Radionuclide Concentrations in Soils and Vegetation at Low-Level Radioactive Waste Disposal Area G during 2005
The three most recent reports in this unclassified series are LA-14095-PR, LA-14108-PR, and LA-14181-PR.

Edited by Hector Hinojosa, Group IM-1
Prepared by Teresa Hiteman, Group ENV-ECO
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P.R. Fresquez
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RADIONUCLIDE CONCENTRATIONS IN SOILS AND VEGETATION AT LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AREA G DURING 2005

P.R. Fresquez, M.W. McNaughton, and M.J. Winch

ABSTRACT

Soil samples were collected at 15 locations and unwashed overstory and understory vegetation samples were collected from up to nine locations within and around the perimeter of Area G, the primary disposal facility for low-level radioactive solid waste at Los Alamos National Laboratory (LANL). Soil and plant samples were also collected from the proposed expansion area west of Area G for the purpose of gaining preoperational baseline data. Soil and plant samples were analyzed for radionuclides that have shown a history of detection in past years; these included $^{3}$H, $^{238}$Pu, $^{239,240}$Pu, $^{241}$Am, $^{234}$U, $^{235}$U, and $^{238}$U for soils and $^{3}$H, $^{238}$Pu, and $^{239,240}$Pu for plants. As in previous years, the highest levels of $^{3}$H in soils and vegetation were detected at the south portion of Area G near the $^{3}$H shafts; whereas, the highest concentrations of the Pu isotopes were detected in the northern and northeastern portions near the pads for transuranic waste. All concentrations of radionuclides in soils and vegetation, however, were still very low (pCi range) and far below LANL screening levels and regulatory standards.

1. 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 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 include contaminated equipment, paper, clothing, building materials, soils, and process wastes and are placed in pits, trenches, or shafts and then covered with fill material (Hansen et al., 1980). Tritium ($^{3}$H), plutonium ($^{238}$Pu and $^{239,240}$Pu), americium ($^{241}$Am), uranium ($^{234}$U, $^{235}$U, $^{238}$U), and a variety of fission and activation products
Figure 1. The location of Area G at Los Alamos National Laboratory.
are the main radionuclides in waste materials deposited at Area G (U.S. DOE, 1979).

As part of the Environmental Surveillance Program at LANL, samples of soils and vegetation have been collected within and around the perimeter of Area G to monitor and assess the site's impact on the surrounding environment (Lopez, 2002). A soil sampling program is the most direct means of estimating the types, concentrations, and distribution of radionuclides in the environment within and around nuclear facilities (Fresquez et al., 1996). 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 (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 receptors from waste disposal areas. Trees, in particular, have been shown to be excellent indicators of subterranean ³H migration from low-level radioactive waste disposal sites (Rickard and Kirby, 1987; Fresquez et al., 2003).

The objective of this program is to compare radionuclides of concern in soils and vegetation collected from within and around Area G with similar media collected from regional background areas in an effort to determine impacts to human health and the environment, if any. Radionuclides that were analyzed this year included those that have shown a history of detection at Area G; they were ³H, ²⁴¹Am, ²³⁸Pu, ²³⁹,²⁴⁰Pu, and the uranium isotopes for soils and ³H, ²³⁸Pu, and ²³⁹,²³⁴Pu for vegetation. Based on past years, other radionuclides such as cesium and strontium do not appear to be of significant concern and were not analyzed this year.

2. METHODS

In 2005, the Soils, Foodstuffs, and Biota Environmental Surveillance Team of LANL’s Meteorology and Air Quality Group collected 15 soil surface samples and up to nine overstory and understory vegetation samples at locations within and around Area G at TA-54 (Figure 2). Table 1 describes each site in more detail. Other soil and
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.)
vegetation materials were collected west of Area G in the proposed expansion area (site identified as 8 in Figure 2 and Table 1); this site has been sampled for some time now for the purpose of gaining preoperational baseline data.

a. Soil Sampling

Over the years, two soil sampling strategies have been used at Area G to determine the pathway contributions of surface water runoff and fugitive dust. The first soil sampling strategy (1980 to present) involves collecting grab samples along the perimeter fence line and is focused on the possibility of contaminated sediment movement through surface-water runoff out of Area G (Conrad et al., 1995). The locations chosen represent the most sensitive to possible contaminant migration. The second soil sampling strategy (1996 to present) involved collecting composite samples

<table>
<thead>
<tr>
<th>Location Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>South of 3H shafts immediately outside the Area G fence</td>
</tr>
<tr>
<td>2</td>
<td>West of the high-level 3H shafts immediately outside the Area G fence</td>
</tr>
<tr>
<td>3</td>
<td>East of Pit 38 (inside the Area G fence)</td>
</tr>
<tr>
<td>3b</td>
<td>North of Pit 38 outside the Area G fence</td>
</tr>
<tr>
<td>4</td>
<td>Outside the Area G fence north of the transuranic (TRU) Waste Pads 2 and 4</td>
</tr>
<tr>
<td>6b</td>
<td>Southeast of TRU Waste Pad 4 outside Area G fence</td>
</tr>
<tr>
<td>7a</td>
<td>Southeastern portions of Pits 17 and 18 (inside the Area G fence)</td>
</tr>
<tr>
<td>7b</td>
<td>East end of Pit 7 (inside the Area G fence)</td>
</tr>
<tr>
<td>7c</td>
<td>North of Pit 8 outside the Area G fence</td>
</tr>
<tr>
<td>G-29-03</td>
<td>Southwest of Pit 22 (outside the Area G fence)</td>
</tr>
<tr>
<td>G-31-01</td>
<td>Southeast of Disposal Trench C (outside the Area G fence)</td>
</tr>
<tr>
<td>G-41-02</td>
<td>East of the eastern end of Pit 2 and TRU Waste Pad 4 (outside the Area G fence)</td>
</tr>
<tr>
<td>G-43-01</td>
<td>North of TRU Waste Pad 2 (outside the Area G fence)</td>
</tr>
<tr>
<td>G-48-02</td>
<td>North of Pit 10 (outside the Area G fence)</td>
</tr>
<tr>
<td>G-58-01</td>
<td>North of western end of Pit 38 near gate (outside the Area G fence)</td>
</tr>
<tr>
<td>8</td>
<td>Proposed expansion area is one-half mile west of the entrance gate to Area G</td>
</tr>
</tbody>
</table>

Table 1. Sampling Locations Used in 2005 and Shown on Figure 2.
over a larger area within and outside the perimeter of Area G to determine the amount of contaminants as a result of fugitive dust (Fresquez et al., 1997). The methods of collection of the two soil sampling strategies are the following:

1. Samples prefixed with the letter G were collected as a grab sample from the top 15 cm (6 in.) of the soil surface with either a stainless steel or a disposable polystyrene scoop. These samples were placed into 500-mL (17-oz.) poly bottles.

2. Samples prefixed with a number 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 11.4-L (three-gallon) Ziploc® bag, and a subsample from the composite was placed in a 500-mL (17-oz.) poly bottle.

All soil samples were submitted under full chain-of-custody to Paragon Analytics, Inc., for analysis of \(^{3}H\), \(^{238}Pu\), \(^{239,240}Pu\), \(^{234}U\), \(^{235}U\), \(^{238}U\), and \(^{241}Am\). All quality assurance/quality control requirements were met by Paragon Analytics, Inc. All methods of radiochemical analyses have been described previously (Fresquez et al., 1997; Childs and Conrad, 1997) and the methods for estimating Total Propagated Analytical Uncertainty (TPU) for all radiometric analyses were described in detail previously (Nyhan et al., 2002). Radionuclide results were reported in pCi/mL of soil moisture for \(^{3}H\) and pCi/g dry soil for all the others.

b. Plant Sampling

Samples of overstory vegetation, mostly juniper trees, and understory vegetation, mostly grasses and forbs, were collected. Overstory and understory samples were collected at all sampling locations from the same 10- by 10-m plots as the soil composite samples. (Note: In past years both piñon pine and juniper trees were sampled, but in 2004 most piñon pine trees died because of a severe insect infestation coupled with drought. Therefore, only juniper trees are sampled in this study.) Samples of the overstory consisted of the tips of tree shoots approximately 2.5 to 5.1 cm (1 to 2 in.) in length,
which were collected at a height of 1.3 to 1.6 m (4 to 5 ft); whereas, samples of the
understory plants consisted of clippings of the top growth cut at the soil level.

Personnel collecting samples wore plastic gloves and used clean shears to clip
vegetation; gloves and shears were decontaminated (washed with soap and water)
between sampling locations. Vegetation clippings ranged from 0.9 to 1.4 kg (2 to 3 lb) of
composited material, which was placed in labeled double-bagged Ziploc® plastic bags
and transported to the laboratory in a locked ice chest. Each sample was divided into two
subsets to provide enough material for $^3$H analysis and for the other radionuclides.
Samples were not washed and thus represent the total concentration of radionuclides
deposited on the plant surfaces by rain splash 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 (34-oz.) glass beaker and slowly ashed at
500°C (932°F) for 40 h. The ashed sample was pulverized and homogenized, then
transferred to labeled 500-mL (17-oz.) poly bottles, and submitted with the distillate
samples under full chain-of-custody to Paragon Analytics, Inc., for the analysis of $^3$H,
$^{238}$Pu, and $^{239,240}$Pu; all quality assurance/quality control requirements were met. All
methods of radiochemical analyses have been described previously (Fresquez et al.,
1996). Radionuclide results were reported in pCi/mL of tissue moisture for $^3$H and pCi/g
ash for the plutonium isotopes. Results reported in grams of ash are usually two to four
orders of magnitude greater than live (wet) weight. To convert units on a per gram ash
weight basis to a wet weight basis for dose assessments, see Fresquez et al. (2004) for
moisture conversion ratios for the various plant groups.

**c. Determining the Composition of Uranium**

To determine the source of U in soils at the 99% confidence level, the U isotopic
distribution of $^{234}$U and $^{238}$U, which for naturally occurring U is one, was assessed using
the following steps: (1) the difference between $^{234}$U and $^{238}$U was calculated, (2) the
squares of their uncertainties were summed and then the square root of this number was
taken, (3) the $^{234}\text{U}$ and $^{238}\text{U}$ difference was divided by the pooled square root, (4) if the result was greater than 3, then it was observed whether the $^{234}\text{U}$ value or the $^{238}\text{U}$ value was larger, (5) if the $^{234}\text{U}$ value was larger, then excess enriched U was indicated. Conversely, if the $^{238}\text{U}$ value was larger, then excess depleted U was indicated.

**d. Soil and Plant Standards**

To evaluate Area G impacts from detectable (the result is greater than three times the TPU) radionuclides, the analytical results of soil and plant samples collected from the facility are first compared to Regional Statistical Reference Levels (RSRLs). RSRLs are the upper-level background concentration (mean plus three standard deviations = 99% confidence level) for radionuclides calculated from soil and vegetation data collected from regional background locations away from the influence of the Laboratory over the past five years and represent natural and fallout sources (Fresquez and Gonzales, 2004).

Where the levels exceed RSRLs, the concentrations are then compared to the screening levels (SLs). For soils, the SLs were developed by the Environmental Restoration Project at LANL to identify contaminants of concern (i.e., an investigative action level) on the basis of a conservative (e.g., residential) 15-mrem protective dose limit (ER, 2002). For vegetation, the SLs were developed by the Meteorology and Air Quality Group dose assessment team at the Laboratory to identify the contaminants of concern at 10% of the standard.

Finally, if a contaminant exceeds the SL then it is compared to the standard. For soils, the measured concentrations are used to calculate a per-person dose with the help of the RESRAD computer model (Yu et al., 1995). The calculated dose is based on a residential scenario and assumes soil ingestion, inhalation of suspended dust, and ingestion of homegrown fruits and vegetables as the primary exposure pathways for one or more radionuclides. The unit conversions, input parameters, model and parameter assumptions, and the uncertainty analysis that are used can be found in Fresquez et al. (1996). This calculated per-person dose is compared to the 100-mrem/yr U.S. Department of Energy (DOE) standard (U.S. DOE, 1993). For vegetation, the measured concentrations are used to calculate a dose according to U.S. DOE (2002) and compare it
with the 1 rad/d DOE dose standard for terrestrial plants. Table 2 summarizes the levels and/or standard used to evaluate the soil and vegetation monitoring program at Area G.

### Table 2. Application of Soil and Vegetation Standards and Other Reference Levels to Area G Radionuclide Monitoring Data.

<table>
<thead>
<tr>
<th>Media</th>
<th>Standard</th>
<th>Screening Level</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>100 mrem/y</td>
<td>15 mrem/y</td>
<td>RSRL</td>
</tr>
<tr>
<td>Vegetation</td>
<td>1 rad/d</td>
<td>0.1 rad/d</td>
<td>RSRL</td>
</tr>
</tbody>
</table>

### 3. RESULTS

**a. Radionuclide Concentrations in Soils**

Results of radionuclide concentrations in soils are given in Table 3. The chain-of-custody records and Paragon Analytics, Inc., analytical reports are included in Appendix A for reference.

Concentrations of $^3$H in soils were detected above the RSRL in four of the 15 soil samples collected. These results are similar to those detected in past years, particularly in the southern portion of Area G where the $^3$H shafts are located (Nyhan et al., 2004; Fresquez et al., 2004). All results, however, are far below the SL of 6,400 pCi/mL.

Many of the soil samples collected at Area G, particularly around the perimeter of the north and northeastern sections, contained $^{241}$Am (eight out of 15), $^{238}$Pu (seven out of 15), and $^{239,240}$Pu (nine out of 15) above RSRLs. The highest concentrations of $^{241}$Am (0.41 pCi/g dry), $^{238}$Pu (3.1 pCi/g dry), and $^{239,240}$Pu (1.1 pCi/g dry) were detected in a soil grab sample located on the perimeter of the northeastern corner of Area G. All concentrations were below SLs, however.

Only one uranium isotope, $^{234}$U, out of 45 values was higher than the RSRL (1.4 vs 1.3 pCi/g dry) and the ratio of $^{234}$U to $^{238}$U in all of the soil samples collected indicated natural sources. These data are very similar to last year’s results.

**b. Radionuclide Concentrations in Plants**

Tables 4 and 5 show $^3$H, $^{238}$Pu, and $^{239,240}$Pu concentrations in unwashed overstory and understory vegetation, respectively, collected from within and around Area G during
the 2005 growing season. The Paragon Analytics, Inc., analytical reports are included in Appendix B for reference.

In general, all concentrations of radionuclides in overstory and understory vegetation collected from within and around Area G are very low and most were not greater than both the TPU and RSRL values. As in previous years, the highest concentrations of $^3$H in vegetation were observed on the southern perimeter of Area G adjacent to the $^3$H shafts (Sites 1 and 2) (Nyhan et al., 2004; Fresquez et al., 2004; Fresquez and Lopez, 2004). Similarly, the highest concentrations of $^{238}$Pu and $^{239,240}$Pu in vegetation were detected in samples collected from the north (Site 7c) and northeastern (Site 4) regions of Area G. All radionuclides, however, were below SLs.

4. CONCLUSIONS

All concentrations of radionuclides in soils and plants collected at Area G were low and below SLs and regulatory standards. Therefore, exposure to radionuclides in Area G soils and vegetation poses little risk to humans and the environment.

ACKNOWLEDGMENTS

Thanks to Louis Naranjo, Jr., for sample collection and processing. Also, special thanks to Hector Hinojosa for editing and to Teresa Hiteman for composition work.
Table 3. Radionuclide Concentrations (TPU, 99% confidence level) in Soils Collected from Area G in 2005.
(Bold values are greater than the TPU and RSRL.)

<table>
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<tr>
<th>Location</th>
<th>(^{210})Pb (pCi/mL)</th>
<th>(^{241})Am (pCi/g dry)</th>
<th>(^{238})Pu (pCi/g dry)</th>
<th>(^{239,240})Pu (pCi/g dry)</th>
<th>(^{234})U (pCi/g dry)</th>
<th>(^{235})U (pCi/g dry)</th>
<th>(^{238})U (pCi/g dry)</th>
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<tr>
<td>1</td>
<td>7.4</td>
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<td>0.041</td>
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<td>0.044</td>
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<td>(0.021)</td>
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Table 3 (cont.)

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<thead>
<tr>
<th>Location</th>
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<th>$^{241}$Am (pCi/g dry)</th>
<th>$^{239}$Pu (pCi/g dry)</th>
<th>$^{238,240}$Pu (pCi/g dry)</th>
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<td>(0.26)</td>
<td>(0.027)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>Exp. (8)$^a$</td>
<td>0.08</td>
<td>0.0026</td>
<td>-0.0005</td>
<td>0.0057</td>
<td>0.79</td>
<td>0.059</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>(0.41)</td>
<td>(0.012)</td>
<td>(0.0083)</td>
<td>(0.011)</td>
<td>(0.21)</td>
<td>(0.027)</td>
<td>(0.24)</td>
</tr>
<tr>
<td>RSRL$^b$</td>
<td>0.94</td>
<td>0.018</td>
<td>0.0070</td>
<td>0.032</td>
<td>1.3</td>
<td>0.12</td>
<td>1.4</td>
</tr>
<tr>
<td>SL$^c$</td>
<td>6,400$^e$</td>
<td>39</td>
<td>49</td>
<td>44</td>
<td>63</td>
<td>17</td>
<td>93</td>
</tr>
</tbody>
</table>

$^a$Expansion Area located just west of Area G. The data are being gathered for baseline use.

$^b$Regional Statistical Reference Level; this is the upper-limit background concentration (mean plus three standard deviations) based on data from 1999 through 2003 (Fresquez, 2004).

$^c$Los Alamos National Laboratory Screening (investigative) Level based on RESRAD version 6.21 (ER, 2001).
Table 4. Radionuclide Concentrations (TPU, 99% confidence level) in Unwashed Overstory Vegetation Collected from Area G in 2005. (Bold values are equal to or greater than both the TPU and RSRL values.)

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>$^3$H (pCi/mL)</th>
<th>$^{238}$Pu (pCi/g ash)</th>
<th>$^{239,240}$Pu (pCi/g ash)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>73 (17)</td>
<td>-0.0004 (0.0069)</td>
<td>0.0073 (0.0096)</td>
</tr>
<tr>
<td>2</td>
<td>598 (137)</td>
<td>0.0081 (0.011)</td>
<td>0.017 (0.015)</td>
</tr>
<tr>
<td>3</td>
<td>1.1 (0.56)</td>
<td>0.0052 (0.0095)</td>
<td>0.020 (0.017)</td>
</tr>
<tr>
<td>3b</td>
<td>0.26 (0.44)</td>
<td>0.0029 (0.0078)</td>
<td>0.0049 (0.0089)</td>
</tr>
<tr>
<td>4</td>
<td>0.34 (0.42)</td>
<td><strong>0.013 (0.015)</strong></td>
<td><strong>0.16 (0.062)</strong></td>
</tr>
<tr>
<td>6b</td>
<td>-0.03 (0.45)</td>
<td>0.0013 (0.0072)</td>
<td>0.020 (0.017)</td>
</tr>
<tr>
<td>7c</td>
<td>2.2 (0.69)</td>
<td><strong>0.034 (0.023)</strong></td>
<td>0.043 (0.027)</td>
</tr>
<tr>
<td>Expansion area (8)</td>
<td>0.37 (0.48)</td>
<td>-0.0007 (0.0068)</td>
<td>0.0012 (0.0068)</td>
</tr>
<tr>
<td><strong>RSRL</strong></td>
<td><strong>0.72</strong></td>
<td><strong>0.013</strong></td>
<td><strong>0.070</strong></td>
</tr>
</tbody>
</table>

*Regional Statistical Reference Level; this is the upper-limit background concentration (mean plus three standard deviations) based on data from 1998 through 2003 (Fresquez and Gonzales, 2004).*

Table 5. Radionuclide Concentrations (TPU, 99% confidence level) in Unwashed Understory Vegetation Collected from Area G in 2005. (Bold values are equal to or greater than both the TPU and RSRL values.)

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>$^3$H (pCi/mL)</th>
<th>$^{238}$Pu (pCi/g ash)</th>
<th>$^{239,240}$Pu (pCi/g ash)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>97 (23)</td>
<td>-0.0008 (0.0075)</td>
<td>0.0041 (0.0075)</td>
</tr>
<tr>
<td>2</td>
<td>1700 (390)</td>
<td>-0.0004 (0.0069)</td>
<td>0.0085 (0.010)</td>
</tr>
<tr>
<td>3</td>
<td>0.83 (0.60)</td>
<td><strong>0.0066 (0.0090)</strong></td>
<td>0.0097 (0.012)</td>
</tr>
<tr>
<td>3b</td>
<td>0.33 (0.50)</td>
<td>0.0014 (0.0074)</td>
<td>0.0015 (0.0074)</td>
</tr>
<tr>
<td>4</td>
<td>0.47 (0.56)</td>
<td>0.034 (0.023)</td>
<td><strong>0.063 (0.032)</strong></td>
</tr>
<tr>
<td>6b</td>
<td>0.03 (0.39)</td>
<td>-0.0018 (0.0092)</td>
<td>0.0062 (0.010)</td>
</tr>
<tr>
<td>7a</td>
<td>2.6 (0.83)</td>
<td><strong>0.0067 (0.0095)</strong></td>
<td>0.0037 (0.0068)</td>
</tr>
<tr>
<td>7b</td>
<td>1.8 (0.83)</td>
<td>0.019 (0.017)</td>
<td>0.0068 (0.0093)</td>
</tr>
<tr>
<td>7c</td>
<td>1.9 (0.63)</td>
<td>0.043 (0.026)</td>
<td><strong>0.12 (0.048)</strong></td>
</tr>
<tr>
<td>Expansion area (8)</td>
<td>0.30 (0.47)</td>
<td>-0.0003 (0.0072)</td>
<td>0.0009 (0.0072)</td>
</tr>
<tr>
<td><strong>RSRL</strong></td>
<td><strong>3.6</strong></td>
<td><strong>0.0049</strong></td>
<td><strong>0.015</strong></td>
</tr>
</tbody>
</table>

*Regional Statistical Reference Level; this is the upper-limit background concentration (mean plus three standard deviations) based on data from 1998 through 2003 (Fresquez and Gonzales, 2004).*
REFERENCES


APPENDIX A

ANALYTICAL DATA REPORTS OF RADIONUCLIDE CONCENTRATIONS IN SOILS COLLECTED AT AREA G DURING 2005
# Environmental Surveillance Team Chain of Custody Record

**Project Contact:** Phil Fresquez  
**Contact Phone:** (505) 667-0815  
**Project Name:** Facility Sampling (soils, sediments)  
**Cost Center:** TC2000  
**Program Code:** 097548  
**Cost Account:** 05404503  
**Creation Date:** 5/2/2005

<table>
<thead>
<tr>
<th>USI</th>
<th>Date Collected</th>
<th>Time Collected</th>
<th>Location Name</th>
<th>Number of Samples</th>
<th>Analysis Requested</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| 493  | 6/11/2005      | 11:00          | 3b            | 1                 | 3H, Am, 241        | East of Pit 18 inside Area G fence.  
| 486  | 6/12/2005      | 11:20          | 7d            | 1                 | 120                 | East of Pit 18 inside Area G fence.  
| 487  | 6/12/2005      | 11:20          | 4             | 1                 | 120                 | East of Pit 28 outside Area G fence.  
| 488  | 7/4/2005       | 12:00          | 6b            | 1                 | 120                 | East of Pit 18 inside Area G fence.  
| 489  | 6/13/2005      | 1:50           | 7a            | 1                 | Detection level HOC | East of Pit 28 inside Area G fence.  
| 490  | 6/13/2005      | 1:50           | 7b            | 1                 | 0.02                | East of Pit 18 inside Area G fence.  
| 491  | 6/13/2005      | 1:45           | 8             | 1                 | 0.02                | East of Pit 28 inside Area G fence.  

**Releasings:**
- **Louis Naranjo Jr.**  
  **Received by:** (print and sign)  
  **Time:** 6/11/2005 10:00  

**Samplers (print names and initials):**  
- Louis Naranjo Jr.  
- Glenda S.  
- Fred G.  
- Raymond Martinez RM  
- Gilbert Pineda GCH  
- Leon Tafolla KT

**Comments:**

*Monday, May 02, 2005*
# Environmental Surveillance Team Chain of Custody Record

**Chain of Custody Number:** 89  
**Creation Date:** 5/2/2005

### Project Details
- **Project Contact:** Phil Fresquez  
- **Project Name:** Facility Sampling (soils, sediments)  
- **Cost Center:** TC2000  
- **Program Code:** 6367 C341B  
- **Cost Account:** 16410400 3A00/9760  
- **Location:** TA-54 Area G Grab sample (soil)

### Samples
<table>
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<th>Number of Samples</th>
<th>Analysis Requested</th>
<th>Remarks</th>
<th>Field ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>494</td>
<td>5/6/2005</td>
<td>11:15</td>
<td>G-58-01</td>
<td>1</td>
<td>Bq, Am-241</td>
<td>NW end of P7 3F (outside fence)</td>
<td>.01</td>
</tr>
<tr>
<td>495</td>
<td>5/6/2005</td>
<td>11:20</td>
<td>G-48-02</td>
<td>1</td>
<td>ISO Pu</td>
<td>West of P6 pad 2 outside fence</td>
<td>.02</td>
</tr>
<tr>
<td>496</td>
<td>5/6/2005</td>
<td>11:00</td>
<td>G-49-01</td>
<td>1</td>
<td>ISO U</td>
<td>West of P7 pad 2 outside fence</td>
<td>.03</td>
</tr>
<tr>
<td>497</td>
<td>5/6/2005</td>
<td>11:35</td>
<td>G-41-02</td>
<td>1</td>
<td></td>
<td>East of P7 pad 2 outside fence</td>
<td>.04</td>
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<tr>
<td>498</td>
<td>5/6/2005</td>
<td>3:00</td>
<td>G-27-05</td>
<td>1</td>
<td>Detection level MDC</td>
<td>Southeast of P7 pad 2 outside fence</td>
<td>.05</td>
</tr>
<tr>
<td>499</td>
<td>5/6/2005</td>
<td>3:45</td>
<td>G-31-01</td>
<td>1</td>
<td>Am = 0.02</td>
<td>Southeast of disposal tank fence</td>
<td>.06</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>ISO Pu = 0.02</td>
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<td>.07</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>ISO U = 0.01</td>
<td></td>
<td>.08</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bq = 400 PC/liter</td>
<td></td>
<td>.09</td>
</tr>
</tbody>
</table>

### Requisition Details
- **Requisitioned by (print and sign):** Louis Noronha Jr.  
- **Date:** 6/10/05  
- **Time:** 00:00

### Received Details
- **Received by (print and sign):** Louis Noronha Jr.  
- **Date:** 6/10/05  
- **Time:** 00:00

### Sample Analysis
- **Sampled by: Louis Noronha Jr.," Glenda Fred, Raymond Martinez PM, Gilbert Gutierrez, Louis Noronha Jr.**

### Comments
- **Monday, May 02, 2005**

---

**Page 1 of 1**
# Tritium Analysis By Liquid Scintillation Sample Results Summary

**Client Name:** ESH20 LANL  
**Client Project Name:** TA-55, Area G Grab sample (soil)  
**Client Project Number:** 7C2000 C348 3A00 9700  
**Laboratory Name:** Paragon Analytics  
**PAI Work Order:** 0508167  
**Page:** 1 of 2  
**Reported on:** Wednesday, July 20, 2005  
**12:48:17 PM**

<table>
<thead>
<tr>
<th>Lab Sample ID</th>
<th>Client Sample ID</th>
<th>Sample Type</th>
<th>Nuclide</th>
<th>Result +/- 2 s TPU</th>
<th>MDC</th>
<th>Units</th>
<th>Matrix</th>
<th>Prep Batch</th>
<th>Date Analyzed</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>0506167-1</td>
<td>88.484</td>
<td>Sample</td>
<td>H-3</td>
<td>0.10 +/- 0.27</td>
<td>0.45</td>
<td>pCi/ml</td>
<td>SOIL</td>
<td>3H050628-2</td>
<td>7/13/2005</td>
<td>U</td>
</tr>
<tr>
<td>0506167-2</td>
<td>88.485</td>
<td>Sample</td>
<td>H-3</td>
<td>0.55 +/- 0.29</td>
<td>0.45</td>
<td>pCi/ml</td>
<td>SOIL</td>
<td>3H050628-2</td>
<td>7/13/2005</td>
<td>LT</td>
</tr>
<tr>
<td>0506167-3</td>
<td>88.486</td>
<td>Sample</td>
<td>H-3</td>
<td>0.10 +/- 0.27</td>
<td>0.45</td>
<td>pCi/ml</td>
<td>SOIL</td>
<td>3H050628-2</td>
<td>7/13/2005</td>
<td>U</td>
</tr>
<tr>
<td>0506167-4</td>
<td>88.487</td>
<td>Sample</td>
<td>H-3</td>
<td>-0.01 +/- 0.27</td>
<td>0.45</td>
<td>pCi/ml</td>
<td>SOIL</td>
<td>3H050628-2</td>
<td>7/14/2005</td>
<td>U</td>
</tr>
<tr>
<td>0506167-5</td>
<td>88.488</td>
<td>Sample</td>
<td>H-3</td>
<td>0.39 +/- 0.28</td>
<td>0.45</td>
<td>pCi/ml</td>
<td>SOIL</td>
<td>3H050628-2</td>
<td>7/14/2005</td>
<td>U</td>
</tr>
<tr>
<td>0506167-6</td>
<td>88.489</td>
<td>Sample</td>
<td>H-3</td>
<td>0.82 +/- 0.31</td>
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<td>pCi/ml</td>
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<td>0506167-7</td>
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<td>H-3</td>
<td>0.45 +/- 0.37</td>
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<td>pCi/ml</td>
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<td>0506167-9</td>
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<td>Sample</td>
<td>H-3</td>
<td>7.4 +/- 1.2</td>
<td>0.4</td>
<td>pCi/ml</td>
<td>SOIL</td>
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<td>7/14/2005</td>
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</table>

**Comments:**

**Data Package ID:** H30506167-1

**Qualifiers/Flags:**
- **U:** Result is less than the sample specific MDC.
- **LT:** Result is less than Requested MDC, greater than sample specific MDC.
- **Y:** Chemical Yield is in control at 100 +/- 10%. Quantitative Yield is assumed.
- **Y2:** Chemical Yield outside default limits.
- **M:** Pre-requested MDC was not met.
- **MR:** Pre-requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbriviations:**
- **TPU:** Total Propagated Uncertainty (see PAI SOP 743)
- **MDC:** Minimum Detectable Concentration (see PAI SOP 709)
- **BDL:** Below Detection Limit

**Data Printed:** Wednesday, July 20, 2005

**Paragon Analytics**

**LIMS Version:** 5.202A
# Tritium Analysis By Liquid Scintillation Sample Results Summary

Client Name: ESH20_LANL  
Client Project Name: TA-55, Area G Grab sample (soil)  
Laboratory Name: Paragon Analytics  
PAI Work Order: 0506167  
Page: 2 of 2  
Reported on: Wednesday, July 20, 2005  
12:48:18 PM  

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<th>MDC</th>
<th>Units</th>
<th>Matrix</th>
<th>Prep Batch</th>
<th>Date Analyzed</th>
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<td>Sample</td>
<td>H-3</td>
<td>0.08 +/- 0.27</td>
<td>0.45</td>
<td>pCi/ml</td>
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<td>7/14/2005</td>
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</table>

**Comments:**

**Data Package ID:** H30506167-1

**Qualifiers/Flags:**  
U - Result is less than the sample specific MDC,  
L - Result is less than Requested MDC, greater than sample specific MDC,  
Y - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
M - The requested MDC was not met.  
M2 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**  
TPU - Total Propagated Uncertainty (see PAI SOP 748)  
MDC - Minimum Detectable Concentration (see PAI SOP 709)  
BDL - Below Detection Limit

**Data Printed:** Wednesday, July 20, 2005

**Paragon Analytics**  
LIMS Version: 5.202A  
Page 2 of 2
# Tritium Analysis By Liquid Scintillation Sample Results Summary

**Client Name:** ESH20_LANL  
**Client Project Name:** TA-55, area G Grab sample (soil)  
**Client Project Number:** 7C2000 C348 3A00 9700  
**Laboratory Name:** Paragon Analytics  
**PAI Work Order:** 0506168  
**Reported on:** Wednesday, July 20, 2005 12:52:02 PM

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<th>Units</th>
<th>Matrix</th>
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<th>Date Analyzed</th>
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<td>0506168-1</td>
<td>89.494</td>
<td>Sample</td>
<td>H-3</td>
<td>0.09 +/- 0.27</td>
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<td>pCi/ml</td>
<td>SOIL</td>
<td>3H500628-2</td>
<td>7142005</td>
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<td>0506168-2</td>
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<td>Sample</td>
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<td>pCi/ml</td>
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<td>7142005</td>
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<td>89.496</td>
<td>Sample</td>
<td>H-3</td>
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<td>3H500628-2</td>
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<tr>
<td>0506168-6</td>
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<td>Sample</td>
<td>H-3</td>
<td>9.9 +/- 1.6</td>
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<td>pCi/ml</td>
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**Comments:**

**Data Package ID:** H30506168-1

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<tr>
<td>LT</td>
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</tr>
<tr>
<td>Y1</td>
<td>Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.</td>
</tr>
<tr>
<td>Y2</td>
<td>Chemical Yield outside default limits.</td>
</tr>
<tr>
<td>M</td>
<td>The requested MDC was not met.</td>
</tr>
<tr>
<td>MD</td>
<td>The requested MDC was not met, but the reported activity is greater than the reported MDC.</td>
</tr>
</tbody>
</table>

**Abbreviations:**

TPU - Total Propagated Uncertainty (see PAI SOP 740)  
MDC - Minimum Detectable Concentration (see PAI SOP 709)  
BDL - Below Detection Limit

**Date Printed:** Wednesday, July 20, 2005  
**Paragon Analytics**  
**LIMS Version:** 5.202A
Isotopic Americium By Alpha Spectroscopy Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: TA-55, Area G Grab sample (soil)
Client Project Number: 7C2000 C348 3A00 9700

Laboratory Name: Paragon Analytics
PAI Work Order: 0506167
Reported on: Tuesday, July 19, 2005 1:27:20 PM

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<th>MDC</th>
<th>Units</th>
<th>Matrix</th>
<th>Prep Batch</th>
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<th>Flags</th>
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Comments:

Data Package ID: am0506167-1

Abbreviations:
- TPU - Total Propagated Uncertainty (see PAI SOP 743)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)
- SOL - Below Detection Limit
- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
## Isotopic Americium By Alpha Spectroscopy Sample Results Summary

Client Name: ESH20_LANL  
Client Project Name: TA-55, Area G Grab sample (soil)  
Client Project Number: 7C2000 C34B 3A09 9700  
Laboratory Name: Paragon Analytics  
PAI Work Order: 0506167  
Page: 2 of 2  
Reported on: Tuesday, July 19, 2005  
1:27:20 PM

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Comments:

**Data Package ID: am0506167-1**

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<th>Abbreviations:</th>
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<td>U - Result is less than the sample specific MDC.</td>
<td>TPU - Total Propagated Uncertainty (see PAI SOP 743)</td>
</tr>
<tr>
<td>LT - Result is less than Requested MDC, greater than sample specific MDC.</td>
<td>MDC - Minimum Detectable Concentration (see PAI SOP 706)</td>
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<td>Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.</td>
<td>BD - Below Detection Limit</td>
</tr>
<tr>
<td>Y2 - Chemical Yield outside default limits.</td>
<td></td>
</tr>
<tr>
<td>M - The requested MDC was not met.</td>
<td></td>
</tr>
<tr>
<td>MO - The requested MDC was not met, but the reported activity is greater than the reported MDC.</td>
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</tbody>
</table>
## Isotopic Americium By Alpha Spectroscopy Sample Results Summary

**Client Name:** ESH20_LANL  
**Client Project Name:** TA-55, Area G Grab sample (soil)  
**Client Project Number:** 7C2200 C34B 3A00 9700

**Laboratory Name:** Paragon Analytics  
**PAI Work Order:** 0506168  
**Reported on:** Tuesday, July 19, 2005 1:34:38 PM

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<td>0506168-3</td>
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**Comments:**

**Data Package ID:** am0506168-1

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**Qualifiers/Flags:**

- **U:** Result is less than the sample specific MDC.
- **LT:** Result is less than Requested MDC, greater than sample specific MDC.
- **Y1:** Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- **Y2:** Chemical Yield outside default limits.
- **W:** The requested MDC was not met.
- **X:** The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- **TGU:** Total Propagated Uncertainty (see PAI SOP 740)
- **MDC:** Minimum Detectable Concentration (see PAI SOP 709)
- **BDL:** Below Detection Limit

---

**Date Printed:** Tuesday, July 19, 2005  
**Paragon Analytics**  
**LIMS Version:** 5.202A
# Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

**Client Name:** ESH20_LANL  
**Client Project Name:** TA-55, Area G Grab sample (soil)  
**Client Project Number:** 7C2000 C34B 3A00 9700

**Laboratory Name:** Paragon Analytics  
**PAI Work Order:** 0506167  
**Page:** 1 of 3  
**Reported on:** Tuesday, July 19, 2005, 1:29:50 PM

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**Comments:**

**Data Package ID:** pu0506167-1

**Qualifier/Flags:**
- J - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- V - The requested MDC was not met.
- VD - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- TPU - Total Promulgated Uncertainty (see PAI SOP 749)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)
- BDL - Below Detection Limit

**Date Printed:** Tuesday, July 19, 2005
### Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

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<th>Lab Sample ID</th>
<th>Client Sample ID</th>
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<th>Nuclide</th>
<th>Result +/- 2 s TPU</th>
<th>MDC</th>
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<th>Prep Batch</th>
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<td>0506167-6</td>
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**Comments:**

**Data Package ID:** pu0506167-1

**Qualifiers/Flags:**
- U - Result is less than the sample specific MCC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- BDL - Below Detection Limit

**Abbreviations:**
- TPU - Total Propagated Uncertainty (see PAI SOP 743)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)

**Date Printed:** Tuesday, July 19, 2005
Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

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<th>Lab Sample ID</th>
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Comments:

Data Package ID: pu0506167-1

1/ Result is less than the sample specific MDC.
L1 - Result is less than Requested MDC, greater than sample specific MDC.
C1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
C2 - Chemical Yield outside default limits.
C3 - The requested MDC was not met.
C4 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)
BDL - Below Detection Limit

Date Printed: Tuesday, July 19, 2005
# Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

Client Name: ESH20_LANL  
Client Project Name: TA-55, Area G Grab sample (soil)  
Laboratory Name: Paragon Analytics  
PAI Work Order: 05006168  
Reported on: Tuesday, July 19, 2005, 1:32:08 PM

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Data Package ID: pu0506168-1

Qualifiers/Flags:
- $^y$ - Result is less than the sample specific MDC
- $^t$ - Result is less than Requested MDC, greater than sample specific MDC
- $^y1$ - Chemical Yield is in control at 100.110%. Quantitative Yield is assumed
- $^y2$ - Chemical Yield outside default limits
- $^U$ - The requested MDC was not met.
- $^N$ - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- TPU - Total Propagated Uncertainty (see PAI SOP 745)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)
- BDL - Below Detection Limit
### Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

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**Comments:**

**Data Package ID:** pu0506168-1

**Qualifiers/Flags:**
- **U**: Result is less than the sample specific MDC.
- **LT**: Result is less than Requested MDC, greater than sample specific MDC.
- **Y1**: Chemical Yield is in control at 100-110%. Quantitative Yields assumed.
- **Y2**: Chemical Yield outside default limits.
- **M**: The requested MDC was not met.
- **BDL**: Below Detection Limit

**Abbreviations:**
- **TPU**: Total Propagated Uncertainty (see PAI SOP 743)
- **MDC**: Minimum Detectable Concentration (see PAI SOP 709)
- **BDL**: Below Detection Limit

**Date Printed:** Tuesday, July 19, 2005
## Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** ESH20_LANL  
**Client Project Name:** TA-55, Area G Grab sample (soil)  
**Client Project Number:** 7C2000 348 A00 9700  
**Laboratory Name:** Paragon Analytics  
**PAC Work Order:** 0506167  
**Page:** 1 of 4  
**Reported on:** Tuesday, July 19, 2005  
**2:00:43 PM**

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### Comments:

**Data Package ID:** ur0506167-1

**Qualifiers/Flags:**
- 0: Result is less than the sample specific MDC
- 1: Result is less than Requested MDC, greater than sample specific MDC
- 1Y: Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- 12: Chemical Yield outside default limits.
- M: The requested MDC was not met.
- W: The requested MDC was not met, but the reported activity is greater than the reported MDC.

### Abbreviations:
- TPU: Total Propagated Uncertainty (see PAC SOP 745)
- MDC: Minimum Detectable Concentration (see PAC SOP 700)
- BDL: Below Detection Limit
## Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** ESH02 Lanl  
**Client Project Name:** TA-55, Area G Grab sample (soil)  
**Client Project Number:** 7C2000 C34B 3A00 9700  
**Laboratory Name:** Paragon Analytics  
**P&I Work Order:** 0506167  
**Reported on:** Tuesday, July 19, 2005, 2:00:43 PM  

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**Comments:**

**Data Package ID:** ur0506167-1

**Qualifiers/Flags:**
- J: Result is less than the sample specific MDC.
- T: Result is less than Requested MDC, greater than sample specific MDC.
- F1: Chemical Yield is in control at 90-110%. Quantitative Yield is assumed.
- F2: Chemical Yield outside defined limits.
- A: The requested MDC was not met.
- AS OT: The measured MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- TPU: Total Propagated Uncertainty (see PAI SOP 743)
- MDC: Minimum Detectable Concentration (see PAI SOP 705)
- BDL: Below Detection Limit

**Date Printed:** Tuesday, July 19, 2005  
**Page 2 of 4**
# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** ESH20_LANL  
**Client Project Name:** TA-55, Area G Grab sample (soil)  
**Laboratory Name:** Paragon Analytics  
**Client Project Number:** 7C2000 C34B 3A00 9700  
**Reported on:** Tuesday, July 19, 2005  
**Page:** 3 of 4  

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**Comments:**

**Data Package ID:** ur0506167-1

**Qualifiers/Flags:**

- 7: Result is less than the sample specific MDC
- 8: Result is greater than sample specific MDC
- 97: Chemical Yield is in percent at 70-110%. Quantitative Yield is assumed
- 92: Chemical Yield outside default limits
- 8: The requested MDC was not met.
- 55: Measured MDC was not met, but the reported activity is greater than the required MDC.

**Abbreviations:**

- TPU: Total Propagated Uncertainty (see PAI SOP 743)
- MDC: Minimum Detectable Concentration (see PAI SOP 709)
- BDL: Below Detection Limit
## Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** ESH20_LANL  
**Client Project Name:** TA-55, Area G Grab sample (soil)  
**Client Project Number:** 7C2000 C34B 3A00 9700  
**Laboratory Name:** Paragon Analytics  
**PAI Work Order:** 0606167  
**Reported on:** Tuesday, July 19, 2005, 2:00:43 PM

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### Comments:

**Data Package ID:** ur0506167-1

**Abbreviations:***

- **TPU:** Total Propagated Uncertainty (see PAI SOP 743)
- **MDC:** Minimum Detectable Concentration (see PAI SOP 709)

- **BDL:** Below Detection Limit

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**Date Printed:** Tuesday, July 19, 2005  
**Paragon Analytics**  
**LIMS Version:** 5.202A
# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

Client Name: ESH20_LANL  
Client Project Name: TA-55, Area G Grab sample (soil)  
Client Project Number: 7C2000 C34B 3A00 9700  
Laboratory Name: Paragon Analytics  
PAI Work Order: 0006168  
Reported on: Tuesday, July 26, 2005  
3:45:30 PM

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<td>89.495</td>
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<td>U-234</td>
<td>0.93 +/- 0.16</td>
<td>0.01</td>
<td>pCi/g</td>
<td>SOIL</td>
<td>AS050705-1</td>
<td>7/15/2005</td>
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<td>Sample</td>
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<td>0.94 +/- 0.16</td>
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<td>7/15/2005</td>
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**Comments:**

**Data Package ID:** ur0506168-1

**Qualifiers/Flags:**
- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - The requested MDC was not met.
- V0 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- TPU - Total Propagated Uncertainty (see PAI SOP 741)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)
- BD - Below Detection Limit
# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** ESH20_LANL  
**Client Project Name:** TA-55, Area G Grab sample (soil)  
**Client Project Number:** 7C2000 C34B 3A00 9700  
**Laboratory Name:** Paragon Analytics  
**PAI Work Order:** 0506168  
**Date Analyzed:** 7/20/2005  
**Reported on:** Tuesday, July 26, 2005, 3:45:31 PM

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<th>Flags</th>
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<td>U-234</td>
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<td>0.94 +/- 0.17</td>
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## Comments:

**Data Package ID:** ur0506168-1

**Qualifiers/Flags:**
- **U:** Result is less than the sample specific MDC.
- **LT:** Result is less than Requested MDC, greater than sample specific MDC.
- **Y1:** Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- **Y2:** Chemical Yield outside default limits.
- **B:** The requested MDC was not met.
- **M3:** The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- **TPU:** Total Propagated Uncertainty (see PAI SOP 743)
- **MDC:** Minimum Detectable Concentration (see PAI SOP 709)
- **BDL:** Below Detection Limit
APPENDIX B

ANALYTICAL DATA REPORTS OF RADIONUCLIDE CONCENTRATIONS IN OVERSTORY AND UNDERSTORY VEGETATION COLLECTED AT AREA G DURING 2005
**Environmental Surveillance Team Chain of Custody Record**

**Project Contact:** Phil Fresquez  
**Contact Phone:** (505) 667-0815  
**Project Name:** Facility Sampling (soil, sediments & R-54 Vegetation oversite)  
**Cost Center:** TC2000  
**Program Code:** C357  
**Cost Account:** 05404E03

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<th>Date Collected</th>
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<th>Location Name</th>
<th>Number of Samples</th>
<th>Analysis Requested</th>
<th>Remarks</th>
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<td>3b</td>
<td>1</td>
<td>Number of fit 38 outside fence</td>
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<td>8</td>
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<td>700 pCi/ml</td>
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Replenished by (print and sign):  
Louis Narayandas  
Received by (print and sign):  
Carmelita  

Sampled by (print names and initial):  
Louis Narayandas, Victoria Martinez BL, Glenda Fred YY, Raymond Martinez RM, Gilbert Guzman MLM, Laurin Today K1

Comments:  
ASH VEGETATION OUTFRONT TA -54 AREA G / waters.

**Creation Date:** 05/03/2005
## Tritium Analysis By Liquid Scintillation Sample Results Summary

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<th>Matrix</th>
<th>Prep Batch</th>
<th>Date Analyzed</th>
<th>Flags</th>
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<td>0506164-10</td>
<td>91.511</td>
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<td>H-3</td>
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<td>pCi/ml</td>
<td>WATER</td>
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<td>0506164-11</td>
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<td>Sample</td>
<td>H-3</td>
<td>0.34 +/- 0.28</td>
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<td>pCi/ml</td>
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<td>3H0507061</td>
<td>7/14/2005</td>
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<td>0506164-12</td>
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<td>H-3</td>
<td>-0.03 +/- 0.30</td>
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<td>7/15/2005</td>
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<tr>
<td>0506164-13</td>
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<td>Sample</td>
<td>H-3</td>
<td>1.07 +/- 0.37</td>
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<td>pCi/ml</td>
<td>WATER</td>
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<td>7/19/2005</td>
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<tr>
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<td>WATER</td>
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<td>7/19/2005</td>
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**Comments:**

**Data Package ID:** H30506164-1

**Qualifiers/Flags:**
- **U:** Result is less than the sample specific MDC.
- **LT:** Result is less than Requested MDC, greater than sample specific MDC.
- **Y1:** Chemical Yield is in control at 100-110% Quantitative Yield is assumed.
- **Y2:** Chemical Yield outside default limits.
- **M:** The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- **TRU:** Total Reported Uncertainty (see PAI SOP 743)
- **MDC:** Minimum Detectable Concentration (see PAI SOP 709)
- **BDL:** Below Detection Limit

**Data Printed:** Wednesday, July 20, 2005

---

Paragon Analytics

LIMS Version: 5.202A
### Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

Client Name: ESH20_LANL  
Client Project Name: TA-54 Vegetation Oversory (OS)  
Client Project Number: 7C2000 C357 0540 4E03

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<th>MDC</th>
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<th>Prep Batch</th>
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<td>7/6/2005</td>
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<td>Pu-239/240</td>
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<td>Sample</td>
<td>Pu-239/240</td>
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<td>0.008</td>
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<td>0506164-5</td>
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**Comments:**

**Data Package ID:** pu0506164-1

**Qualifiers/Flags:**
- **U** - Result is less than the sample specific MDC.
- **LT** - Result is less than Requested MDC, greater than sample specific MDC.
- **Y1** - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- **Y2** - Chemical Yield outside default limits.
- **M** - The requested MDC was not met.

**Abbreviations:**
- **TPU** - Total Propagated Uncertainty (see PAI SOP 740)
- **MDC** - Minimum Detectable Concentration (see PAI SOP 799)
- **SDL** - Below Detection Limit

**Date Printed:** Tuesday, July 19, 2005

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**Paragon Analytics**

**LIMS Version:** 5.202A
# Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

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<th>MDC</th>
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<th>Flags</th>
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**Comments:**

**Data Package ID:** pu0506164-1

**Qualifiers/Flags:**
- **U**: Result is less than the sample specific MDC.
- **LT**: Result is less than Requested MDC, greater than sample specific MDC.
- **Y1**: Chemical Yield is in control at 90-110%. Quantitative Yield is assumed.
- **Y2**: Chemical Yield outside default limits.
- **M**: The requested MDC was not met.
- **M3**: The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- TPU: Total Propagated Uncertainty (see PAI SOP 740)
- MDC: Minimum Detectable Concentration (see PAI SOP 709)
- BDIX: Below Detection Limit

**Data Printed:** Tuesday, July 19, 2005  
**Paragon Analytics**  
**LIMS Version:** 5.2.02A
# Environmental Surveillance Team Chain of Custody Record

**Project Contact:** Phil Fresquez  
**Contact Phone:** (505) 667-0815  
**Project Name:** Facility Sampling (soil, sediments & TA-54 Area G (Vegetation))  
**Cost Center:** 7C2000

<table>
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<th>Time Collected</th>
<th>Location Name</th>
<th>Number of Samples</th>
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**Requisitioned by (print and sign):** Louis Narvaez Jr  
**Date:** 5/6/2005  
**Time:** 3:00 PM

**Received by (print and sign):**  
**Date:**  
**Time:**  

**Comments:**  
ASH VEGETATION - UNDERSTORY TA-54 AREA - GI / WATERS

Monday, May 02, 2005
## Tritium Analysis By Liquid Scintillation Sample Results Summary

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<th>Units</th>
<th>Matrix</th>
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<th>Date Analyzed</th>
<th>Flags</th>
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<td>Sample</td>
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<td>0506165-14</td>
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**Comments:**

**Data Package ID:** H30506166-1

**Qualifiers/Flags:**
- **U** - Result is less than the sample specific MDC.
- **LT** - Result is less than Requested MDC, greater than sample specific MDC.
- **Y1** - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- **Y2** - Chemical Yield outside default limits.
- **M** - The requested MDC was not met.
- **MW** - Requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- **TPU** - Total Propagated Uncertainty (see PAI SOP 743)
- **MDC** - Minimum Detectable Concentration (see PAI SOP 705)
- **BDL** - Below Detection Limit

**Date Printed:** Wednesday, July 20, 2005

**Paragon Analytics**

**LIMS Version:** 5.202A
# Tritium Analysis By Liquid Scintillation Sample Results Summary

**Client Name:** ESH20_LANL  
**Client Project Name:** TA-54 Area G (Vegetation Understory)  
**Client Project Number:** 7C2000 C357 0540 4E03  
**Laboratory Name:** Paragon Analytics  
**PAI Work Order:** 0506166  
**Page:** 2 of 2  
**Reported on:** Wednesday, July 20, 2005  
**12:33:02 PM**

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<th>Units</th>
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<th>Prep Batch</th>
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**Comments:**

**Data Package ID:** H30506166-1

**Qualifiers/Flags:**
- **U**: Result is less than the sample specific MDC.
- **LT**: Result is less than Requested MDC, greater than sample specific MDC.
- **Y1**: Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- **Y2**: Chemical Yield outside default limits.
- **MC**: Requested MDC was not met.
- **MR**: The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- **TPU**: Total Propagated Uncertainty (see PAI SOP 743)
- **MDC**: Minimum Detectable Concentration (see PAI SOP 709)

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**Printed:** Wednesday, July 20, 2005  
**Paragon Analytics**  
**LIMS Version:** 5.202A
## Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

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<td>Pu-238</td>
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### Comments:

**Data Package ID:** pu0506166-1

**Qualifiers/Flags:**
- **U:** Result is less than the sample specific MDC.
- **LT:** Result is less than Requested MDC, greater than sample specific MDC.
- **Y1:** Chemical Yield is in control at 100-110%. Quantitative Yields assumed.
- **Y2:** Chemical Yield outside default limits.
- **M:** The requested MDC was not met.
- **MC:** Pu requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**
- **TGU:** Total Propagated Uncertainty (see PAI SOP 745)
- **MDC:** Minimum Detectable Concentration (see PAI SOP 709)
- **SDL:** Below Detection Limit

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**Printed:** Tuesday, July 19, 2005

**LIMS Version:** 5.202A
## Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

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<td>7/6/2005</td>
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<td>0506166-6</td>
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**Comments:**

**Data Package ID:** pu0506166-1

**Qualifiers/Flags:**

- **U**: Result is less than the sample specific MDC.
- **LT**: Result is less than Requested MDC, greater than sample specific MDC.
- **Y1**: Chemical Yield is in control at 100-115%. Quantitative Yield is assumed.
- **Y2**: Chemical Yield outside default limits.
- **M**: The requested MDC was not met.
- **BDL**: Below Detection Limit

**Abbreviations:**

- **TTP**: Total Propagated Uncertainty (see PAI SOP 743)
- **MDC**: Minimum Detectable Concentration (see PAI SOP 705)

**Date Printed:** Tuesday, July 19, 2005

**Paragon Analytics**

**LIMS Version:** 5.020A
## Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

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### Comments:

Data Package ID: pu0506166-1

Qualifiers/Flags:

- **S** - Result is less than the sample specific MDC.
- **LT** - Result is less than Requested MDC, greater than sample specific MDC.
- **Y** - Chemical Yield is in control at 100% - 110%. Quantitative Yield is assumed.
- **LD** - Chemical Yield outside default limits.
- **R** - The requested MDC was not met.
- **RD** - The requested MDC was not met, but the reported activity is greater than the reported MDC.

Abbreviations:

- **TPU** - Total Propagated Uncertainty (see PAI SOP 743)
- **MDC** - Minimum Detectable Concentration (see PAI SOP 709)
- **BDL** - Below Detection Limit

### Data Printed:

- **Date Printed:** Tuesday, July 19, 2005
- **Paragon Analytics**
- **LIMS Version:** 5.202A