		Request the following analysis: 90 238 239 241 Sr, Pu, Pu, Am 137 Cs, tot U		number of containers	Sample Location/Remarks	
Date	Time	Sample Name/Number				
9-25-98	10:30	TH-36			ASHED Pinon nuts main TA-36 .4 mile east of entrance to TA-36	
9-30-98	2:30	TH-49			TA-49 - on the road to DT Well #9	
9-30-98	10:30	TH-39			TA-39 - off SR #4 .5 mile west of main entrance to Bandelier National park.	
10-1-98	11:00	TP			Till. Pickering by Sycamore Creek at 80 miles away from CRACK	
10-5-98	1:30	TH-15			Pharmex. 100yds south of firing site. TH-15	
10-6-98	10:00	Coyote			Coyote, off SR #96, south on Forest Rd. 172, about 1.2 miles on the righthand side of Rd. 172.	
10-8-98	10:45	Jemez			Jemez, SR. 290 to Ponderosa, Forest Rd. 10, to Forest Rd. 138 to Borego mesa.	
Relinquished by: (signature) <i>Qui Naray</i>		Date/Time 1/4/99 10:15		Received by: (signature) <i>Pauline B. Bouchard</i>		
Relinquished by: (signature)		Date/Time		Received by: (signature)		
Relinquished by: (signature)		Date/Time		Received for Lab by: (signature)		Remarks