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Title: Sampling and Analysis Plan (SAP) for Assessment of LANL-Derived Residual Radionuclides in Soils within Tract A-16-d for Land Conveyance and Transfer

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# Sampling and Analysis Plan (SAP) for Assessment of LANL-Derived Residual Radionuclides in Soils within Tract A-16-d for Land Conveyance and Transfer

June 2015

With Addendum: February 2016

## 1.0 Background for A-16-D

### 1.1 Site Location

The A-16-D tract consists of the easternmost portion of DP mesa and is bounded on the North by the canyon bottom of DP canyon and on the South by the edge of the initial slope into Los Alamos Canyon (see Figure 1).

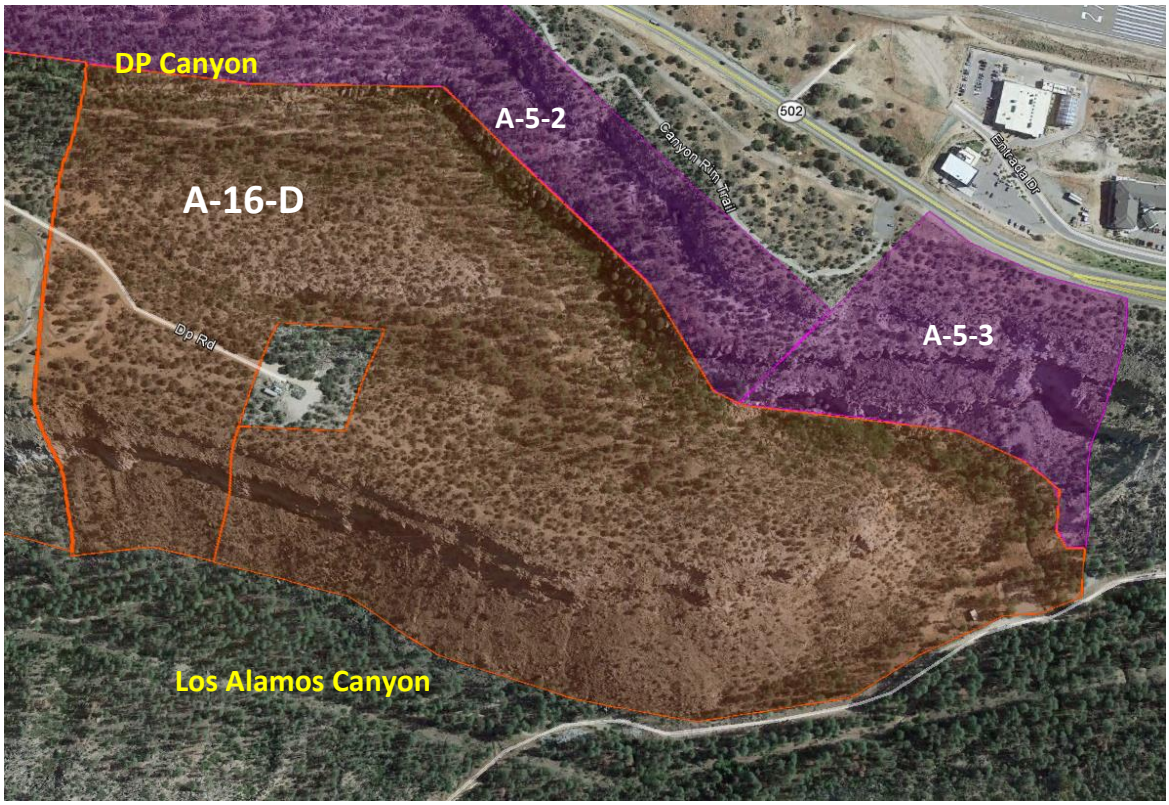


Figure 1. Aerial view of the A-16-D tract and its spatial relation to other Land Conveyance & Transfer tracts. The area in the center of the tract is excluded from this sampling plan for ongoing decontamination and decommissioning (D&D) work. ***Note:*** Map locations and boundaries are approximate.

DP Canyon has a watershed area of approximately 0.6 square miles and a channel length of approximately 1.5 miles. A small spring, DP Spring, is located near the bottom of DP Canyon and has a flow range from 0 L/min to 20 L/min. Streamflow in DP Canyon is intermittent, other than flow from the spring, and results from discharges of industrial effluent from outfalls and from storm water and snowmelt runoff. The tract contains sensitive wildlife habitat which is covered in a Biological Assessment[1].

[1] DP Canyon information was adapted from "Dose Assessment of LANL-Derived Residual Radionuclides in Soils Within Tract A-5-3 for Land Transfer Decisions" 2014. (LA-UR-14-26915) because of the proximity and similarity of this tract to Tract A-5-3. Additional information was obtained using the LANL Potential Release Site database: http://wesweb.lanl.gov/PRS/PRSMain.asp

Los Alamos Canyon runs west to east and is joined by DP Canyon in the north central portion of LANL. Streamflow in upper Los Alamos Canyon includes snowmelt runoff from the Sierra de Los Valles and runoff from rainstorms.

### 1.2 General History

Historical maps from the pre-LANL era (1924), aerial photographs (1935), and historical accounts of life in the area show little development prior to LANL occupancy (pre-World War II). Detroit businessman Ashley Pond started the "Los Alamos Ranch School" in 1917. The school began with a few ranch buildings from the Harold H. Brook homestead.

Laboratory operations began on DP Mesa in the late 1940s. Plutonium processing operations were conducted on DP Mesa in Technical Area-21. Additionally, waste disposal operations were conducted on the mesa top at areas now designated as Material Disposal Areas A, B, T, U, and V (MDA-A, MDA-B, etc. – see Figure 2).

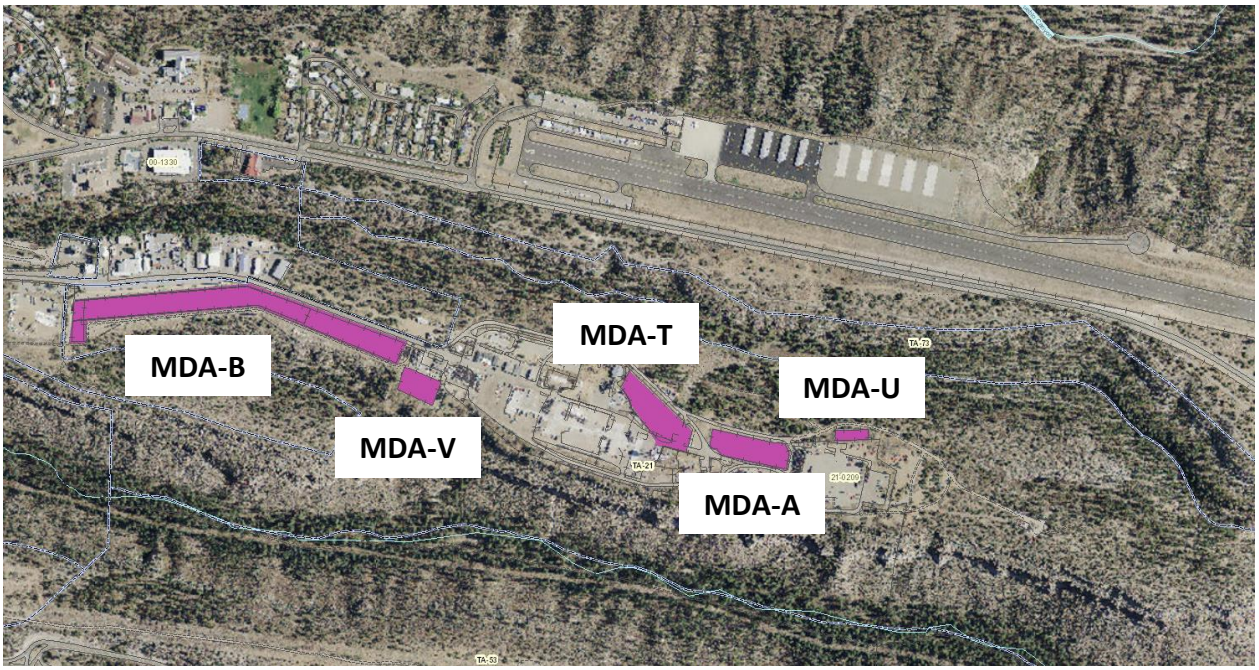

Figure 2. Approximate spatial locations of the MDAs at TA-21 (LANL Decision Support Application, 2015)

Tract A-16-D has remained vacant and undeveloped except for the placement of several structures associated with the TA21 Sewage Treatment Plant (STP), STP outfall, access road (DP road), and related infrastructure which reach this facility (see Section 1.3). The STP and related structures are scheduled for decontamination and decommissioning (D&D) and follow-up sampling will be needed prior to conveyance. For this reason, this sampling plan does not address sampling in the area of the STP. This information may be included as a later addendum to the plan after D&D activities are complete.

There are two Areas of Concern (AOCs) associated with the two canyon drainages and seven Potential Release Sites (PRSs) that intersect with the A-16-D tract (see Section 1.4).

### 1.3 Current Use

Tract A-16-D is unoccupied land and no LANL activities are conducted in the area. The former Sewage Treatment Plant for TA21 was located at the end of the mesa in the middle of the tract. These structures (see Figure 3) are included in LANL's footprint reduction program and are scheduled for removal in 2015-2016:

- 21-227
- 21-229
- 21-230
- 21-387
- Small concrete structures in the outfall – the larger one is a 6'x6' "UV treatment" sump that is approximately 10 feet deep
- Related infrastructure (power/sewer lines) which run through A-16-D to the STP – these items will be sampled in accordance with LANL procedure ENV-ES-TPP-001 during D&D activities, as the sampling in this plan will not specifically address potential contamination in the sewer lines

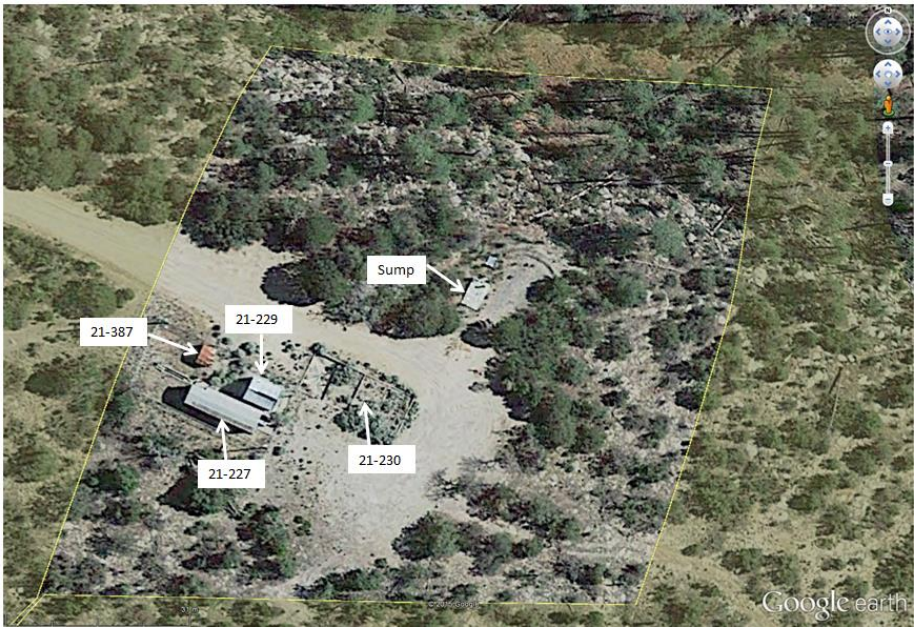

Figure 3. Structures associated with the TA21 STP (from Google Earth 2015)

The proposed D&D work would cut off the buildings 3 ft below ground surface and backfill with clean crushed rubble (meeting the residential standards for volumetric contamination) < 20" diameter. The fill above 3 feet would be clean soil. This procedure was conducted for several buildings in DP East with DOE approval.

### 1.4 Summary of Historical Evaluation of LANL Impact[2]

[2] Much of the information in this section is directly from the LANL Potential Release Site Database: http://wesweb.lanl.gov/PRS/PRSMain.asp

Tract A-16-D has the potential for contamination from activities conducted at LANL, and is considered radiologically "impacted." While the immediate area around the Sewage Treatment Plant (including the full outlined area around each of the associated PRSs) has been excluded from this plan, information on PRSs in the excluded area is included below for context.

The full area of the tract is included within the air shed Solid Waste Management Unit (SWMU) 21-021 associated with historical operations at TA-21. Stack emissions from TA-1 may have resulted in surface deposition of radionuclides, particularly plutonium and americium (LANL 2004). Available data indicate that the levels of contamination in sediments do not present a significant human health or ecological risk and that no remedial action is required prior to sampling for land conveyance.

Additional AOCs and PRSs include:

- **C-00-006** (Los Alamos Canyon)
- **C-00-021** (DP Canyon)
  DP Canyon enters TA-21 and continues until it joins Los Alamos Canyon along the boundary between TA-21 and TA-73 at an elevation of approximately 6620 feet. Previous environmental investigations at AOC C-00-021 include regular environmental monitoring that has been conducted in DP Canyon since the 1970s as part of the LANL Environmental Surveillance Program. Sediment samples containing elevated levels of Cesium-137, Plutonium-238/-239, Strontium-90, Thorium-230/-232, and Uranium-238 have been detected. Some concentrations exceeded screening levels. In addition, the Environmental Restoration Project has conducted numerous investigations in and around TA-21 in association with SWMUs/AOCs at TA-21. One of the most significant historical contamination sources at TA-21 is SWMU 21-011(k), which is an outfall that discharged effluent from the Radioactive Liquid Waste Treatment Facilities into DP Canyon from 1956 to 1985. SWMU 21-011(k) is upgradient of Tract A-16-D. Other potential contaminant sources at TA-21 include MDA A (SWMU 21-014), MDA T [consolidated unit 21-016(a)-99], MDA U [consolidated unit 21-017(a)-99], septic tanks and outfalls, and a petroleum product tank farm (SWMU 21-029).
- **21-013(a)** (see Figure 4) Disposal area for sand from the drying beds of the sanitary waste treatment plant.
- **21-013(c)** (see Figure 4) Former location of a surface disposal area located at the eastern end of DP Mesa. The site consisted only of construction debris, including piles of fill, asphalt, and concrete, an excavated trench, an earthen berm that contained scattered concrete, asphalt, and metal debris, and four large concrete pylons. Other surface debris included glass, scrap metal, wood, cans, paper, and plastic. It is not known when the materials were disposed of at this site. During a 1995 cleanup, all debris was removed.
- **21-026(a)** (see Figure 4) The sewage treatment plant 21-026 (a) treated sanitary waste and non-contact cooling water from TA-21 facilities.
- **21-026(b)** (see Figure 4) Treated effluent was discharged to sand filter/sludge drying beds.
- **21-026(c)** (see Figure 4) Chlorine contact chamber located next to the sewage plant.
- **21-026(d)** (see Figure 4) Outfall from Building 21-227.

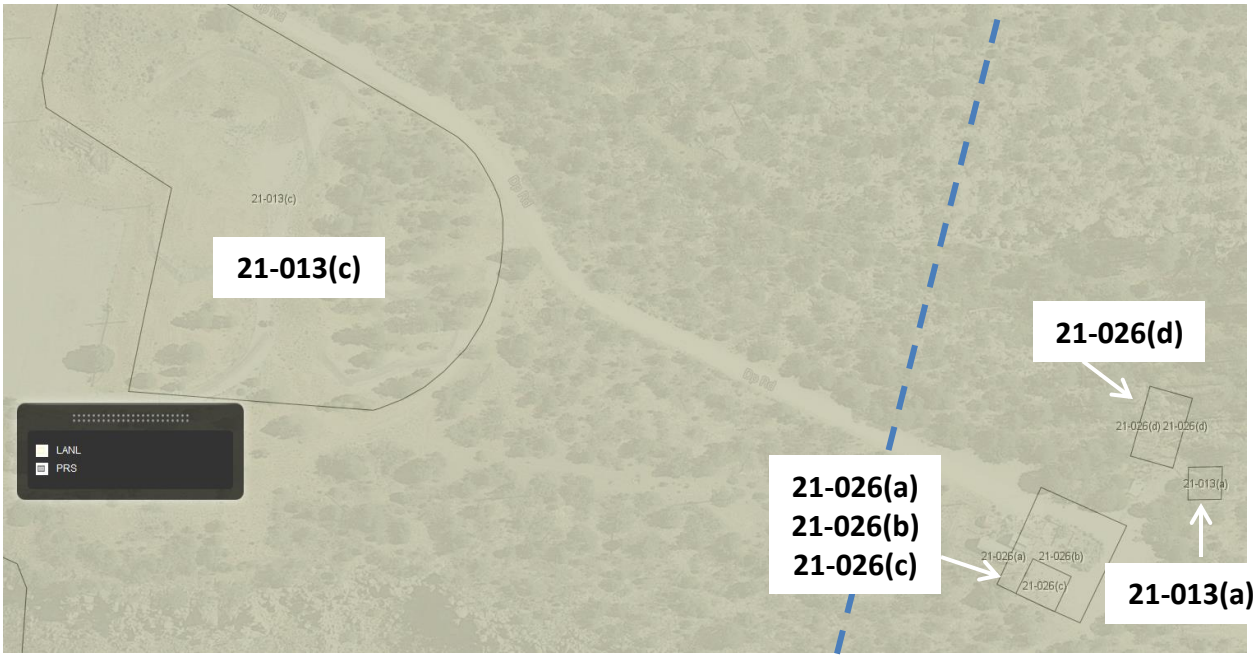

Figure 4. Spatial location of PRSs within tract A-16-D from Intellus (2015). Dashed line indicates the approximate boundary of the excluded area (right of the line) around the Sewage Treatment Plant and associated PRSs.

### 1.4.1 Adjacent Properties with Known or Suspected Releases

SWMU 21-011(k) is an outfall that discharged into the south side of DP Canyon resulting in primarily Cs-137, Sr-90 and Am-241 soil contamination upgradient of Tract A-16-D. This contamination is mainly confined to SWMU-21-011(k) and in downstream sediments within the floodplain. The radionuclide concentrations of these soils are lower than limits for recreational use (LANL 2004).

## 1.5 Preliminary Results from Surveys for Residual Contamination

For the purpose of developing a MARSSIM-based sampling plan (MARSSIM 2000), previous sampling data were used to determine expected medians and standard deviations for sample plan development. Summary data for Pu-239/240 and Cs-137 are provided at the end of this SAP in Attachment 1. Raw data are included in Appendix A.

## 1.6 Conclusions regarding the classification of A-16-D relative to potential for residual radioactive contamination

The soil surface and sediment concentrations in Tract A-16-D represent sample collection from 1992 through 2014 (data from INTELLUS 2015). From this data, the primary area of interest from a radiological perspective is the drainage of DP Canyon, which had elevated levels of both radionuclides in the preliminary data set. Additionally, data from the outfall of the Sewage Treatment Plant indicated possible contamination in the outfall even though the facility was operated as a clean facility. In general, data for the rest of the mesa top and the cliff into Los Alamos canyon indicate some measurable contamination above background at levels consistent

with much of the Los Alamos townsite and substantially below soil Screening Action Levels (SALs) for any use scenario.

The DP Canyon area in this tract qualifies as a Class 2 area under MARSSIM [i.e., having a potential for radioactive contamination or known contamination, but not expected to exceed the SAL] (MARSSIM 2000). Due to the location and gradient of the terrain within the tract, as well as the potential for continued migration of upgradient contaminants at levels above the residential SALs, the future land use scenario for this tract is ***recreational***.

However, the mesa top and slope into Los Alamos canyon (not including the area around the STP) qualify as Class 3 [i.e., not expected to contain any residual radioactivity or expected to contain levels that are close to background or at a small fraction of the threshold for intended use] (MARSSIM 2000). The projected future land use for the mesa top is commercial/industrial. Some construction activities would have to take place to develop the end of the mesa for commercial/industrial use, therefore the site will be evaluated based on a ***construction*** use scenario for radiological decision making. A natural division in the tract occurs along the Los Alamos Canyon rim. Due to the gradient of the terrain to the south of the rim, this area will be evaluated under a Class 3 ***recreational*** use scenario.

If future use designation changes in these areas, sampling plans for specifically identified exposure scenarios could be considered.

## 2.0 Data Quality Objectives for the Sampling and Analysis Plan

This sampling and analysis plan (SAP) for tract A-16-D follows the LANL (2012a) procedure EDA-TP-238, **"Dose assessment data quality objectives for land transfers into the public domain."**

### 2.1 Objective of the SAP

The objective of this SAP is to confirm, within the stated statistical confidence limits, that the mean levels of potential radioactive residual contamination in soils in A-16-D are documented in appropriate units, and are below the 15 mrem/yr (150 µSv/y) limit for public recreational or construction use. The Screening Action Levels (SALs) for the recreational and construction scenarios are provided in Table 1. SALs, as derived in LANL (2014), are used by LANL as preapproved Authorization Limits (ALs), as required in DOE Order 458.1 (section 2.k.(6)(f)2 in the Contractor Requirements Document (DOE 2013)), and are identified with regards to statistical decisions.

Table 1. Background levels (Ryti et al 1998) and SALs based on an annual dose of 15 mrem/yr (150 µSv/y) (LANL 2014, Table B-1)

| Radionuclide | Background [pCi/g] (Ryti et al 1998) | Recreational SAL [pCi/g] 15 mrem/yr (150 µSv/yr) | Construction SAL [pCi/g] 15 mrem/yr (150 µSv/yr) |
|---|---|---|---|
| Am-241 | 0.013 | 890 | 85 |
| Cs-137 | 1.65 | 210 | 18 |
| Co-60 | - | 46 | 4.1 |

| | | | |
|---|---|---|---|
| Tritium (H-3) | 0.08 | 430,000 | 37,000 |
| Pu-238 | 0.023 | 850 | 79 |
| Pu-239 | 0.054 | 770 | 72 |
| Sr-90 | 1.31 | 3200 | 980 |
| U-234 | 2.59 | 2300 | 460 |
| U-235 | 0.2 | 570 | 61 |
| U-238 | 2.29 | 1700 | 250 |

### 2.2 Decision Identification

The principle study question is: Does the residual radioactive contamination exceed ALs for the respective exposure scenarios the decision area A-16-D? The decision alternatives are:

- If results from the soil radioactive contamination measurements are at or above the AL (collectively), the site is not a candidate for land transfer.
- If results from the soil radioactive contamination measurements are below the AL (collectively), the site is a candidate for land transfer.

### 2.3 Inputs into the Decision

The assumed near-term future land use and exposure pathway is for recreational and construction use (area specific). The 15 mrem/yr (150 µSv/y) SALs used in this analysis were calculated using RESRAD (RESRAD 2001).

Data to be used in the analysis include surface soil/sediment concentration measurements for radionuclides. The unity (sum of fractions) rule will be applied. The formula used in for the unity rule is:

$$\frac{C_1}{AL_1} + \frac{C_2}{AL_2} + \frac{C_3}{AL_3} \ldots\ldots \frac{C_n}{AL_n} \leq 1$$

where $C_{1\text{-}n}$ and $AL_{1\text{-}n}$ are the upper-bound estimates of the mean concentrations for radionuclides (e.g., upper 95% values) and Authorized Levels 1 through n, respectively.

### 2.4 Study Boundaries

The study is limited to Tract A-16-D, as identified in Figure 1 (excluding the area around the STP)**Error! Reference source not found.**. The list of radionuclides in the analysis includes: Am-241, Cs-137, Co-60, H-3, Pu-238, Pu-239, Sr-90, U-234, U-235, and U-238. Individual doses are evaluated out to 1000 years.

### 2.5 Decision Rule

Three decision areas were generated for the tract, as described in the Visual Sample Plan outputs in Appendix B:

- DP Canyon – Class 2 Recreational
- Mesa Top – Class 3 Construction
- LA Canyon – Class 3 Recreational

The decision rule is based on the null hypothesis that the mean residual contamination levels in soil and/or sediment in each decision area combined over all radionuclides is above the AL and likely to result in an all-pathway radiation dose to the critical receptor above 15 mrem/yr (150 µSv/y). The alternative hypothesis is that the mean residual contamination levels in soil and/or sediment combined over all radionuclides is below the AL and not likely to result in an all-pathway radiation dose to the critical receptor above 15 mrem/yr (150 µSv/y).

### 2.6 Limits on Decision Errors

The acceptable statistical errors for this analysis are that Type I error (i.e., conclude contamination levels at site are < AL when in fact it is > AL) has a probability of $p < 0.05$; and the Type II error is (i.e., conclude soil contamination level is > AL when in fact it is < AL) has a probability of $p < 0.1$. The distribution for the preliminary data is *not* assumed to be normal.

### 2.7 Optimization of Design Process

The survey design is optimized by analyzing historical data and the context of future use. Specifically, the elevated measurements of radionuclides in DP Canyon necessitate classifying this area as Class 2. However, the recreational use scenario overrides the MARSSIM requirement of limiting the area to 10,000$m^2$. On the mesa top, treating the area as Class 3 optimizes the number of required sample locations based on construction land use, and splitting the Class 3 area into two decision units makes sense spatially.

Sampling areas for the full A-16-D tract are included in Figure 5. If land use requirements change in the future, sampling could be targeted to the specific area of the proposed activity.

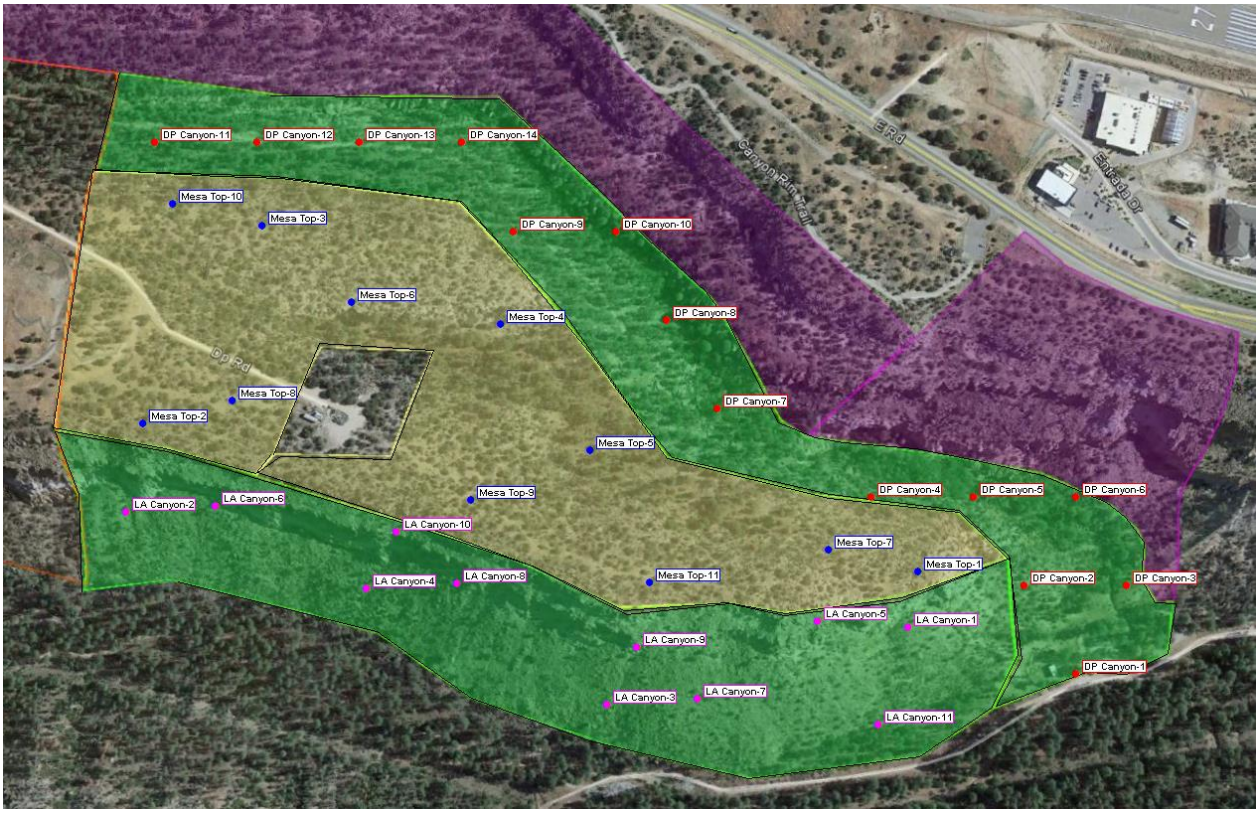

Figure 5. Map of sampling locations in the three decision areas for tract A-16-D. ***Note:*** Map locations and boundaries are approximate.

## 2.8 Statistically-Based Evaluation for Number of Samples Required using MARSSIM

Google Earth was used to plan sampling in A-16-D, and an image of the tract was incorporated into Visual Sampling Plan (VSP) software (Matzke et al. 2010). The MARSSIM application within VSP was then used to determine the statistically-based sampling plan for comparing an average to a fixed threshold. The preliminary sampling data in Attachment 1 were used to determine the standard deviations needed for calculating the necessary number of samples for each of the identified radionuclides. Samples were randomly located in the two Class 3 decision areas, and a triangular grid pattern was used in the Class 2 decision area.

## 2.9 Instrumentation and Measurement Quality Objectives

The main objectives are to determine appropriate analysis techniques for each radionuclide and ensure Measurement Quality Objectives (MQOs) are satisfied. One should be confident that the measurement results are valid and appropriate for the decisions being made.

### 2.9.1 Measurement Quality Objectives:

- Detection Capability: Minimum Detection Concentration should be below the MARSSIM-defined Lower-Bound of the Gray Region.

- The degree of measurement uncertainty (combined precision and bias) should be reported and the level should be reasonable relative to the needed accuracy of the decision and accounted for in the statistical analysis.
- Range of the instrument and measurement technique should be appropriate for the concentrations expected.
- The instrument and measurement technique should be specific for the radionuclide(s) being measured. Specificity is the ability of the measurement method to measure the radionuclide of concern in the presence of interferences.
- For field instruments, the instrument should be rugged enough to consistently provide reliable measurements. However, in this case, all samples will be analyzed in the laboratory.

**2.9.2 Procedures used to meet these Measurement Quality Objectives:**

1) Collection of valid soil sample appropriate for the dose assessment,
    a. Soil sampling will follow the LANL (2012b) procedure SOP-5132 **"Collection of soil and vegetation samples for the environmental surveillance program."** These are surface soil samples appropriate for the deposition pathway and the exposure scenario (i.e., top 5 cm). Subsurface soil samples are not required as depositions would be to surfaces with little migration to deeper soil expected.
    b. Additional quality assurance for the collection of the samples is provided through LANL (2008) procedure QAPP-0001 **"Quality and assurance project plan for the soils, foodstuffs, and non-foodstuff biota monitoring project."**
2) Soil sample analysis will use EPA-approved analytical procedures for each radionuclide. The following will be used by the independent laboratory:
    a. Environmental Measurements Laboratory (EML). **The procedures manual of the Environmental Measurements Laboratory**. Report HASL-300; 1997. Radionuclide specific procedures for the radionuclides of Am-241, Pu-239 and U-238 are provided in EML (EML 1997).
    b. Environmental Protection Agency (EPA). **Method 901.1 - Gamma Emitting Radionuclides in Drinking Water***: Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, EPA 600/4-80-032, prepared by EPA's Environmental Monitoring and Support Laboratory, August 1980 (EPA 1980). Available from NTIS, document no. PB 80-224744.
    c. Environmental Protection Agency (EPA). **Method 905.0 - Radioactive Strontium in Drinking Water***: Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, EPA 600/4-80-032, prepared by EPA's Environmental Monitoring and Support Laboratory, August 1980 (EPA 1980). Available from U.S. Department of Commerce, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161, document no. PB 80-224744.
    d. Environmental Protection Agency (EPA). **Method 906.0 - Tritium in Drinking Water***: Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, EPA 600/4-80-032, prepared by EPA's Environmental Monitoring and Support Laboratory, August 1980 (EPA 1980). Available from U.S. Department of Commerce, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161, document no. PB 80-224744.

After the measurements are completed, the laboratory results in units equivalent to the ALs will be evaluated with respect to the MQOs, as stated above.

**2.10 Statistical Evaluation of the Survey Results**

All the applicable data that has passed the MQO evaluation will be used to determine the upper-bound estimate of the mean for soil concentrations (generally, the 95% value) for each radionuclide. The EPA software ProUCL (EPA 2013) will be used to determine this value. The statistical decision as to whether the residual soil contamination levels (i.e., the 95% UCLs) are below the authorized limits will be evaluated using the following criteria. All analyses and results will be documented.

Decision Criteria:

1) When evaluating individual sample results, if all samples are ≤ the AL, then no further action is required and the site passes the criteria for the specific use. No further actions are needed.
2) If all individual samples or the UCL are > the AL, then the site is not a candidate for release and site remediation is needed, followed by resampling before it can be released.
3) If the UCL is below the AL but some individual measurements are above the AL, then statistical analysis is needed. Generally, non-parametric statistical approaches are used to evaluate the null hypothesis. If contamination is present in background, the Wilcoxon Rank Sum test is suggested, and if contamination is not present in background or very low relative to the AL, the Sign Test is suggested. For this tract, the Sign Test will be used with a $p < 0.05$ decision threshold for significance. See MARSSIM Chapter 8 for details and examples (2000).
4) Alternatively, one could confirm that the ratio of the upper-confidence level (UCL) of the average concentration divided by the AL and the sum of hot spot activity ratios do not exceed unity:

$$\frac{\overline{C}_{UCL}}{C_{AL}} + \sum_{i=1}^{n} \frac{C_{i,C>AL}}{C_{AL} * AF} \leq 1$$

   Here $\overline{C}_{UCL}$ is the 95% upper bound estimate of the concentration mean, $C_{AL}$ is the AL (15 mrem/yr (150 µSv/y)), $C_{i,c>AL}$ is the sample concentration for a single sample above the AL (i.e., has elevated measured concentrations), and *AF* is the Area Factor [ratio of effective dose calculated for area of contamination normalized to effective dose calculated for 10,000 $m^2$ (RESRAD default)]. If the result of this calculation is > 1, the site is a candidate for further characterization of the nature and extent of the contamination, remediation of the site, follow up confirmatory sampling, and reanalysis against the decision criteria in this section. Area Factors are dependent on the exposure scenario and should be calculated individually.
5) If there are multiple radionuclides (*i*) being evaluated in a sampling unit, the sum of the ratios should be less than or equal to 1.

6) The dose assessment based on the soil measurements will include the sum of doses from all radionuclides, and this sum will be compared to the 3 mrem/yr (30 µSv/yr) threshold for follow-up ALARA analysis.

## 3.0 Results of the Analysis for Sampling Number and Locations

The specific details of the analysis (specific statistical parameter values, analysis, results, and approximate coordinates for the randomly selected sampling locations using MARSSIM) are provided in Appendix 2. Sampling will include:

- 14 samples on a triangular grid pattern in DP Canyon (Class 2)
- 11 randomly located samples on the mesa top (Class 3)
- 11 randomly located samples in LA Canyon (Class 3)

The approximate locations are indicated in Figure 5, and coordinates and a larger image are provided in Attachment 2. Locations were selected using a quasi-random number generator for x and y coordinates (Matzke et al. 2010). Due to distortion of the Google Earth image in the VSP software, locations are approximate.

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LANL Decision Support Application available at: http://gis-arcserver-p/DSA_Rev3/default.aspx

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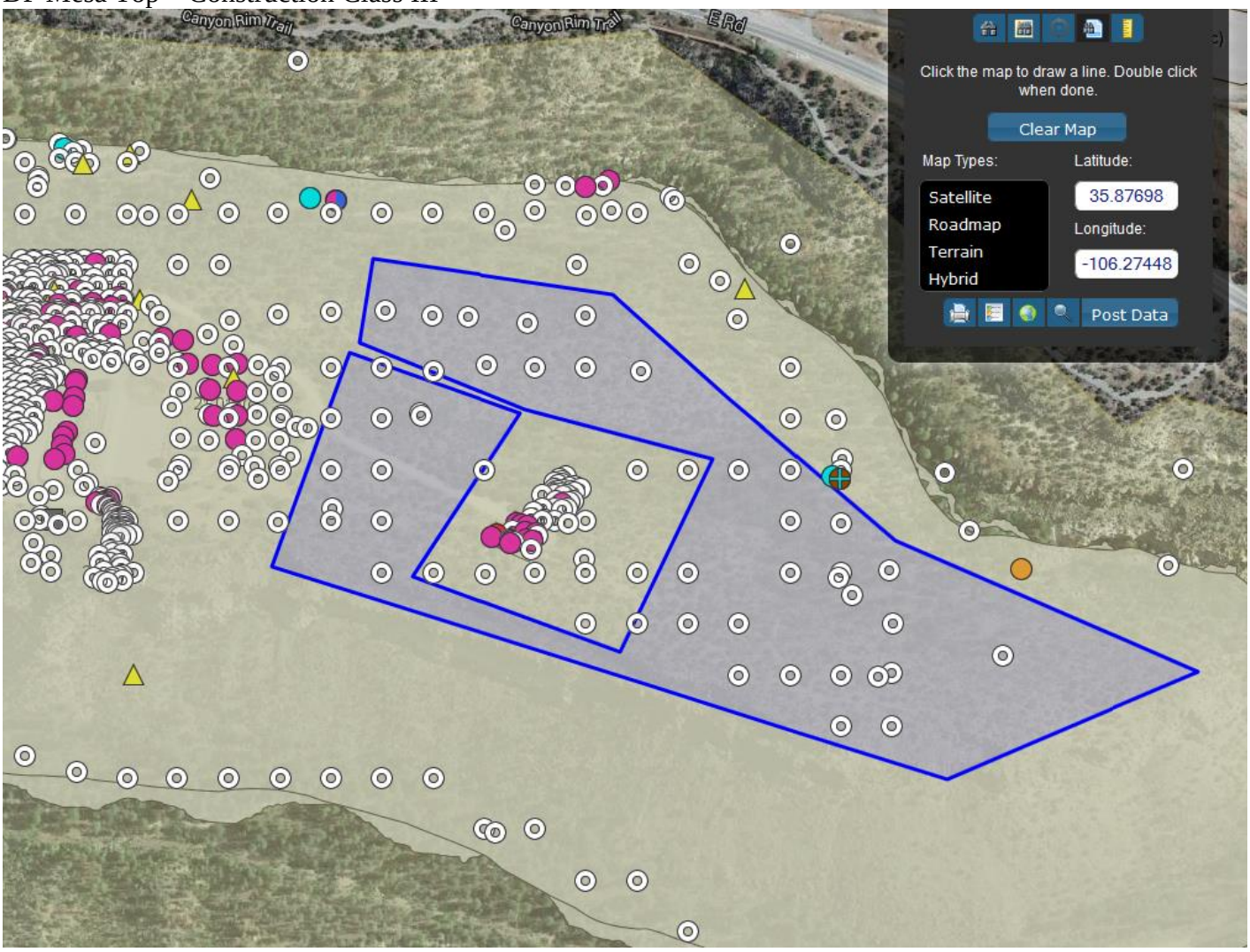
**Appendices and Attachments**

Attachment 1 – Preliminary Data
Attachment 2 – Coordinates and Map for Sampling
Appendix A – Raw Data
Appendix B – VSP Outputs

# Attachment 1 – Preliminary Data

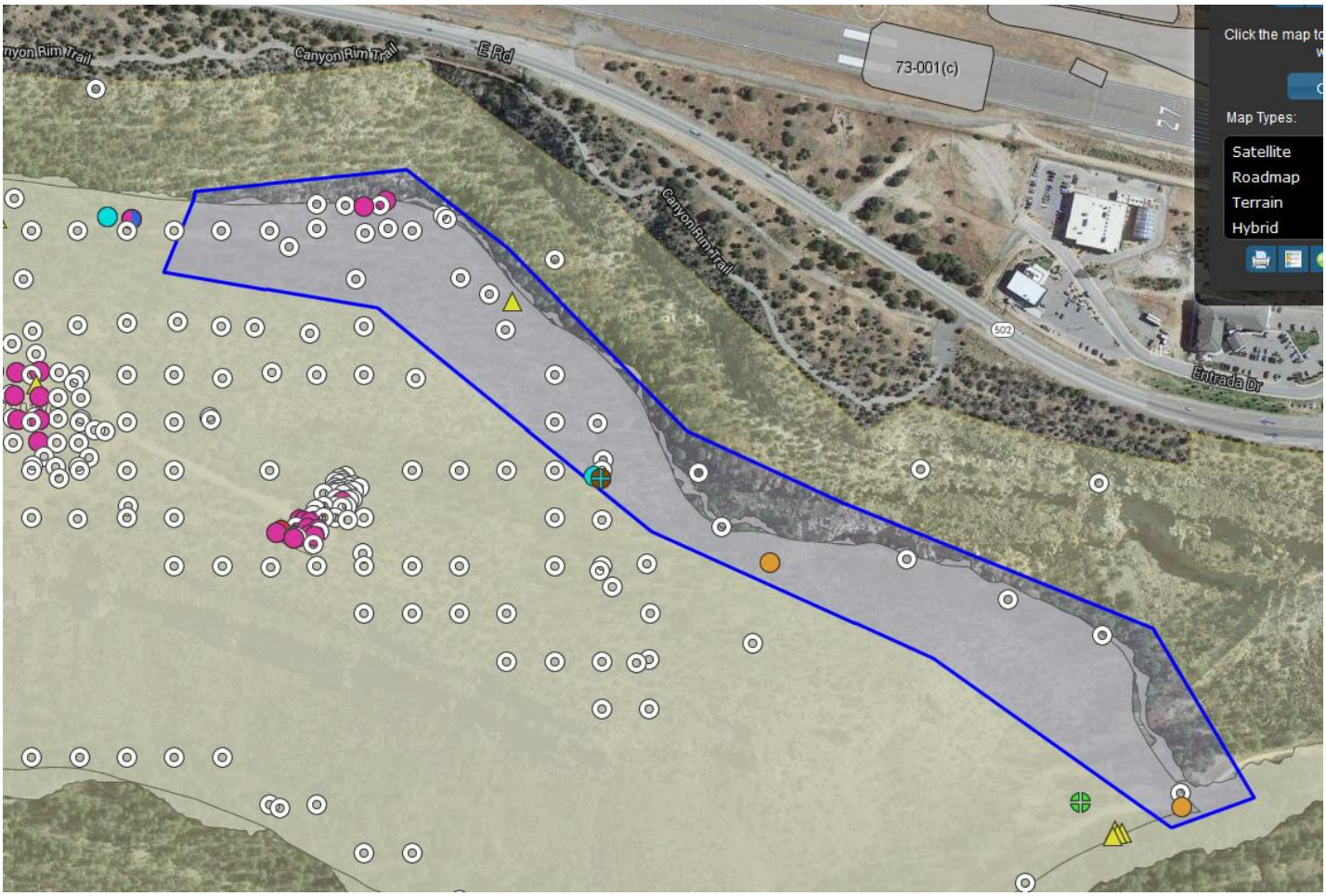
DP Mesa Top – Construction Class III




| *Mesa Top Pu-239/240 [pCi/g]* | |
|---|---|
| | |
| **Mean** | 0.29 |
| **Standard Error** | 0.04 |
| **Median** | 0.13 |
| **Mode** | 0.05 |
| **Standard Deviation** | 0.33 |
| **Sample Variance** | 0.11 |
| **Range** | 1.48 |
| **Minimum** | 0.00 |
| **Maximum** | 1.48 |
| **Count** | 62 |
| **Confidence Level(95.0%)** | 0.08 |
| **UCL Estimate** | 0.371 |

| *Mesa Top Cs-137 [pCi/g]* | |
|---|---|
| | |
| **Mean** | 0.37 |
| **Standard Error** | 0.21 |
| **Median** | 0.17 |
| **Mode** | #N/A |
| **Standard Deviation** | 0.46 |
| **Sample Variance** | 0.21 |
| **Range** | 0.99 |
| **Minimum** | -0.03 |
| **Maximum** | 0.96 |
| **Count** | 5 |
| **Confidence Level(95.0%)** | 0.57 |
| **UCL Estimate** | 0.94 |

DP Canyon – Recreational Class II



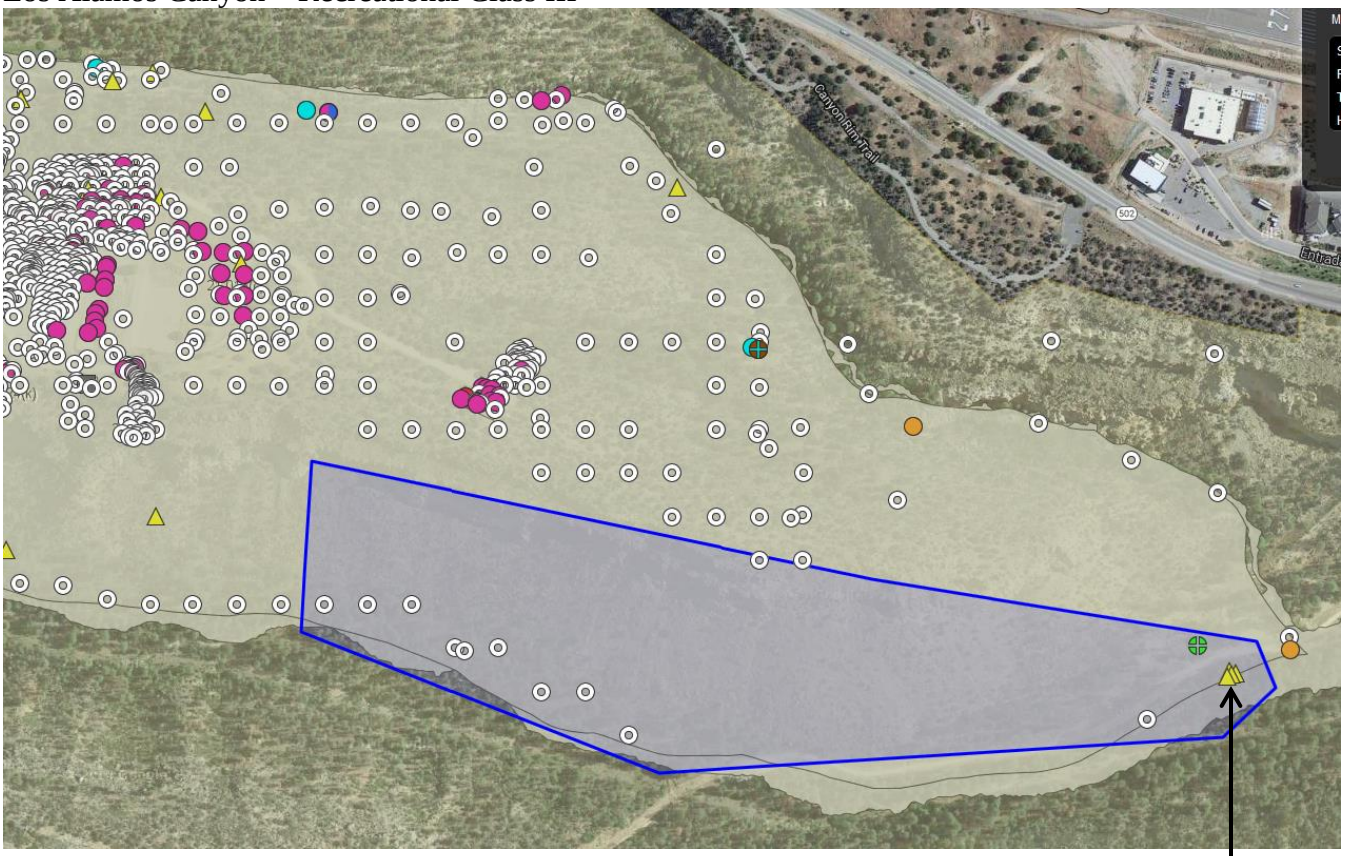

| *DP Canyon Pu-239/240 [pCi/g]* | |
|---|---|
| | |
| **Mean** | 3.52 |
| **Standard Error** | 1.03 |
| **Median** | 1.06 |
| **Mode** | #N/A |
| **Standard Deviation** | 7.28 |

| | |
|---|---|
| **Sample Variance** | 52.98 |
| **Range** | 48.25 |
| **Minimum** | 0.05 |
| **Maximum** | 48.30 |
| **Count** | 50 |
| **Confidence Level(95.0%)** | 2.07 |
| **UCL Estimate** | 5.58 |

| ***DP Canyon Cs-137 [pCi/g] (no decay correction)*** | |
|---|---|
| | |
| **Mean** | 38.63 |
| **Standard Error** | 8.39 |
| **Median** | 12.90 |
| **Mode** | 12.90 |
| **Standard Deviation** | 50.33 |
| **Sample Variance** | 2532.81 |
| **Range** | 191.90 |
| **Minimum** | 0.10 |
| **Maximum** | 192.00 |
| **Count** | 36 |
| **Confidence Level(95.0%)** | 17.03 |
| **UCL Estimate** | 55.66 |

| ***DP Canyon Cs-137 [pCi/g] (decay corrected)*** | |
|---|---|
| | |
| **Mean** | 26.32 |
| **Standard Error** | 5.66 |
| **Median** | 8.83 |
| **Mode** | #N/A |
| **Standard Deviation** | 33.96 |
| **Sample Variance** | 1152.98 |
| **Range** | 131.38 |
| **Minimum** | 0.10 |
| **Maximum** | 131.48 |
| **Count** | 36 |
| **Confidence Level(95.0%)** | 11.49 |
| **UCL Estimate** | 37.81 |

Los Alamos Canyon – Recreational Class III




| *LA Canyon Pu-239/240 [pCi/g]* | |
|---|---|
| | |
| **Mean** | 0.62 |
| **Standard Error** | 0.13 |
| **Median** | 0.29 |
| **Mode** | #N/A |
| **Standard Deviation** | 1.05 |
| **Sample Variance** | 1.11 |
| **Range** | 6.41 |
| **Minimum** | 0.00 |
| **Maximum** | 6.41 |
| **Count** | 65 |
| **Confidence Level(95.0%)** | 0.26 |
| **UCL Estimate** | 0.88 |

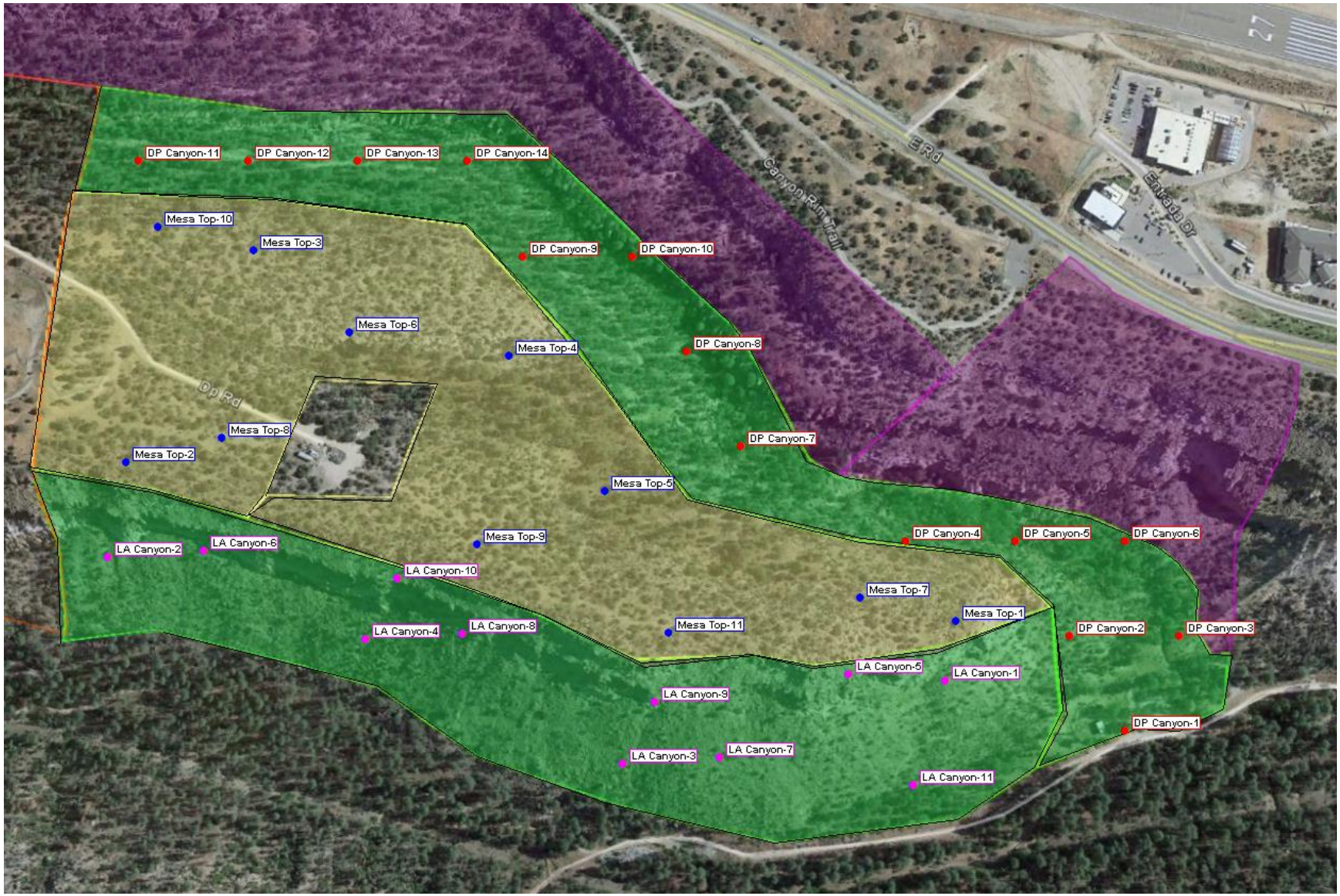
Max: 15 pCi/g Cs-137 (1984) Watercourse sample is actually located in the DP Canyon area based on revised decision unit boundary (LA Canyon Class 2 classification is still appropriate). This data point raises the standard deviation for the LA Canyon preliminary data but the number of samples is unaffected.

| *LA Canyon Cs-137 [pCi/g] (decay corrected)* | |
|---|---|
| | |
| **Mean** | 0.62 |
| **Standard Error** | 0.20 |
| **Median** | 0.09 |
| **Mode** | 0.10 |
| **Standard Deviation** | 1.33 |

| | |
|---|---|
| **Sample Variance** | 1.76 |
| **Range** | 7.35 |
| **Minimum** | 0.00 |
| **Maximum** | 7.35 |
| **Count** | 45 |
| **Confidence Level(95.0%)** | 0.40 |
| **UCL Estimate** | 1.02 |

| ***LA Canyon Cs-137 [pCi/g] (no decay correction)*** | |
|---|---|
| | |
| **Mean** | 1.21 |
| **Standard Error** | 0.41 |
| **Median** | 0.15 |
| **Mode** | 0.14 |
| **Standard Deviation** | 2.74 |
| **Sample Variance** | 7.50 |
| **Range** | 15.00 |
| **Minimum** | 0.00 |
| **Maximum** | 15.00 |
| **Sum** | 54.39 |
| **Count** | 45 |
| **Confidence Level(95.0%)** | 0.82 |
| **UCL Estimate** | 2.03 |

## Attachment 2 – Coordinates and Map for Sampling



Note: due to potential image distortion in VSP, some of the coordinates listed in the tables may not accurately reflect the point shown in the image. Additionally, some of the locations may not be readily accessible. Samples may be field located or moved based on accessibility; accurate GPS locations should be recorded with the sample data.

| Tract A-16-D<br>DP Canyon Class 2 Recreation<br>(Triangular Systematic Sampling – UTM Coordinates) | | |
|---|---|---|
| | X Coordinate (m) | Y Coordinate (m) |
| DP Canyon-1 | 386207.2974 | 3970601.3060 |
| DP Canyon-2 | 386163.6447 | 3970676.9146 |
| DP Canyon-3 | 386250.9500 | 3970676.9146 |
| DP Canyon-4 | 386032.6867 | 3970752.5233 |
| DP Canyon-5 | 386119.9920 | 3970752.5233 |
| DP Canyon-6 | 386207.2974 | 3970752.5233 |
| DP Canyon-7 | 385901.7286 | 3970828.1319 |
| DP Canyon-8 | 385858.0760 | 3970903.7406 |
| DP Canyon-9 | 385727.1179 | 3970979.3492 |
| DP Canyon-10 | 385814.4233 | 3970979.3492 |
| DP Canyon-11 | 385421.5492 | 3971054.9579 |
| DP Canyon-12 | 385508.8546 | 3971054.9579 |
| DP Canyon-13 | 385596.1599 | 3971054.9579 |
| DP Canyon-14 | 385683.4653 | 3971054.9579 |

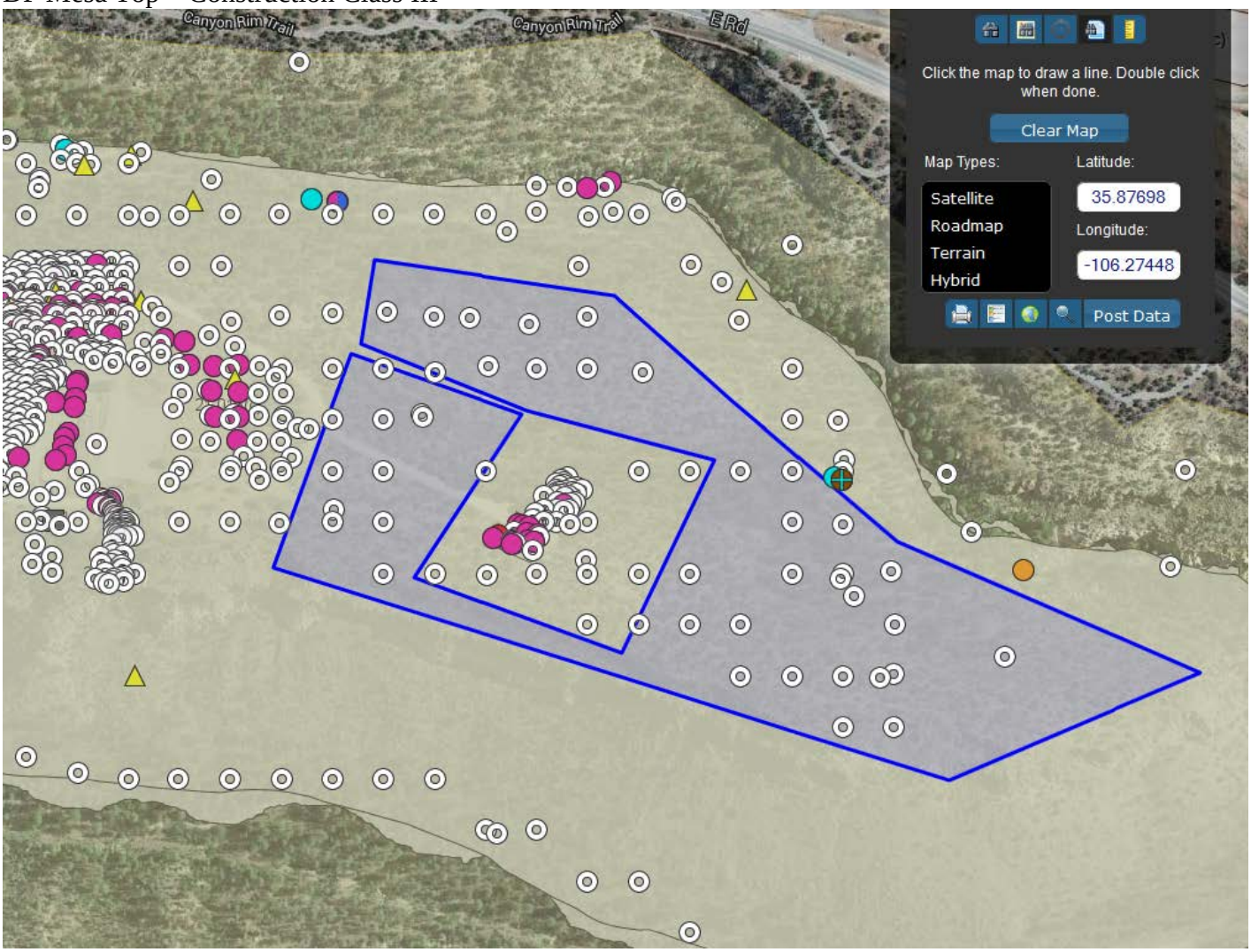
| Tract A-16-D<br>Mesa Top Class 3 Construction<br>(Simple Random Sampling – UTM Coordinates) | | |
|---|---|---|
| | X Coordinate (m) | Y Coordinate (m) |
| Mesa Top-1 | 386072.8704 | 3970689.1700 |
| Mesa Top-2 | 385411.1587 | 3970815.6757 |
| Mesa Top-3 | 385512.9605 | 3970984.3500 |
| Mesa Top-4 | 385716.5641 | 3970900.0129 |
| Mesa Top-5 | 385792.9154 | 3970792.2487 |
| Mesa Top-6 | 385589.3118 | 3970918.7545 |

| | | |
|---|---|---|
| Mesa Top-7 | 385996.5191 | 3970707.9116 |
| Mesa Top-8 | 385487.5100 | 3970834.4173 |
| Mesa Top-9 | 385691.1136 | 3970750.0802 |
| Mesa Top-10 | 385436.6091 | 3971003.0916 |
| Mesa Top-11 | 385843.8163 | 3970679.7992 |

| Tract A-16-D<br>LA Canyon Class 3 Recreation<br>(Simple Random Sampling – UTM Coordinates) | | |
|---|---|---|
| | X Coordinate (m) | Y Coordinate (m) |
| LA Canyon-1 | 386064.0861 | 3970641.2405 |
| LA Canyon-2 | 385396.4190 | 3970740.0561 |
| LA Canyon-3 | 385807.2911 | 3970575.3634 |
| LA Canyon-4 | 385601.8550 | 3970674.1790 |
| LA Canyon-5 | 385987.0476 | 3970646.1203 |
| LA Canyon-6 | 385473.4575 | 3970744.9359 |
| LA Canyon-7 | 385884.3296 | 3970580.2432 |
| LA Canyon-8 | 385678.8935 | 3970679.0588 |
| LA Canyon-9 | 385832.9706 | 3970624.1612 |
| LA Canyon-10 | 385627.5345 | 3970722.9769 |
| LA Canyon-11 | 386038.4066 | 3970558.2842 |

# Attachment 1 – Preliminary Data

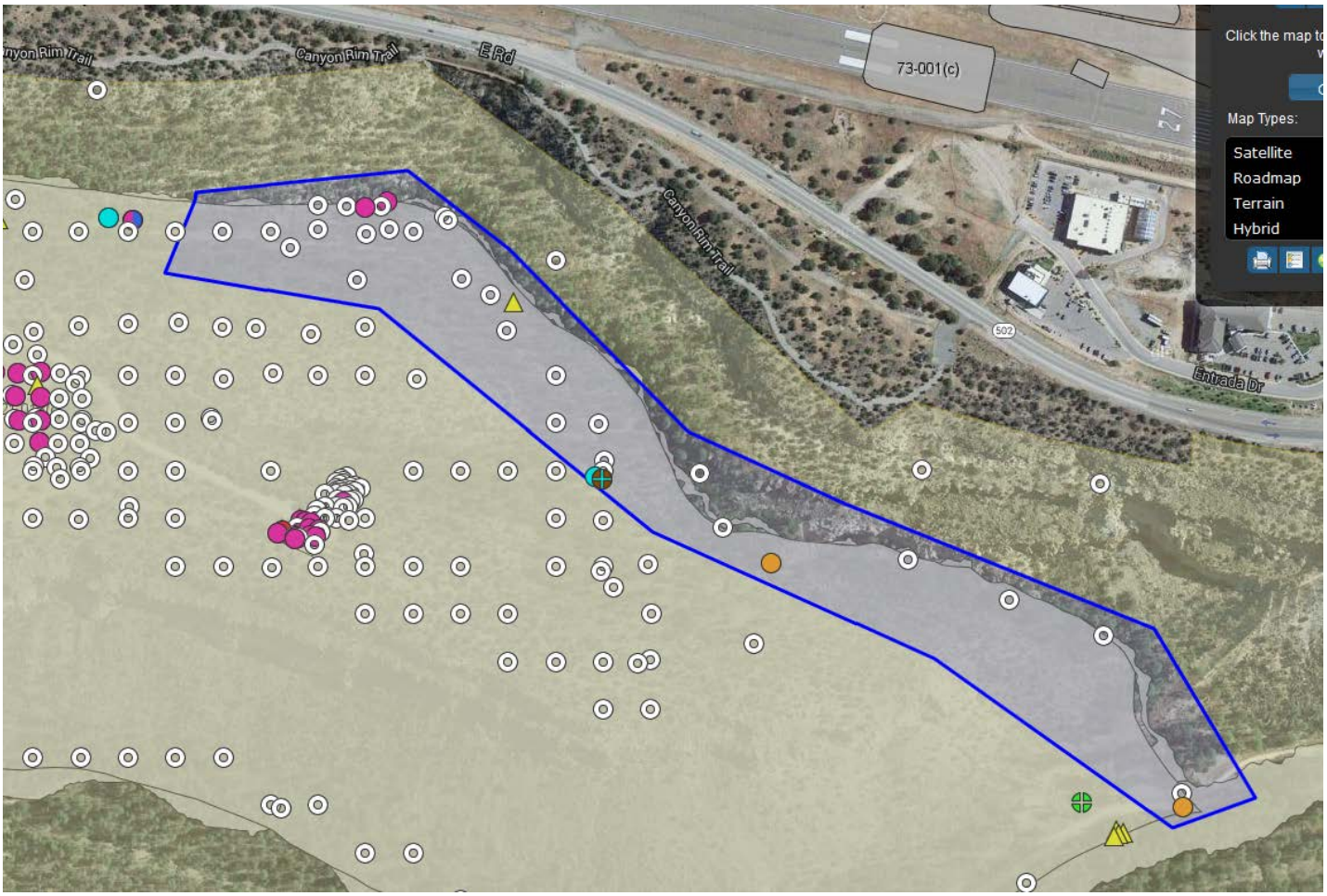
DP Mesa Top – Construction Class III




| *Mesa Top Pu-239/240 [pCi/g]* | |
|---|---|
| | |
| **Mean** | 0.29 |
| **Standard Error** | 0.04 |
| **Median** | 0.13 |
| **Mode** | 0.05 |
| **Standard Deviation** | 0.33 |
| **Sample Variance** | 0.11 |
| **Range** | 1.48 |
| **Minimum** | 0.00 |
| **Maximum** | 1.48 |
| **Count** | 62 |
| **Confidence Level(95.0%)** | 0.08 |
| **UCL Estimate** | 0.371 |

| *Mesa Top Cs-137 [pCi/g]* | |
|---|---|
| | |
| **Mean** | 0.37 |
| **Standard Error** | 0.21 |
| **Median** | 0.17 |
| **Mode** | #N/A |
| **Standard Deviation** | 0.46 |
| **Sample Variance** | 0.21 |
| **Range** | 0.99 |
| **Minimum** | -0.03 |
| **Maximum** | 0.96 |
| **Count** | 5 |
| **Confidence Level(95.0%)** | 0.57 |
| **UCL Estimate** | 0.94 |

DP Canyon – Recreational Class II



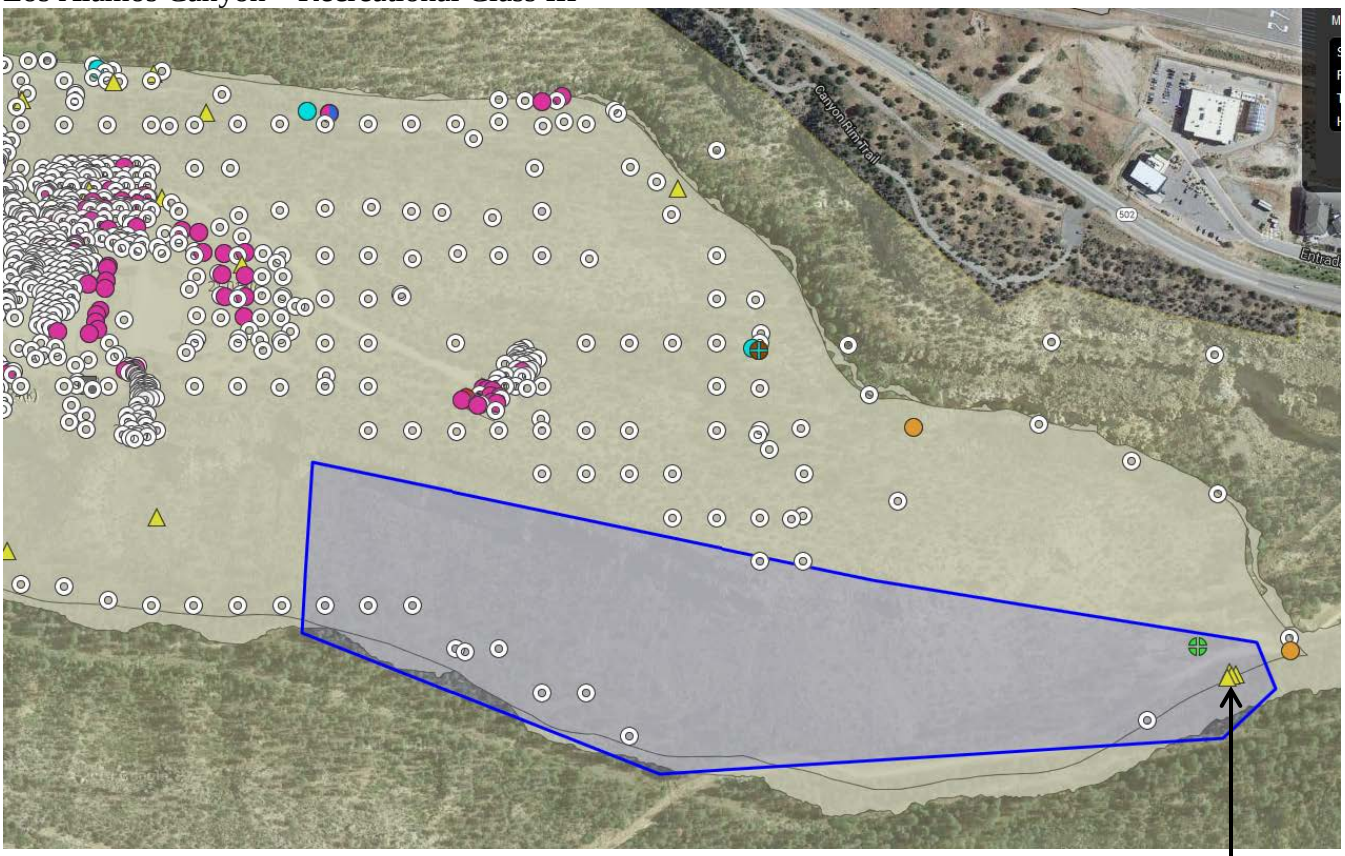

| *DP Canyon Pu-239/240 [pCi/g]* | |
|---|---|
| | |
| **Mean** | 3.52 |
| **Standard Error** | 1.03 |
| **Median** | 1.06 |
| **Mode** | #N/A |
| **Standard Deviation** | 7.28 |

| | |
|---|---|
| **Sample Variance** | 52.98 |
| **Range** | 48.25 |
| **Minimum** | 0.05 |
| **Maximum** | 48.30 |
| **Count** | 50 |
| **Confidence Level(95.0%)** | 2.07 |
| **UCL Estimate** | 5.58 |

| ***DP Canyon Cs-137 [pCi/g] (no decay correction)*** | |
|---|---|
| | |
| **Mean** | 38.63 |
| **Standard Error** | 8.39 |
| **Median** | 12.90 |
| **Mode** | 12.90 |
| **Standard Deviation** | 50.33 |
| **Sample Variance** | 2532.81 |
| **Range** | 191.90 |
| **Minimum** | 0.10 |
| **Maximum** | 192.00 |
| **Count** | 36 |
| **Confidence Level(95.0%)** | 17.03 |
| **UCL Estimate** | 55.66 |

| ***DP Canyon Cs-137 [pCi/g] (decay corrected)*** | |
|---|---|
| | |
| **Mean** | 26.32 |
| **Standard Error** | 5.66 |
| **Median** | 8.83 |
| **Mode** | #N/A |
| **Standard Deviation** | 33.96 |
| **Sample Variance** | 1152.98 |
| **Range** | 131.38 |
| **Minimum** | 0.10 |
| **Maximum** | 131.48 |
| **Count** | 36 |
| **Confidence Level(95.0%)** | 11.49 |
| **UCL Estimate** | 37.81 |

Los Alamos Canyon – Recreational Class III




| *LA Canyon Pu-239/240 [pCi/g]* | |
|---|---|
| | |
| **Mean** | 0.62 |
| **Standard Error** | 0.13 |
| **Median** | 0.29 |
| **Mode** | #N/A |
| **Standard Deviation** | 1.05 |
| **Sample Variance** | 1.11 |
| **Range** | 6.41 |
| **Minimum** | 0.00 |
| **Maximum** | 6.41 |
| **Count** | 65 |
| **Confidence Level(95.0%)** | 0.26 |
| **UCL Estimate** | 0.88 |

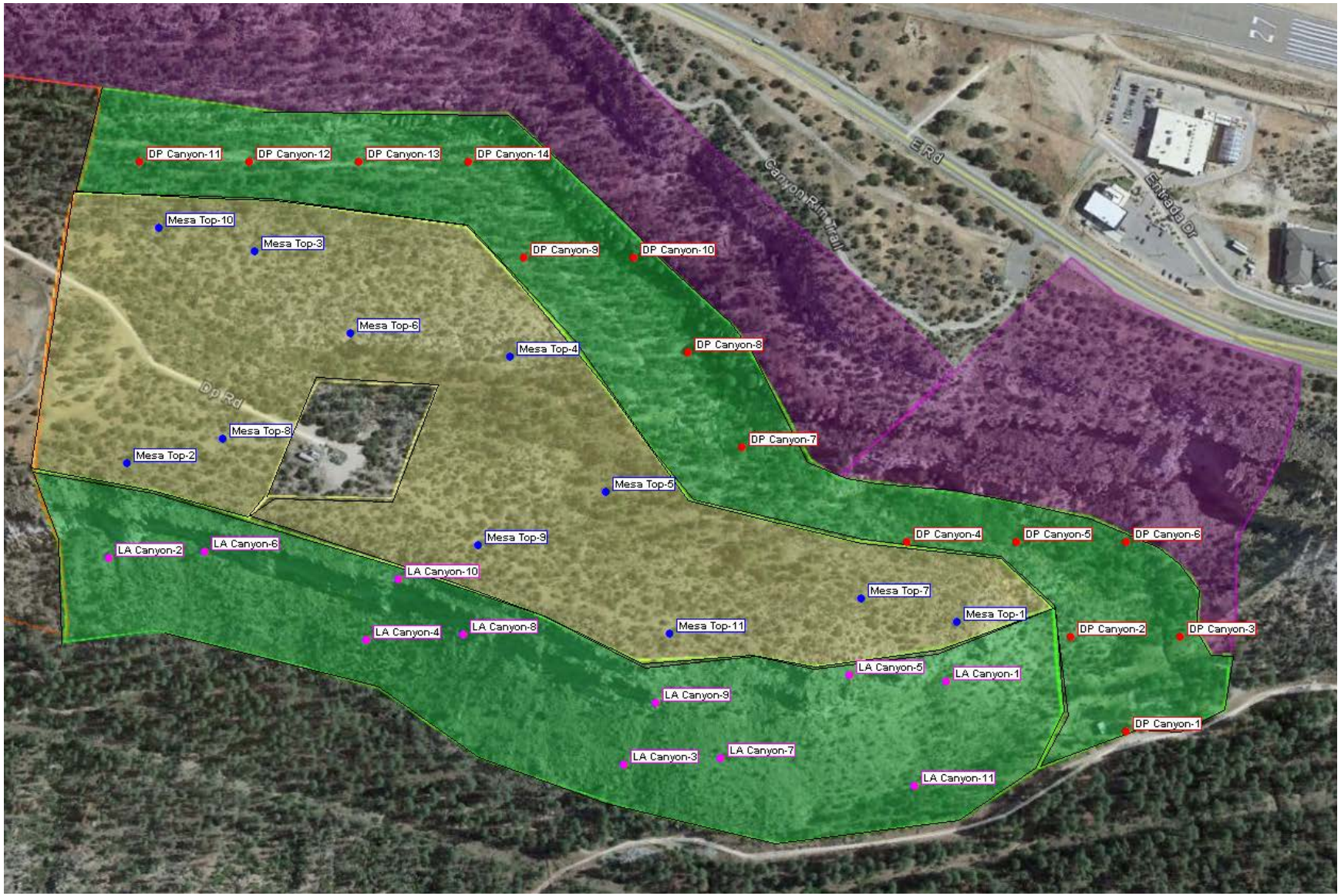
Max: 15 pCi/g Cs-137 (1984) Watercourse sample is actually located in the DP Canyon area based on revised decision unit boundary (LA Canyon Class 2 classification is still appropriate). This data point raises the standard deviation for the LA Canyon preliminary data but the number of samples is unaffected.

| *LA Canyon Cs-137 [pCi/g] (decay corrected)* | |
|---|---|
| | |
| **Mean** | 0.62 |
| **Standard Error** | 0.20 |
| **Median** | 0.09 |
| **Mode** | 0.10 |
| **Standard Deviation** | 1.33 |

| | |
|---|---|
| **Sample Variance** | 1.76 |
| **Range** | 7.35 |
| **Minimum** | 0.00 |
| **Maximum** | 7.35 |
| **Count** | 45 |
| **Confidence Level(95.0%)** | 0.40 |
| **UCL Estimate** | 1.02 |

| ***LA Canyon Cs-137 [pCi/g] (no decay correction)*** | |
|---|---|
| | |
| **Mean** | 1.21 |
| **Standard Error** | 0.41 |
| **Median** | 0.15 |
| **Mode** | 0.14 |
| **Standard Deviation** | 2.74 |
| **Sample Variance** | 7.50 |
| **Range** | 15.00 |
| **Minimum** | 0.00 |
| **Maximum** | 15.00 |
| **Sum** | 54.39 |
| **Count** | 45 |
| **Confidence Level(95.0%)** | 0.82 |
| **UCL Estimate** | 2.03 |

## Attachment 2 – Coordinates and Map for Sampling



Note: due to potential image distortion in VSP, some of the coordinates listed in the tables may not accurately reflect the point shown in the image. Additionally, some of the locations may not be readily accessible. Samples may be field located or moved based on accessibility; accurate GPS locations should be recorded with the sample data.

| Tract A-16-D<br>DP Canyon Class 2 Recreation<br>(Triangular Systematic Sampling – UTM Coordinates) | | |
|---|---|---|
| | X Coordinate (m) | Y Coordinate (m) |
| DP Canyon-1 | 386207.2974 | 3970601.3060 |
| DP Canyon-2 | 386163.6447 | 3970676.9146 |
| DP Canyon-3 | 386250.9500 | 3970676.9146 |
| DP Canyon-4 | 386032.6867 | 3970752.5233 |
| DP Canyon-5 | 386119.9920 | 3970752.5233 |
| DP Canyon-6 | 386207.2974 | 3970752.5233 |
| DP Canyon-7 | 385901.7286 | 3970828.1319 |
| DP Canyon-8 | 385858.0760 | 3970903.7406 |
| DP Canyon-9 | 385727.1179 | 3970979.3492 |
| DP Canyon-10 | 385814.4233 | 3970979.3492 |
| DP Canyon-11 | 385421.5492 | 3971054.9579 |
| DP Canyon-12 | 385508.8546 | 3971054.9579 |
| DP Canyon-13 | 385596.1599 | 3971054.9579 |
| DP Canyon-14 | 385683.4653 | 3971054.9579 |

| Tract A-16-D<br>Mesa Top Class 3 Construction<br>(Simple Random Sampling – UTM Coordinates) | | |
|---|---|---|
| | X Coordinate (m) | Y Coordinate (m) |
| Mesa Top-1 | 386072.8704 | 3970689.1700 |
| Mesa Top-2 | 385411.1587 | 3970815.6757 |
| Mesa Top-3 | 385512.9605 | 3970984.3500 |
| Mesa Top-4 | 385716.5641 | 3970900.0129 |
| Mesa Top-5 | 385792.9154 | 3970792.2487 |
| Mesa Top-6 | 385589.3118 | 3970918.7545 |

| | | |
|---|---|---|
| Mesa Top-7 | 385996.5191 | 3970707.9116 |
| Mesa Top-8 | 385487.5100 | 3970834.4173 |
| Mesa Top-9 | 385691.1136 | 3970750.0802 |
| Mesa Top-10 | 385436.6091 | 3971003.0916 |
| Mesa Top-11 | 385843.8163 | 3970679.7992 |

| Tract A-16-D<br>LA Canyon Class 3 Recreation<br>(Simple Random Sampling – UTM Coordinates) | | |
|---|---|---|
| | X Coordinate (m) | Y Coordinate (m) |
| LA Canyon-1 | 386064.0861 | 3970641.2405 |
| LA Canyon-2 | 385396.4190 | 3970740.0561 |
| LA Canyon-3 | 385807.2911 | 3970575.3634 |
| LA Canyon-4 | 385601.8550 | 3970674.1790 |
| LA Canyon-5 | 385987.0476 | 3970646.1203 |
| LA Canyon-6 | 385473.4575 | 3970744.9359 |
| LA Canyon-7 | 385884.3296 | 3970580.2432 |
| LA Canyon-8 | 385678.8935 | 3970679.0588 |
| LA Canyon-9 | 385832.9706 | 3970624.1612 |
| LA Canyon-10 | 385627.5345 | 3970722.9769 |
| LA Canyon-11 | 386038.4066 | 3970558.2842 |

# Appendix A: Raw Data

Mesa Top

| Location | Field Sample ID | Date Sampled | Parameter | Result | Units | Lab Qualifier | Validation Qualifier | Detect? | Matrix | Purpose | Type | Time | Program | Filtered | Leached | Start Depth | End Depth | Depth Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-01220 | AAA0036 | 03/24/1992 | Plutonium-239/240 | 0.038 | pCi/g | | NQ | Y | SO | REG | S | 10:05 | | N | N | 0 | 0.08 | ft |
| 21-01220 | AAA0037 | 03/24/1992 | Plutonium-239/240 | 0.055 | pCi/g | | NQ | Y | SO | REG | S | 10:17 | | N | N | 0 | 0.5 | ft |
| 21-01221 | AAA0040 | 03/24/1992 | Plutonium-239/240 | 1.046 | pCi/g | | NQ | Y | SO | REG | S | 11:10 | | N | N | 0 | 0.08 | ft |
| 21-01222 | AAA0022 | 03/23/1992 | Plutonium-239/240 | 1.035 | pCi/g | | NQ | Y | SO | REG | S | 10:55 | | N | N | 0 | 0.08 | ft |
| 21-01222 | AAA0023 | 03/23/1992 | Plutonium-239/240 | 0.517 | pCi/g | | NQ | Y | SO | REG | S | 10:35 | | N | N | 0 | 0.5 | ft |
| 21-01225 | AAA0075 | 03/26/1992 | Plutonium-239/240 | 0.638 | pCi/g | | NQ | Y | SO | REG | S | 13:30 | | N | N | 0 | 0.08 | ft |
| 21-01226 | AAA0058 | 03/25/1992 | Plutonium-239/240 | 1.235 | pCi/g | | NQ | Y | SO | REG | S | 09:30 | | N | N | 0 | 0.08 | ft |
| 21-01226 | AAA0059 | 03/25/1992 | Plutonium-239/240 | 0.53 | pCi/g | | NQ | Y | SO | REG | S | 09:15 | | N | N | 0 | 0.5 | ft |
| 21-01227 | AAA0035 | 03/24/1992 | Plutonium-239/240 | 0.051 | pCi/g | | NQ | Y | SO | REG | S | 08:40 | | N | N | 0 | 0.08 | ft |
| 21-01228 | AAA0033 | 03/23/1992 | Plutonium-239/240 | 0.343 | pCi/g | | NQ | Y | SO | REG | S | 15:55 | | N | N | 0 | 0.08 | ft |
| 21-01228 | AAA0034 | 03/24/1992 | Plutonium-239/240 | 0.056 | pCi/g | | NQ | Y | SO | REG | S | 15:35 | | N | N | 0 | 0.5 | ft |
| 21-01229 | AAA0019 | 03/23/1992 | Plutonium-239/240 | 0.047 | pCi/g | | NQ | Y | SO | REG | S | 09:50 | | N | N | 0 | 0.08 | ft |
| 21-01230 | AAA0016 | 03/23/1992 | Plutonium-239/240 | 1.482 | pCi/g | | NQ | Y | SO | REG | S | 09:15 | | N | N | 0 | 0.08 | ft |
| 21-01230 | AAA0017 | 03/23/1992 | Plutonium-239/240 | 0.116 | pCi/g | | NQ | Y | SO | REG | S | 08:45 | | N | N | 0 | 0.5 | ft |
| 21-01230 | AAA0018 | 03/23/1992 | Plutonium-239/240 | 0.058 | pCi/g | | NQ | Y | SO | FD | S | 08:45 | | N | N | 0 | 0.5 | ft |
| 21-01233 | AAA0073 | 03/26/1992 | Plutonium-239/240 | 0.086 | pCi/g | | NQ | Y | SO | REG | S | 13:00 | | N | N | 0 | 0.08 | ft |
| 21-01233 | AAA0074 | 03/26/1992 | Plutonium-239/240 | 0.099 | pCi/g | | NQ | Y | SO | REG | S | 12:50 | | N | N | 0 | 0.5 | ft |
| 21-01234 | AAA0062 | 03/26/1992 | Plutonium-239/240 | 0.766 | pCi/g | | NQ | Y | SO | REG | S | 09:25 | | N | N | 0 | 0.08 | ft |
| 21-01238 | AAA0072 | 03/26/1992 | Plutonium-239/240 | 0.121 | pCi/g | | NQ | Y | SO | REG | S | 09:55 | | N | N | 0 | 0.08 | ft |
| 21-01239 | AAA0063 | 03/26/1992 | Plutonium-239/240 | 0.171 | pCi/g | | NQ | Y | SO | REG | S | 08:50 | | N | N | 0 | 0.08 | ft |
| 21-01239 | AAA0064 | 03/26/1992 | Plutonium-239/240 | 0.128 | pCi/g | | NQ | Y | SO | REG | S | 08:38 | | N | N | 0 | 0.5 | ft |
| 21-01244 | AAA0070 | 03/26/1992 | Plutonium-239/240 | 0.23 | pCi/g | | NQ | Y | SO | REG | S | 12:30 | | N | N | 0 | 0.08 | ft |
| 21-01244 | AAA0071 | 03/26/1992 | Plutonium-239/240 | 0.074 | pCi/g | | NQ | Y | SO | REG | S | 12:20 | | N | N | 0 | 0.5 | ft |
| 21-01245 | AAA0065 | 03/26/1992 | Plutonium-239/240 | 0.058 | pCi/g | | NQ | Y | SO | REG | S | 08:15 | | N | N | 0 | 0.08 | ft |
| 21-01249 | AAA0069 | 03/26/1992 | Plutonium-239/240 | 0.677 | pCi/g | | NQ | Y | SO | REG | S | 10:25 | | N | N | 0 | 0.08 | ft |
| 21-01250 | AAA0066 | 03/25/1992 | Plutonium-239/240 | 1.088 | pCi/g | | NQ | Y | SO | REG | S | 15:35 | | N | N | 0 | 0.08 | ft |
| 21-01250 | AAA0067 | 03/25/1992 | Plutonium-239/240 | 0.325 | pCi/g | | NQ | Y | SO | REG | S | 15:20 | | N | N | 0 | 0.5 | ft |
| 21-01256 | AAA0068 | 03/25/1992 | Plutonium-239/240 | 0.135 | pCi/g | | NQ | Y | SO | REG | S | 14:55 | | N | N | 0 | 0.08 | ft |
| 21-01259 | AAA0002 | 03/19/1992 | Plutonium-239/240 | 0.134 | pCi/g | | NQ | Y | SO | REG | S | 15:41 | | N | N | 0 | 0.08 | ft |
| 21-01259 | AAA0003 | 03/19/1992 | Plutonium-239/240 | 0.076 | pCi/g | | NQ | Y | SO | REG | S | 16:05 | | N | N | 0 | 0.5 | ft |
| 21-01263 | AAA0270 | 06/10/1992 | Plutonium-239/240 | 0.091 | pCi/g | | NQ | Y | SO | REG | S | 08:55 | | N | N | 0 | 0.08 | ft |
| 21-01263 | AAA0271 | 06/10/1992 | Plutonium-239/240 | 0.133 | pCi/g | | NQ | Y | SO | REG | S | 08:15 | | N | N | 0 | 0.5 | ft |
| 21-01264 | AAA0269 | 06/10/1992 | Plutonium-239/240 | 0.114 | pCi/g | | NQ | Y | SO | REG | S | 08:20 | | N | N | 0 | 0.08 | ft |
| 21-01267 | AAA0362 | 06/10/1992 | Plutonium-239/240 | 0.452 | pCi/g | | NQ | Y | SO | REG | S | 15:52 | | N | N | 0 | 0.08 | ft |
| 21-01268 | AAA0268 | 06/10/1992 | Plutonium-239/240 | 0.047 | pCi/g | | NQ | Y | SO | REG | S | 08:00 | | N | N | 0 | 0.08 | ft |
| 21-01269 | AAA0267 | 06/09/1992 | Plutonium-239/240 | 0.112 | pCi/g | | NQ | Y | SO | REG | S | 16:52 | | N | N | 0 | 0.08 | ft |
| 21-01272 | AAA0361 | 06/10/1992 | Plutonium-239/240 | 0.511 | pCi/g | | NQ | Y | SO | REG | S | 15:30 | | N | N | 0 | 0.08 | ft |
| 21-01273 | AAA0355 | 06/10/1992 | Plutonium-239/240 | 0.441 | pCi/g | | NQ | Y | SO | REG | S | 13:53 | | N | N | 0 | 0.08 | ft |
| 21-01274 | AAA0354 | 06/10/1992 | Plutonium-239/240 | 0.566 | pCi/g | | NQ | Y | SO | REG | S | 13:07 | | N | N | 0 | 0.08 | ft |
| 21-01275 | AAA0265 | 06/09/1992 | Plutonium-239/240 | 0.198 | pCi/g | | NQ | Y | SO | REG | S | 16:25 | | N | N | 0 | 0.08 | ft |
| 21-01275 | AAA0266 | 06/09/1992 | Plutonium-239/240 | 0.111 | pCi/g | | NQ | Y | SO | REG | S | 16:10 | | N | N | 0 | 0.5 | ft |
| 21-01278 | AAA0356 | 06/10/1992 | Plutonium-239/240 | 0.106 | pCi/g | | NQ | Y | SO | REG | S | 13:30 | | N | N | 0 | 0.08 | ft |
| 21-01279 | AAA0351 | 06/10/1992 | Plutonium-239/240 | 0.031 | pCi/g | | NQ | Y | SO | REG | S | 10:10 | | N | N | 0 | 0.08 | ft |
| 21-01279 | AAA0352 | 06/10/1992 | Plutonium-239/240 | 0.011 | pCi/g | | NQ | Y | SO | REG | S | 09:45 | | N | N | 0 | 0.42 | ft |
| 21-01279 | AAA0353 | 06/10/1992 | Plutonium-239/240 | 0.024 | pCi/g | | NQ | Y | SO | FD | S | 09:45 | | N | N | 0 | 0.42 | ft |
| 21-01280 | AAA0263 | 06/09/1992 | Plutonium-239/240 | 0.551 | pCi/g | | NQ | Y | SO | REG | S | 15:36 | | N | N | 0 | 0.08 | ft |
| 21-01280 | AAA0264 | 06/09/1992 | Plutonium-239/240 | 0.551 | pCi/g | | NQ | Y | SO | FD | S | 15:36 | | N | N | 0 | 0.08 | ft |
| 21-01281 | AAA0258 | 06/09/1992 | Plutonium-239/240 | 0.14 | pCi/g | | NQ | Y | SO | REG | S | 11:45 | | N | N | 0 | 0.08 | ft |
| 21-01282 | AAA0275 | 06/10/1992 | Plutonium-239/240 | 0.09 | pCi/g | | NQ | Y | SO | REG | S | 10:25 | | N | N | 0 | 0.08 | ft |
| 21-01283 | AAA0274 | 06/10/1992 | Plutonium-239/240 | 0.528 | pCi/g | | NQ | Y | SO | REG | S | 10:45 | | N | N | 0 | 0.08 | ft |
| 21-01284 | AAA0259 | 06/09/1992 | Plutonium-239/240 | 0.06 | pCi/g | | NQ | Y | SO | REG | S | 14:05 | | N | N | 0 | 0.08 | ft |
| 21-01284 | AAA0260 | 06/09/1992 | Plutonium-239/240 | 0.118 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | | N | N | 0 | 0.5 | ft |
| 21-01285 | AAA0257 | 06/09/1992 | Plutonium-239/240 | 0.165 | pCi/g | | NQ | Y | SO | REG | S | 11:08 | | N | N | 0 | 0.08 | ft |
| 21-01287 | AAA0024 | 03/23/1992 | Plutonium-239/240 | 0.18 | pCi/g | | NQ | Y | SO | REG | S | 11:50 | | N | N | 0 | 0.08 | ft |
| 21-01287 | AAA0025 | 03/23/1992 | Plutonium-239/240 | 0.294 | pCi/g | | NQ | Y | SO | REG | S | 11:30 | | N | N | 0 | 0.5 | ft |
| 21-01467 | AAA0261 | 06/09/1992 | Plutonium-239/240 | 0.186 | pCi/g | | NQ | Y | SO | REG | S | 14:43 | | N | N | 0 | 0.08 | ft |
| 21-01467 | AAA0262 | 06/09/1992 | Plutonium-239/240 | 0.033 | pCi/g | | NQ | Y | SO | REG | S | 14:32 | | N | N | 0 | 0.5 | ft |
| 21-104 | MD21-13-36267 | 06/17/2013 | Plutonium-239/240 | 0.267 | pCi/g | | NQ | Y | SO | REG | S | 13:00 | | N | N | 0 | 0.5 | ft |
| 21-105 | MD21-13-36268 | 06/17/2013 | Plutonium-239/240 | 0.194 | pCi/g | | NQ | Y | SO | REG | S | 13:05 | | N | N | 0 | 0.5 | ft |
| 21-106 | MD21-13-36269 | 06/17/2013 | Plutonium-239/240 | 0.045 | pCi/g | | NQ | Y | SO | REG | S | 13:15 | | N | N | 0 | 0.5 | ft |
| 21-10899 | MD21-98-0504 | 10/15/1998 | Plutonium-239/240 | 0.0017 | pCi/g | U | U | N | SD | REG | R | 14:00 | | N | N | 0 | 0 | ft |
| 21-10900 | MD21-98-0505 | 10/15/1998 | Plutonium-239/240 | 0.005 | pCi/g | U | U | N | SD | REG | R | 14:15 | | N | N | 0 | 0 | ft |

| *Pu-239/240* | |
|---|---|
| Mean | 0.29 |
| Standard Error | 0.04 |
| Median | 0.13 |
| Mode | 0.05 |
| Standard Deviation | 0.33 |
| Sample Variance | 0.11 |
| Range | 1.48 |
| Minimum | 0.00 |
| Maximum | 1.48 |
| Sum | 17.77 |
| Count | 62 |
| Confidence Level(95 | 0.08 |
| UCL Estimate | 0.371 |

| Location | Field Sample ID | Date Sampled | Parameter | Result | Units | Lab Qualifier | Validation Qualifier | Detect? | Matrix | Purpose | Type | Time | Program | Filtered | Leached | Start Depth | End Depth | Depth Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-104 | MD21-13-36267 | 06/17/2013 | Cesium-137 | 0.963 | pCi/g | | NQ | Y | SO | REG | S | 13:00 | | N | N | 0 | 0.5 | ft |
| 21-105 | MD21-13-36268 | 06/17/2013 | Cesium-137 | 0.765 | pCi/g | | NQ | Y | SO | REG | S | 13:05 | | N | N | 0 | 0.5 | ft |
| 21-106 | MD21-13-36269 | 06/17/2013 | Cesium-137 | 0.166 | pCi/g | | NQ | Y | SO | REG | S | 13:15 | | N | N | 0 | 0.5 | ft |
| 21-10899 | MD21-98-0504 | 10/15/1998 | Cesium-137 | 0.002 | pCi/g | U | U | N | SD | REG | R | 14:00 | | N | N | 0 | 0 | ft |
| 21-10900 | MD21-98-0505 | 10/15/1998 | Cesium-137 | -0.027 | pCi/g | U | U | N | SD | REG | R | 14:15 | | N | N | 0 | 0 | ft |

*Cs-137*

| | |
|---|---|
| Mean | 0.37 |
| Standard Error | 0.21 |
| Median | 0.17 |
| Mode | #N/A |
| Standard Deviation | 0.46 |
| Sample Variance | 0.21 |
| Range | 0.99 |
| Minimum | -0.03 |
| Maximum | 0.96 |
| Sum | 1.87 |
| Count | 5 |
| Confidence Level(9 | 0.57 |
| UCL Estimate | 0.94 |

| Location | Field Sample ID | Date Sampled | Parameter | Result | Units | Lab Qualifier | Validation Qualifier | Detect? | Matrix | Purpose | Type | Time | Program | Filtered | Leached | Start Depth | End Depth | Depth Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-01232 | AAA0382 | 6/11/1992 | Plutonium-239/240 | 0.191 | pCi/g | | R | Y | SO | REG | S | 12:52 | | N | N | 0 | 0.08 | ft |
| 21-01237 | AAA0381 | 6/11/1992 | Plutonium-239/240 | 0.16 | pCi/g | | R | Y | SO | REG | S | 11:15 | | N | N | 0 | 0.08 | ft |
| 21-01243 | AAA0375 | 6/11/1992 | Plutonium-239/240 | 1.41 | pCi/g | | R | Y | SO | REG | S | 11:00 | | N | N | 0 | 0.08 | ft |
| 21-01243 | AAA0376 | 6/11/1992 | Plutonium-239/240 | 1.089 | pCi/g | | R | Y | SO | REG | S | 10:45 | | N | N | 0 | 0.33 | ft |
| 21-01248 | AAA0374 | 6/11/1992 | Plutonium-239/240 | 2.509 | pCi/g | | R | Y | SO | REG | S | 10:30 | | N | N | 0 | 0.08 | ft |
| 21-01255 | AAA0373 | 6/11/1992 | Plutonium-239/240 | 1.031 | pCi/g | | NQ | Y | SO | REG | S | 10:02 | | N | N | 0 | 0.08 | ft |
| 21-01261 | AAA0372 | 6/11/1992 | Plutonium-239/240 | 0.199 | pCi/g | | NQ | Y | SO | REG | S | 9:45 | | N | N | 0 | 0.08 | ft |
| 21-01266 | AAA0370 | 6/11/1992 | Plutonium-239/240 | 0.813 | pCi/g | | NQ | Y | SO | REG | S | 9:25 | | N | N | 0 | 0.08 | ft |
| 21-01266 | AAA0371 | 6/11/1992 | Plutonium-239/240 | 0.174 | pCi/g | | NQ | Y | SO | REG | S | 9:15 | | N | N | 0 | 0.5 | ft |
| 21-01270 | AAA0368 | 6/11/1992 | Plutonium-239/240 | 0.541 | pCi/g | | NQ | Y | SO | REG | S | 8:50 | | N | N | 0 | 0.08 | ft |
| 21-01270 | AAA0369 | 6/11/1992 | Plutonium-239/240 | 1.103 | pCi/g | | NQ | Y | SO | FD | S | 8:50 | | N | N | 0 | 0.08 | ft |
| 21-01271 | AAA0367 | 6/11/1992 | Plutonium-239/240 | 0.513 | pCi/g | | NQ | Y | SO | REG | S | 8:26 | | N | N | 0 | 0.08 | ft |
| 21-01276 | AAA0366 | 6/11/1992 | Plutonium-239/240 | 0.402 | pCi/g | | NQ | Y | SO | REG | S | 8:07 | | N | N | 0 | 0.08 | ft |
| 21-01277 | AAA0357 | 6/10/1992 | Plutonium-239/240 | 1.102 | pCi/g | | NQ | Y | SO | REG | S | 14:30 | | N | N | 0 | 0.08 | ft |
| 21-01277 | AAA0358 | 6/10/1992 | Plutonium-239/240 | 0.086 | pCi/g | | NQ | Y | SO | REG | S | 14:20 | | N | N | 0 | 0.5 | ft |
| 21-01468 | AAA0359 | 6/10/1992 | Plutonium-239/240 | 0.284 | pCi/g | | NQ | Y | SO | REG | S | 15:02 | | N | N | 0 | 0.08 | ft |
| 21-01468 | AAA0360 | 6/10/1992 | Plutonium-239/240 | 3.256 | pCi/g | | NQ | Y | SO | REG | S | 14:50 | | N | N | 0 | 0.5 | ft |
| 21-05490 | 0121-97-1353 | 8/21/1997 | Plutonium-239/240 | 11.88 | pCi/g | | NQ | Y | SED | REG | SED | 9:22 | | N | N | 0.92 | 1.75 | ft |
| 21-05490 | CA21-98-0131 | 11/23/1998 | Plutonium-239/240 | 4.9 | pCi/g | | NQ | Y | SED | REG | SED | 11:22 | | N | N | 0 | 0.92 | ft |
| 21-05490 | CA21-98-0133 | 11/23/1998 | Plutonium-239/240 | 0.475 | pCi/g | | NQ | Y | SED | REG | SED | 12:00 | | N | N | 1.77 | 3.44 | ft |
| 21-05491 | CA21-98-0134 | 11/23/1998 | Plutonium-239/240 | 10.87 | pCi/g | | NQ | Y | SED | REG | SED | 12:00 | | N | N | 0 | 30 | cm |
| 21-05491 | 0121-97-1354 | 8/21/1997 | Plutonium-239/240 | 4.45 | pCi/g | | NQ | Y | SED | REG | SED | 10:50 | | N | N | 1 | 1.5 | ft |
| 21-05491 | 0121-97-1355 | 8/21/1997 | Plutonium-239/240 | 48.3 | pCi/g | | NQ | Y | SED | REG | SED | 11:10 | | N | N | 0 | 0.98 | ft |
| 21-05491 | CA21-98-0152 | 11/23/1998 | Plutonium-239/240 | 4.5 | pCi/g | | NQ | Y | SED | REG | SED | 12:25 | | N | N | 30 | 41 | cm |
| 21-05491 | CA21-98-0153 | 11/23/1998 | Plutonium-239/240 | 4 | pCi/g | | NQ | Y | SED | FD | SED | 12:00 | | N | N | 0 | 30 | cm |
| 21-05491 | CA21-98-0126 | 11/23/1998 | Plutonium-239/240 | 4.3 | pCi/g | | NQ | Y | SED | REG | SED | 12:25 | | N | N | 53 | 83 | cm |
| 21-05497 | CA21-98-0154 | 11/20/1998 | Plutonium-239/240 | 0.393 | pCi/g | | NQ | Y | SED | REG | SED | 13:50 | | N | N | 105 | 135 | cm |
| 21-05497 | 0121-97-1432 | 10/23/1997 | Plutonium-239/240 | 11.2 | pCi/g | | NQ | Y | SED | REG | SED | 0:00 | | N | N | 1.74 | 2.13 | ft |
| 21-107 | MD21-13-36270 | 6/17/2013 | Plutonium-239/240 | 2.345 | pCi/g | | NQ | Y | SO | REG | S | 13:45 | | N | N | 0 | 1 | ft |
| 21-10961 | CA21-98-0102 | 11/20/1998 | Plutonium-239/240 | 2.47 | pCi/g | | NQ | Y | SED | REG | SED | 13:15 | | N | N | 0.26 | 0.76 | ft |
| 21-10961 | CA21-98-0103 | 11/20/1998 | Plutonium-239/240 | 0.922 | pCi/g | | NQ | Y | SED | REG | SED | 13:30 | | N | N | 1.67 | 1.9 | ft |
| 21-10962 | CA21-98-0104 | 11/20/1998 | Plutonium-239/240 | 9.73 | pCi/g | | NQ | Y | SED | REG | SED | 13:45 | | N | N | 0 | 1.02 | ft |
| 21-10962 | CA21-98-0105 | 11/20/1998 | Plutonium-239/240 | 8.8 | pCi/g | | NQ | Y | SED | REG | SED | 14:00 | | N | N | 31 | 65 | cm |
| 21-10962 | CA21-98-0106 | 11/20/1998 | Plutonium-239/240 | 0.606 | pCi/g | | NQ | Y | SED | REG | SED | 14:12 | | N | N | 3.74 | 4.46 | ft |
| 21-10962 | CA21-98-0107 | 11/20/1998 | Plutonium-239/240 | 1.407 | pCi/g | | NQ | Y | SED | REG | SED | 14:20 | | N | N | 4.46 | 4.99 | ft |
| 21-10963 | CA21-98-0108 | 11/20/1998 | Plutonium-239/240 | 1.255 | pCi/g | | NQ | Y | SED | REG | SED | 13:55 | | N | N | 0 | 0.56 | ft |
| 21-10963 | CA21-98-0109 | 11/20/1998 | Plutonium-239/240 | 7.44 | pCi/g | | NQ | Y | SED | REG | SED | 14:20 | | N | N | 0.56 | 1.35 | ft |
| 21-10963 | CA21-98-0110 | 11/20/1998 | Plutonium-239/240 | 10.08 | pCi/g | | NQ | Y | SED | REG | SED | 14:40 | | N | N | 1.35 | 2 | ft |
| 21-10967 | CA21-98-0120 | 11/20/1998 | Plutonium-239/240 | 0.084 | pCi/g | LT | NQ | Y | SED | REG | SED | 15:45 | | N | N | 0 | 0.16 | ft |
| 21-10968 | CA21-98-0121 | 11/23/1998 | Plutonium-239/240 | 0.991 | pCi/g | | NQ | Y | SED | REG | SED | 9:40 | | N | N | 0.66 | 1.31 | ft |
| 21-10968 | CA21-98-0149 | 11/23/1998 | Plutonium-239/240 | 0.357 | pCi/g | | NQ | Y | SED | REG | SED | 9:30 | | N | N | 0 | 0.66 | ft |
| 21-10968 | CA21-98-0150 | 11/23/1998 | Plutonium-239/240 | 2.54 | pCi/g | | NQ | Y | SED | REG | SED | 9:50 | | N | N | 40 | 70 | cm |
| 21-10973 | CA21-98-0151 | 11/23/1998 | Plutonium-239/240 | 0.488 | pCi/g | | NQ | Y | SED | REG | SED | 9:45 | | N | N | 38 | 50 | cm |
| 21-10973 | CA21-98-0122 | 11/23/1998 | Plutonium-239/240 | 4.18 | pCi/g | | NQ | Y | SED | REG | SED | 10:21 | | N | N | 0.16 | 0.66 | ft |
| 21-112 | MD21-13-36275 | 6/18/2013 | Plutonium-239/240 | 0.046 | pCi/g | | NQ | Y | SO | REG | S | 10:55 | | N | N | 0 | 0.5 | ft |
| 21-115 | MD21-13-36278 | 6/18/2013 | Plutonium-239/240 | 0.328 | pCi/g | | NQ | Y | SO | REG | S | 12:45 | | N | N | 0 | 0.5 | ft |
| 21-116 | MD21-13-36279 | 6/18/2013 | Plutonium-239/240 | 0.626 | pCi/g | | NQ | Y | SO | REG | S | 13:00 | | N | N | 0 | 0.5 | ft |
| 21-117 | MD21-13-36280 | 6/18/2013 | Plutonium-239/240 | 0.075 | pCi/g | | NQ | Y | SO | REG | S | 13:10 | | N | N | 0 | 0.5 | ft |
| 21-118 | MD21-13-36281 | 6/18/2013 | Plutonium-239/240 | 0.06 | pCi/g | | NQ | Y | SO | REG | S | 13:15 | | N | N | 0 | 0.5 | ft |
| DPS-3 | SED6808155801 | 8/15/1968 | Plutonium-239/240 | 0.79 | pCi/g | | NQ | N | SED | REG | SED | 0:00 | | N | N | | | |

| *Pu-239/240* | |
|---|---|
| Mean | 3.52 |
| Standard Error | 1.03 |
| Median | 1.06 |
| Mode | #N/A |
| Standard Deviation | 7.28 |
| Sample Variance | 52.98 |
| Range | 48.25 |
| Minimum | 0.05 |
| Maximum | 48.30 |
| Sum | 175.75 |
| Count | 50 |
| Confidence Level(95.0 | 2.07 |
| UCL Estimate | 5.58 |

| Location | Field Sample ID | Date Sampled | Parameter | Result | Units | Decay Correct | Lab Qualifier | Validation | Detect? | Matrix | Purpo | Type | Time | Program | Filtered | Leached | Start Depth | End Depth | Depth Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-05490 | 0121-97-1353 | 8/21/1997 | Cesium-137 | 149 | pCi/g | 99.0 | | NQ | Y | SED | REG | SED | 9:22 | | N | N | 0.92 | 1.75 | ft |
| 21-05490 | CA21-98-0131 | 11/23/1998 | Cesium-137 | 78 | pCi/g | 53.3 | | NQ | Y | SED | REG | SED | 11:22 | | N | N | 0 | 0.92 | ft |
| 21-05490 | CA21-98-0133 | 11/23/1998 | Cesium-137 | 11.5 | pCi/g | 7.9 | | NQ | Y | SED | REG | SED | 12:00 | | N | N | 1.77 | 3.44 | ft |
| 21-05491 | CA21-98-0126 | 11/23/1998 | Cesium-137 | 3.32 | pCi/g | 2.3 | | NQ | Y | SED | REG | SED | 12:25 | | N | N | 53 | 83 | cm |
| 21-05491 | CA21-98-0152 | 11/23/1998 | Cesium-137 | 3.61 | pCi/g | 2.5 | | NQ | Y | SED | REG | SED | 12:25 | | N | N | 30 | 41 | cm |
| 21-05491 | 0121-97-1354 | 8/21/1997 | Cesium-137 | 109 | pCi/g | 72.4 | | NQ | Y | SED | REG | SED | 10:50 | | N | N | 1 | 1.5 | ft |
| 21-05491 | 0121-97-1355 | 8/21/1997 | Cesium-137 | 133 | pCi/g | 88.4 | | NQ | Y | SED | REG | SED | 11:10 | | N | N | 0 | 0.98 | ft |
| 21-05497 | 0121-97-1432 | 10/23/1997 | Cesium-137 | 93.2 | pCi/g | 62.2 | | NQ | Y | SED | REG | SED | 0:00 | | N | N | 1.74 | 2.13 | ft |
| 21-05497 | CA21-98-0154 | 11/20/1998 | Cesium-137 | 12.9 | pCi/g | 8.8 | | NQ | Y | SED | REG | SED | 13:50 | | N | N | 105 | 135 | cm |
| 21-107 | MD21-13-36270 | 6/17/2013 | Cesium-137 | 13.67 | pCi/g | 13.1 | | NQ | Y | SO | REG | S | 13:45 | | N | N | 0 | 1 | ft |
| 21-10961 | CA21-98-0102 | 11/20/1998 | Cesium-137 | 10.3 | pCi/g | 7.0 | | NQ | Y | SED | REG | SED | 13:15 | | N | N | 0.26 | 0.76 | ft |
| 21-10961 | CA21-98-0103 | 11/20/1998 | Cesium-137 | 10.8 | pCi/g | 7.4 | | NQ | Y | SED | REG | SED | 13:30 | | N | N | 1.67 | 1.9 | ft |
| 21-10962 | CA21-98-0104 | 11/20/1998 | Cesium-137 | 111 | pCi/g | 75.9 | | NQ | Y | SED | REG | SED | 13:45 | | N | N | 0 | 1.02 | ft |
| 21-10962 | CA21-98-0105 | 11/20/1998 | Cesium-137 | 85 | pCi/g | 58.1 | | NQ | Y | SED | REG | SED | 14:00 | | N | N | 31 | 65 | cm |
| 21-10962 | CA21-98-0106 | 11/20/1998 | Cesium-137 | 2.48 | pCi/g | 1.7 | | NQ | Y | SED | REG | SED | 14:12 | | N | N | 3.74 | 4.46 | ft |
| 21-10962 | CA21-98-0107 | 11/20/1998 | Cesium-137 | 6.5 | pCi/g | 4.4 | | NQ | Y | SED | REG | SED | 14:20 | | N | N | 4.46 | 4.99 | ft |
| 21-10963 | CA21-98-0108 | 11/20/1998 | Cesium-137 | 10.4 | pCi/g | 7.1 | | NQ | Y | SED | REG | SED | 13:55 | | N | N | 0 | 0.56 | ft |
| 21-10963 | CA21-98-0109 | 11/20/1998 | Cesium-137 | 90 | pCi/g | 61.5 | | NQ | Y | SED | REG | SED | 14:20 | | N | N | 0.56 | 1.35 | ft |
| 21-10963 | CA21-98-0110 | 11/20/1998 | Cesium-137 | 192 | pCi/g | 131.3 | | NQ | Y | SED | REG | SED | 14:40 | | N | N | 1.35 | 2 | ft |
| 21-10964 | CA21-98-0111 | 11/20/1998 | Cesium-137 | 15.4 | pCi/g | 10.5 | | NQ | Y | SED | REG | SED | 14:45 | | N | N | 0 | 0.66 | ft |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-10964 | CA21-98-0112 | 11/20/1998 | Cesium-137 | 18.7 pCi/g | 12.8 | | NQ | Y | SED | REG | SED | 14:55 | N | N | 0.66 | 1.31 ft |
| 21-10964 | CA21-98-0113 | 11/20/1998 | Cesium-137 | 22.5 pCi/g | 15.4 | | NQ | Y | SED | REG | SED | 15:10 | N | N | 1.57 | 2.53 ft |
| 21-10964 | CA21-98-0114 | 11/20/1998 | Cesium-137 | 57.8 pCi/g | 39.5 | | NQ | Y | SED | REG | SED | 15:20 | N | N | 3.12 | 3.94 ft |
| 21-10964 | CA21-98-0115 | 11/20/1998 | Cesium-137 | 64 pCi/g | 43.8 | | NQ | Y | SED | REG | SED | 15:10 | N | N | 2.53 | 3.12 ft |
| 21-10966 | CA21-98-0119 | 11/20/1998 | Cesium-137 | 2.2 pCi/g | 1.5 | | NQ | Y | SED | REG | SED | 15:40 | N | N | 0 | 0.59 ft |
| 21-10967 | CA21-98-0120 | 11/20/1998 | Cesium-137 | 1.03 pCi/g | 0.7 | | NQ | Y | SED | REG | SED | 15:45 | N | N | 0 | 0.16 ft |
| 21-10968 | CA21-98-0121 | 11/23/1998 | Cesium-137 | 12.9 pCi/g | 8.8 | | NQ | Y | SED | REG | SED | 9:40 | N | N | 0.66 | 1.31 ft |
| 21-10968 | CA21-98-0149 | 11/23/1998 | Cesium-137 | 4.12 pCi/g | 2.8 | | NQ | Y | SED | REG | SED | 9:30 | N | N | 0 | 0.66 ft |
| 21-10968 | CA21-98-0150 | 11/23/1998 | Cesium-137 | 25.6 pCi/g | 17.5 | | NQ | Y | SED | REG | SED | 9:50 | N | N | 40 | 70 cm |
| 21-10973 | CA21-98-0151 | 11/23/1998 | Cesium-137 | 6.7 pCi/g | 4.6 | | NQ | Y | SED | REG | SED | 9:45 | N | N | 38 | 50 cm |
| 21-10973 | CA21-98-0122 | 11/23/1998 | Cesium-137 | 31.8 pCi/g | 21.7 | | NQ | Y | SED | REG | SED | 10:21 | N | N | 0.16 | 0.66 ft |
| 21-112 | MD21-13-36275 | 6/18/2013 | Cesium-137 | 0.202 pCi/g | 0.2 | | NQ | Y | SO | REG | S | 10:55 | N | N | 0 | 0.5 ft |
| 21-115 | MD21-13-36278 | 6/18/2013 | Cesium-137 | 0.92 pCi/g | 0.9 | | NQ | Y | SO | REG | S | 12:45 | N | N | 0 | 0.5 ft |
| 21-116 | MD21-13-36279 | 6/18/2013 | Cesium-137 | 0.733 pCi/g | 0.7 | | NQ | Y | SO | REG | S | 13:00 | N | N | 0 | 0.5 ft |
| 21-117 | MD21-13-36280 | 6/18/2013 | Cesium-137 | 0.321 pCi/g | 0.3 | | NQ | Y | SO | REG | S | 13:10 | N | N | 0 | 0.5 ft |
| 21-118 | MD21-13-36281 | 6/18/2013 | Cesium-137 | 0.1 pCi/g | 0.1 | | NQ | Y | SO | REG | S | 13:15 | N | N | 0 | 0.5 ft |

| *Cs-137 (no decay correction)* | |
|---|---|
| Mean | 38.63 |
| Standard Error | 8.39 |
| Median | 12.90 |
| Mode | 12.90 |
| Standard Deviatio | 50.33 |
| Sample Variance | 2532.81 |
| Range | 191.90 |
| Minimum | 0.10 |
| Maximum | 192.00 |
| Sum | 1390.70 |
| Count | 36 |
| Confidence Level( | 17.03 |
| UCL Estimate | 55.66 |

| *Cs-137 (decay corrected)* | |
|---|---|
| Mean | 26.32 |
| Standard Error | 5.66 |
| Median | 8.83 |
| Mode | #N/A |
| Standard Deviation | 33.96 |
| Sample Variance | 1152.98 |
| Range | 131.38 |
| Minimum | 0.10 |
| Maximum | 131.48 |
| Sum | 947.54 |
| Count | 36 |
| Confidence Level(95.0% | 11.49 |
| UCL Estimate | 37.81 |

| Location | Field Sample ID | Date Sampled | Parameter | Result | Units | Lab Qualifier | Validation Qualifier | Detect? | Matrix | Purpose | Type | Time | Program | Filtered | Leached | Start Depth | End Depth | Depth Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-01223 | AAA0548 | 06/25/1992 | Plutonium-239/240 | 0.625 | pCi/g | | NQ | Y | SO | REG | S | 15:25 | | N | N | 0 | 0.08 | ft |
| 21-01223 | AAA0549 | 06/25/1992 | Plutonium-239/240 | 0.836 | pCi/g | | NQ | Y | SO | FD | S | 15:25 | | N | N | 0 | 0.08 | ft |
| 21-01223 | AAA0550 | 06/25/1992 | Plutonium-239/240 | 0.857 | pCi/g | | NQ | Y | SO | REG | S | 15:15 | | N | N | 0 | 0.17 | ft |
| 21-01231 | AAA0551 | 06/25/1992 | Plutonium-239/240 | 0.169 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | | N | N | 0 | 0.08 | ft |
| 21-01236 | AAA0552 | 06/25/1992 | Plutonium-239/240 | 0.464 | pCi/g | | NQ | Y | SO | REG | S | 16:35 | | N | N | 0 | 0.08 | ft |
| 21-01242 | AAA0553 | 06/25/1992 | Plutonium-239/240 | 0.473 | pCi/g | | NQ | Y | SO | REG | S | 17:10 | | N | N | 0 | 0.08 | ft |
| 21-01242 | AAA0554 | 06/25/1992 | Plutonium-239/240 | 0.637 | pCi/g | | NQ | Y | SO | REG | S | 17:00 | | N | N | 0 | 0.5 | ft |
| 21-01247 | AAA0557 | 06/26/1992 | Plutonium-239/240 | 0.208 | pCi/g | | NQ | Y | SO | REG | S | 10:05 | | N | N | 0 | 0.08 | ft |
| 21-01254 | AAA0558 | 06/26/1992 | Plutonium-239/240 | 0.152 | pCi/g | | NQ | Y | SO | REG | S | 10:30 | | N | N | 0 | 0.08 | ft |
| 21-01260 | AAA0559 | 06/26/1992 | Plutonium-239/240 | 0.254 | pCi/g | | NQ | Y | SO | REG | S | 11:22 | | N | N | 0 | 0.08 | ft |
| 21-01260 | AAA0560 | 06/26/1992 | Plutonium-239/240 | 0.091 | pCi/g | | NQ | Y | SO | REG | S | 11:12 | | N | N | 0 | 0.5 | ft |
| 21-01265 | AAA0561 | 06/26/1992 | Plutonium-239/240 | 2.35 | pCi/g | | NQ | Y | SO | REG | S | 10:55 | | N | N | 0 | 0.08 | ft |
| 21-01281 | AAA0258 | 06/09/1992 | Plutonium-239/240 | 0.14 | pCi/g | | NQ | Y | SO | REG | S | 11:45 | | N | N | 0 | 0.08 | ft |
| 21-01299 | AAA0555 | 06/26/1992 | Plutonium-239/240 | 0.667 | pCi/g | | NQ | Y | SO | REG | S | 08:50 | | N | N | 0 | 0.08 | ft |
| 21-01299 | AAA0556 | 06/26/1992 | Plutonium-239/240 | 1.99 | pCi/g | | NQ | Y | SO | REG | S | 08:45 | | N | N | 0 | 0.5 | ft |
| LA-00092 | 04LA-97-0052 | 06/05/1997 | Plutonium-239/240 | 1.3 | pCi/g | | NQ | Y | SED | REG | SED | 09:10 | | N | N | 0.46 | 1.04 | ft |
| LA-00092 | 04LA-97-0096 | 06/05/1997 | Plutonium-239/240 | 0.982 | pCi/g | | NQ | Y | SED | REG | SED | 08:40 | | N | N | 0 | 0.45 | ft |
| LA-00092 | 04LA-97-0097 | 06/05/1997 | Plutonium-239/240 | 1.36 | pCi/g | | NQ | Y | SED | FD | SED | 08:40 | | N | N | 0 | 0.45 | ft |
| LA-00092 | 04LA-97-0098 | 06/05/1997 | Plutonium-239/240 | 5.4 | pCi/g | | NQ | Y | SED | REG | SED | 09:30 | | N | N | 1.04 | 1.41 | ft |
| LA-00092 | 04LA-97-0099 | 06/05/1997 | Plutonium-239/240 | 0.843 | pCi/g | | NQ | Y | SED | REG | SED | 09:45 | | N | N | 1.41 | 2 | ft |
| Los Alamos above DP Canyon | CALA-08-16481 | 11/18/2008 | Plutonium-239/240 | 6.41 | pCi/g | | NQ | Y | SED | REG | SED | 11:08 | | N | N | 0 | 0.5 | ft |
| Los Alamos above DP Canyon | CALA-11-2377 | 11/18/2010 | Plutonium-239/240 | 0.322 | pCi/g | | NQ | Y | SED | REG | SED | 15:50 | | N | N | 0 | 0.66 | ft |
| Los Alamos above DP Canyon | CALA-12-1679 | 11/17/2011 | Plutonium-239/240 | 0.162 | pCi/g | | NQ | Y | SED | REG | SED | 13:15 | | N | N | 0 | 0.62 | ft |
| Los Alamos above DP Canyon | CAPA-07-6327 | 09/12/2007 | Plutonium-239/240 | 0.35 | pCi/g | | NQ | Y | SED | REG | SED | 11:40 | | N | N | 0 | 0.42 | ft |
| Los Alamos above DP Canyon | CALA-10-4846 | 11/06/2009 | Plutonium-239/240 | 0.47 | pCi/g | | NQ | Y | SED | REG | SED | 15:05 | | N | N | 0 | 0.23 | ft |
| Los Alamos above DP Canyon | GN03070S03001 | 07/30/2003 | Plutonium-239/240 | 1.26 | pCi/g | | NQ | Y | SED | REG | SED | 12:35 | | N | N | | | |
| Los Alamos above DP Canyon | GN04050S03001 | 06/03/2004 | Plutonium-239/240 | 0.116 | pCi/g | | NQ | Y | SED | REG | SED | 10:22 | | N | N | | | |
| Los Alamos above DP Canyon | GN05060S03001 | 07/07/2005 | Plutonium-239/240 | 0.261 | pCi/g | | NQ | Y | SED | REG | SED | 10:00 | | N | N | | | |
| Los Alamos above DP Canyon | GN060500S03001 | 06/28/2006 | Plutonium-239/240 | 0.0726 | pCi/g | | NQ | Y | SED | REG | SED | 09:40 | | N | N | | | |
| Los Alamos above DP Canyon | GU02041S030 | 04/09/2002 | Plutonium-239/240 | 0.151 | pCi/g | | NQ | Y | SED | REG | SED | 11:10 | | N | N | | | |
| Los Alamos at Upper GS | MM96051SGAL | 05/08/1996 | Plutonium-239/240 | 0.06 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | GU01061SGAL | 06/26/2001 | Plutonium-239/240 | 0.561 | pCi/g | | NQ | Y | SED | REG | SED | 09:40 | | N | N | | | |
| Los Alamos at Upper GS | MM97051SGAL | 05/07/1997 | Plutonium-239/240 | 0.4487 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM97121SGUL | 12/18/1997 | Plutonium-239/240 | 0.4684 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM98071SGAL | 07/21/1998 | Plutonium-239/240 | 0.0827 | pCi/g | | | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM98071SGUL | 07/21/1998 | Plutonium-239/240 | 0.2293 | pCi/g | | | Y | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM98072SGAL | 07/21/1998 | Plutonium-239/240 | 0.1155 | pCi/g | | | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM98072SGUL | 07/21/1998 | Plutonium-239/240 | 0.2135 | pCi/g | | | Y | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | CM99041SGUL | 04/23/1999 | Plutonium-239/240 | 0.2182 | pCi/g | | | Y | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | CC00041SGAL | 04/24/2000 | Plutonium-239/240 | 0.1461 | pCi/g | | | Y | SED | REG | SED | 11:00 | | N | N | | | |
| Los Alamos at Upper GS | 7604SEDSGAL | 04/21/1976 | Plutonium-239/240 | 0.068 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7610SEDSGAL | 10/12/1976 | Plutonium-239/240 | 0.65 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7704SEDSGAL | 04/11/1977 | Plutonium-239/240 | 0.76 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7710SEDSGAL | 10/18/1977 | Plutonium-239/240 | 0.171 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7801SEDSGAL | 01/01/1978 | Plutonium-239/240 | 0.205 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7803SEDSGAL | 03/27/1978 | Plutonium-239/240 | 0.269 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7904SEDSGAL | 04/16/1979 | Plutonium-239/240 | 0.1 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7907SEDSGAL | 07/20/1979 | Plutonium-239/240 | 0.334 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8001SEDSGAL | 01/01/1980 | Plutonium-239/240 | 0.194 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8003SEDSGAL | 03/31/1980 | Plutonium-239/240 | 0.281 | pCi/g | | U | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8104SEDSGAL | 04/21/1981 | Plutonium-239/240 | 0.44 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8201SEDSGAL | 01/01/1982 | Plutonium-239/240 | 0.29 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8210SEDSGAL | 10/28/1982 | Plutonium-239/240 | 0.22 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8301SEDSGAL | 01/01/1983 | Plutonium-239/240 | 0.002 | pCi/g | | U | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8405SEDSGAL | 05/10/1984 | Plutonium-239/240 | 0.611 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8504SEDSGAL | 04/26/1985 | Plutonium-239/240 | 1.17 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8603SEDSGAL | 03/14/1986 | Plutonium-239/240 | 0.507 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8704SEDSGAL | 04/16/1987 | Plutonium-239/240 | 0.516 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8804SEDSGAL | 04/21/1988 | Plutonium-239/240 | 0.669 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8905SEDSGAL | 05/01/1989 | Plutonium-239/240 | 0.192 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 9005SEDSGAL | 05/21/1990 | Plutonium-239/240 | 0.073 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 9101SEDSGAL | 01/01/1991 | Plutonium-239/240 | 0.189 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 9201SEDSGAL | 01/01/1992 | Plutonium-239/240 | 0.329 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 9310SEDSGAL | 10/25/1993 | Plutonium-239/240 | 0.104 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 9407SEDSGAL | 07/07/1994 | Plutonium-239/240 | 0.11 | pCi/g | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |

| *Pu-239/240* | |
|---|---|
| Mean | 0.62 |
| Standard Error | 0.13 |
| Median | 0.29 |
| Mode | #N/A |
| Standard Deviation | 1.05 |
| Sample Variance | 1.11 |
| Kurtosis | 20.06 |
| Skewness | 4.27 |
| Range | 6.41 |
| Minimum | 0.00 |
| Maximum | 6.41 |
| Sum | 40.37 |
| Count | 65 |
| Confidence Level(95.0% | 0.26 |
| UCL Estimate | 0.88 |

| Location | Field Sample ID | Date Sampled | Parameter | Result | Units | Decay Correct | Lab Qualifier | ation Qua | Detect? | Matrix | urpos | Type | Time | Program | Filtered | Leached | Start Depth | End Depth | Depth Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LA-00092 | 04LA-97-0052 | 06/05/1997 | Cesium-137 | 0.634 | pCi/g | 0.4 | | NQ | Y | SED | REG | SED | 09:10 | | N | N | 0.46 | 1.04 | ft |
| Los Alamos above DP Canyon | CALA-08-16481 | 11/18/2008 | Cesium-137 | 0.0912 | pCi/g | 0.1 | | U | N | SED | REG | SED | 11:08 | | N | N | 0 | 0.5 | ft |
| Los Alamos above DP Canyon | CALA-10-4846 | 11/06/2009 | Cesium-137 | 0.0227 | pCi/g | 0.0 | U | U | N | SED | REG | SED | 15:05 | | N | N | 0 | 0.23 | ft |
| Los Alamos above DP Canyon | CALA-11-2377 | 11/18/2010 | Cesium-137 | 0.0221 | pCi/g | 0.0 | U | U | N | SED | REG | SED | 15:50 | | N | N | 0 | 0.66 | ft |
| Los Alamos above DP Canyon | CALA-12-1679 | 11/17/2011 | Cesium-137 | 0.0977 | pCi/g | 0.1 | | NQ | Y | SED | REG | SED | 13:15 | | N | N | 0 | 0.62 | ft |
| Los Alamos above DP Canyon | CAPA-07-6327 | 09/12/2007 | Cesium-137 | 0.0915 | pCi/g | 0.1 | | NQ | Y | SED | REG | SED | 11:40 | | N | N | 0 | 0.42 | ft |
| Los Alamos above DP Canyon | GN03070S03001 | 07/30/2003 | Cesium-137 | 0.399 | pCi/g | 0.3 | | NQ | Y | SED | REG | SED | 12:35 | | N | N | | | |
| Los Alamos above DP Canyon | GN04050S03001 | 06/03/2004 | Cesium-137 | 0.0384 | pCi/g | 0.0 | | J | Y | SED | REG | SED | 10:22 | | N | N | | | |
| Los Alamos above DP Canyon | GN05060S03001 | 07/07/2005 | Cesium-137 | 0.0538 | pCi/g | 0.0 | UI | R | N | SED | REG | SED | 10:00 | | N | N | | | |
| Los Alamos above DP Canyon | GN060500S03001 | 06/28/2006 | Cesium-137 | 0.057 | pCi/g | 0.0 | | J | Y | SED | REG | SED | 09:40 | | N | N | | | |
| Los Alamos above DP Canyon | GU02041S030 | 04/09/2002 | Cesium-137 | 0.156 | pCi/g | 0.1 | | NQ | Y | SED | REG | SED | 11:10 | | N | N | | | |
| Los Alamos at Upper GS | MM96051SGAL | 05/08/1996 | Cesium-137 | 0.05 | pCi/g | 0.0 | | U | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM97051SGAL | 05/07/1997 | Cesium-137 | 0.14 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM97121SGUL | 12/18/1997 | Cesium-137 | 0.13 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM98071SGAL | 07/21/1998 | Cesium-137 | 0.77 | pCi/g | 0.5 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM98071SGUL | 07/21/1998 | Cesium-137 | 0.14 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM98072SGAL | 07/21/1998 | Cesium-137 | 0.86 | pCi/g | 0.6 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | MM98072SGUL | 07/21/1998 | Cesium-137 | 0.14 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | GU01061SGAL | 06/26/2001 | Cesium-137 | 0.47 | pCi/g | 0.3 | | NQ | Y | SED | REG | SED | 09:40 | | N | N | | | |
| Los Alamos at Upper GS | CC00041SGAL | 04/24/2000 | Cesium-137 | 0.148 | pCi/g | 0.1 | | | Y | SED | REG | SED | 11:00 | | N | N | | | |
| Los Alamos at Upper GS | CM99041SGUL | 04/23/1999 | Cesium-137 | 0.079 | pCi/g | 0.1 | | | Y | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7604SEDSGAL | 04/21/1976 | Cesium-137 | 0.17 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7610SEDSGAL | 10/12/1976 | Cesium-137 | 0.15 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7704SEDSGAL | 04/11/1977 | Cesium-137 | 0.19 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7710SEDSGAL | 10/18/1977 | Cesium-137 | 4.5 | pCi/g | 1.9 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7801SEDSGAL | 01/01/1978 | Cesium-137 | 0.23 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7803SEDSGAL | 03/27/1978 | Cesium-137 | 0.2 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7904SEDSGAL | 04/16/1979 | Cesium-137 | 0.09 | pCi/g | 0.0 | | U | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 7907SEDSGAL | 07/20/1979 | Cesium-137 | 0.08 | pCi/g | 0.0 | | U | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8003SEDSGAL | 03/31/1980 | Cesium-137 | 0.47 | pCi/g | 0.2 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |
| Los Alamos at Upper GS | 8104SEDSGAL | 04/21/1981 | Cesium-137 | 8.3 | pCi/g | 3.8 | | NQ | N | SED | REG | SED | 00:00 | | N | N | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Los Alamos at Upper GS | 8201SEDSGAL | 01/01/1982 | Cesium-137 | 0.15 | pCi/g | 0.1 | | NQ | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 8210SEDSGAL | 10/28/1982 | Cesium-137 | 0.15 | pCi/g | 0.1 | | U | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 8301SEDSGAL | 01/01/1983 | Cesium-137 | 0.06 | pCi/g | 0.0 | | NQ | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 8405SEDSGAL | 05/10/1984 | Cesium-137 | 15 | pCi/g | 7.3 | | NQ | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 8504SEDSGAL | 04/26/1985 | Cesium-137 | 6.2 | pCi/g | 3.1 | | NQ | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 8603SEDSGAL | 03/14/1986 | Cesium-137 | 3.7 | pCi/g | 1.9 | | NQ | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 8704SEDSGAL | 04/16/1987 | Cesium-137 | 0.2 | pCi/g | 0.1 | | U | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 8804SEDSGAL | 04/21/1988 | Cesium-137 | 4.3 | pCi/g | 2.3 | | NQ | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 8905SEDSGAL | 05/01/1989 | Cesium-137 | 1.8 | pCi/g | 1.0 | | NQ | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 9005SEDSGAL | 05/21/1990 | Cesium-137 | 0.06 | pCi/g | 0.0 | | U | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 9101SEDSGAL | 01/01/1991 | Cesium-137 | 1.7 | pCi/g | 1.0 | | NQ | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 9201SEDSGAL | 01/01/1992 | Cesium-137 | 0 | pCi/g | 0.0 | | U | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 9310SEDSGAL | 10/25/1993 | Cesium-137 | 1 | pCi/g | 0.6 | | NQ | N | SED | REG | SED | 00:00 | N | N |
| Los Alamos at Upper GS | 9407SEDSGAL | 07/07/1994 | Cesium-137 | 1.1 | pCi/g | 0.7 | | NQ | N | SED | REG | SED | 00:00 | N | N |

| *Cs-137* | |
|---|---|
| Mean | 1.21 |
| Standard Error | 0.41 |
| Median | 0.15 |
| Mode | 0.14 |
| Standard Deviation | 2.74 |
| Sample Variance | 7.50 |
| Range | 15.00 |
| Minimum | 0.00 |
| Maximum | 15.00 |
| Sum | 54.39 |
| Count | 45 |
| Confidence Level(95.0%) | 0.82 |
| UCL Estimate | 2.03 |

| *Cs-137 (decay corrected)* | |
|---|---|
| Mean | 0.62 |
| Standard Error | 0.20 |
| Median | 0.09 |
| Mode | 0.10 |
| Standard Deviation | 1.33 |
| Sample Variance | 1.76 |
| Range | 7.35 |
| Minimum | 0.00 |
| Maximum | 7.35 |
| Sum | 27.85 |
| Count | 45 |
| Confidence Level(95.0% | 0.40 |
| UCL Estimate | 1.02 |

Pu-239

| Location | Date Sampled | Parameter | Result | Units | Field Sample ID | Lab Qualifier | Validation Qualifier | Detect? | Matrix | Purpose | Type | Time | Program | Filtered | Leached | Start Depth | End Depth | Depth Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-01240 | 3/24/1992 | Plutonium-239/240 | 0.519 | pCi/g | AAA0031 | | NQ | Y | SO | REG | S | 9:20 | | N | N | 0 | 0.08 | ft |
| 21-01240 | 3/24/1992 | Plutonium-239/240 | 0.262 | pCi/g | AAA0032 | | NQ | Y | SO | REG | S | 9:05 | | N | N | 0 | 0.5 | ft |
| 21-01241 | 3/20/1992 | Plutonium-239/240 | 0.139 | pCi/g | AAA0013 | | NQ | Y | SO | REG | S | 14:30 | | N | N | 0 | 0.08 | ft |
| 21-01241 | 3/20/1992 | Plutonium-239/240 | 0.124 | pCi/g | AAA0014 | | NQ | Y | SO | REG | S | 14:15 | | N | N | 0 | 0.5 | ft |
| 21-01246 | 3/20/1992 | Plutonium-239/240 | 0.23 | pCi/g | AAA0010 | | NQ | Y | SO | REG | S | 11:04 | | N | N | 0 | 0.08 | ft |
| 21-01251 | 3/20/1992 | Plutonium-239/240 | 0.064 | pCi/g | AAA0007 | | NQ | Y | SO | REG | S | 10:25 | | N | N | 0 | 0.08 | ft |
| 21-01251 | 3/20/1992 | Plutonium-239/240 | 0.273 | pCi/g | AAA0008 | | NQ | Y | SO | REG | S | 10:11 | | N | N | 0 | 0.5 | ft |
| 21-01251 | 3/20/1992 | Plutonium-239/240 | 0.067 | pCi/g | AAA0009 | | NQ | Y | SO | FD | S | 10:25 | | N | N | 0 | 0.08 | ft |
| 21-01252 | 3/20/1992 | Plutonium-239/240 | 0.206 | pCi/g | AAA0005 | | NQ | Y | SO | REG | S | 9:35 | | N | N | 0 | 0.08 | ft |
| 21-01252 | 3/20/1992 | Plutonium-239/240 | 0.138 | pCi/g | AAA0006 | | NQ | Y | SO | REG | S | 9:25 | | N | N | 0 | 0.5 | ft |
| 21-01253 | 3/20/1992 | Plutonium-239/240 | 0.144 | pCi/g | AAA0004 | | NQ | Y | SO | REG | S | 8:50 | | N | N | 0 | 0.08 | ft |
| 21-01257 | 6/10/1992 | Plutonium-239/240 | 0.247 | pCi/g | AAA0365 | | NQ | Y | SO | REG | S | 16:53 | | N | N | 0 | 0.08 | ft |
| 21-01286 | 3/20/1992 | Plutonium-239/240 | 0.149 | pCi/g | AAA0011 | | NQ | Y | SO | REG | S | 13:20 | | N | N | 0 | 0.08 | ft |
| 21-01286 | 3/20/1992 | Plutonium-239/240 | 0.071 | pCi/g | AAA0012 | | NQ | Y | SO | REG | S | 13:30 | | N | N | 0 | 0.5 | ft |
| 21-01398 | 7/13/1992 | Plutonium-239/240 | 0.592 | pCi/g | AAA0776 | | NQ | Y | SO | REG | S | 13:45 | | N | N | 0 | 0.5 | ft |
| 21-01399 | 7/13/1992 | Plutonium-239/240 | 0.613 | pCi/g | AAA0779 | | NQ | Y | SO | REG | S | 14:05 | | N | N | 0 | 0.5 | ft |
| 21-01400 | 7/13/1992 | Plutonium-239/240 | 1.96 | pCi/g | AAA0780 | | NQ | Y | SO | REG | S | 14:30 | | N | N | 0 | 0.5 | ft |
| 21-01401 | 7/20/1992 | Plutonium-239/240 | 2.48 | pCi/g | AAA0781 | | NQ | Y | SO | REG | S | 14:15 | | N | N | 0 | 0.5 | ft |
| 21-01401 | 7/20/1992 | Plutonium-239/240 | 0.609 | pCi/g | AAA0782 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 0.5 | 1 | ft |
| 21-01401 | 7/20/1992 | Plutonium-239/240 | 0.018 | pCi/g | AAA0783 | | NQ | Y | SO | REG | S | 14:35 | | N | N | 1 | 1.5 | ft |
| 21-02113 | 8/29/1994 | Plutonium-239/240 | 0.0797 | pCi/g | AAB9084 | | NQ | Y | SO | REG | S | 13:50 | | N | N | 0 | 0.5 | ft |
| 21-02118 | 8/26/1994 | Plutonium-239/240 | 0.0195 | pCi/g | AAB9089 | | NQ | Y | SO | REG | S | 14:35 | | N | N | 0 | 0.5 | ft |
| 21-02118 | 8/26/1994 | Plutonium-239/240 | 0.0201 | pCi/g | AAB9090 | | NQ | Y | SO | REG | S | 14:50 | | N | N | 0.5 | 1 | ft |
| 21-02119 | 8/26/1994 | Plutonium-239/240 | 0.0719 | pCi/g | AAB9093 | | NQ | Y | SO | REG | S | 13:50 | | N | N | 0 | 0.5 | ft |
| 21-02119 | 8/26/1994 | Plutonium-239/240 | 0.129 | pCi/g | AAB9094 | | NQ | Y | SO | REG | S | 14:05 | | N | N | 0.5 | 1 | ft |
| 21-02120 | 8/26/1994 | Plutonium-239/240 | 0.0175 | pCi/g | AAB9097 | | J- | Y | SO | REG | S | 13:15 | | N | N | 0 | 0.5 | ft |
| 21-02550 | 9/16/1994 | Plutonium-239/240 | 0.0115 | pCi/g | AAB9828 | | NQ | Y | SD | REG | R | 11:00 | | N | N | 5 | 10 | ft |
| 21-02550 | 9/16/1994 | Plutonium-239/240 | 0.0142 | pCi/g | AAB9831 | | NQ | Y | SD | REG | R | 13:05 | | N | N | 20 | 25 | ft |
| 21-02550 | 9/16/1994 | Plutonium-239/240 | 0.0146 | pCi/g | AAB9834 | | NQ | Y | SD | REG | R | 13:40 | | N | N | 35 | 40 | ft |
| 21-02550 | 9/16/1994 | Plutonium-239/240 | 0 | pCi/g | AAB9836 | | R | Y | SD | REG | R | 14:30 | | N | N | 45 | 47 | ft |
| 21-02551 | 9/14/1994 | Plutonium-239/240 | 0.0378 | pCi/g | AAB9837 | | NQ | Y | SD | REG | R | 9:25 | | N | N | 2.5 | 5 | ft |
| 21-02551 | 9/14/1994 | Plutonium-239/240 | 0.0073 | pCi/g | AAB9838 | | NQ | Y | SD | REG | R | 9:40 | | N | N | 7.5 | 10 | ft |
| 21-02551 | 9/14/1994 | Plutonium-239/240 | 0.0012 | pCi/g | AAB9841 | | NQ | Y | SD | REG | R | 10:30 | | N | N | 20 | 25 | ft |
| 21-02551 | 9/14/1994 | Plutonium-239/240 | 0 | pCi/g | AAB9845 | | R | Y | SD | REG | R | 13:30 | | N | N | 40 | 45 | ft |
| 21-02551 | 9/14/1994 | Plutonium-239/240 | 0.0065 | pCi/g | AAB9846 | | NQ | Y | SD | REG | R | 13:55 | | N | N | 45 | 50 | ft |
| 21-02551 | 9/14/1994 | Plutonium-239/240 | 0.0011 | pCi/g | AAB9847 | | NQ | Y | SD | REG | R | 14:10 | | N | N | 50 | 52 | ft |
| 21-02552 | 9/15/1994 | Plutonium-239/240 | 0.0005 | pCi/g | AAB9850 | | NQ | Y | SD | REG | R | 13:10 | | N | N | 10 | 15 | ft |
| 21-02552 | 9/15/1994 | Plutonium-239/240 | 0.0083 | pCi/g | AAB9852 | | NQ | Y | SD | REG | R | 13:35 | | N | N | 20 | 25 | ft |
| 21-02552 | 9/15/1994 | Plutonium-239/240 | 0.0013 | pCi/g | AAB9858 | | NQ | Y | SD | REG | R | 15:55 | | N | N | 50 | 52 | ft |
| 21-02552 | 9/15/1994 | Plutonium-239/240 | 0.001 | pCi/g | AAB9859 | | NQ | Y | SD | FD | R | 15:55 | | N | N | 50 | 52 | ft |
| 21-02565 | 9/15/1994 | Plutonium-239/240 | 0.0045 | pCi/g | AAB9873 | | NQ | Y | SD | REG | R | 8:25 | | N | N | 5 | 10 | ft |
| 21-02565 | 9/15/1994 | Plutonium-239/240 | 0.0132 | pCi/g | AAB9876 | | NQ | Y | SD | REG | R | 9:00 | | N | N | 20 | 25 | ft |
| 21-27550 | 5/15/2007 | Plutonium-239/240 | 0.221 | pCi/g | RE21-07-75726 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27550 | 5/15/2007 | Plutonium-239/240 | 1.38 | pCi/g | RE21-07-75727 | | NQ | Y | SD | REG | R | 0:00 | | N | N | 4.33 | 5.33 | ft |
| 21-27550 | 5/15/2007 | Plutonium-239/240 | 0.0546 | pCi/g | RE21-07-75728 | | NQ | Y | SD | REG | R | 0:00 | | N | N | 6.33 | 7.33 | ft |
| 21-27550 | 5/15/2007 | Plutonium-239/240 | 0.432 | pCi/g | RE21-07-75729 | | NQ | Y | SD | REG | R | 0:00 | | N | N | 9.33 | 10.33 | ft |
| 21-27551 | 6/5/2007 | Plutonium-239/240 | 0.00423 | pCi/g | RE21-07-75730 | U | U | N | SD | REG | R | 0:00 | | N | N | 10 | 11 | ft |
| 21-27551 | 6/5/2007 | Plutonium-239/240 | 0 | pCi/g | RE21-07-75731 | U | U | N | SD | REG | R | 0:00 | | N | N | 15 | 16 | ft |
| 21-27551 | 6/5/2007 | Plutonium-239/240 | 0.00715 | pCi/g | RE21-07-75732 | U | U | N | SD | REG | R | 0:00 | | N | N | 20 | 21 | ft |
| 21-27552 | 5/3/2007 | Plutonium-239/240 | 0.0123 | pCi/g | RE21-07-75734 | U | U | N | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27552 | 5/3/2007 | Plutonium-239/240 | 0.0193 | pCi/g | RE21-07-75735 | U | U | N | SO | REG | S | 0:00 | | N | N | 2 | 3 | ft |
| 21-27552 | 5/3/2007 | Plutonium-239/240 | 0.0173 | pCi/g | RE21-07-75736 | U | U | N | SD | REG | R | 0:00 | | N | N | 5 | 6 | ft |
| 21-27553 | 5/3/2007 | Plutonium-239/240 | 0.165 | pCi/g | RE21-07-75737 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27553 | 5/3/2007 | Plutonium-239/240 | 0.123 | pCi/g | RE21-07-75738 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 2 | 3 | ft |
| 21-27553 | 5/3/2007 | Plutonium-239/240 | 0.0939 | pCi/g | RE21-07-75739 | | NQ | Y | SD | REG | R | 0:00 | | N | N | 5 | 6 | ft |
| 21-27554 | 5/7/2007 | Plutonium-239/240 | 0.0631 | pCi/g | RE21-07-75752 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27554 | 5/7/2007 | Plutonium-239/240 | 0.00503 | pCi/g | RE21-07-75753 | U | U | N | SD | REG | R | 0:00 | | N | N | 2.5 | 3.5 | ft |
| 21-27554 | 5/7/2007 | Plutonium-239/240 | 0.0138 | pCi/g | RE21-07-75754 | U | U | N | SD | REG | R | 0:00 | | N | N | 4.5 | 5.5 | ft |
| 21-27555 | 2/1/2007 | Plutonium-239/240 | 0.0309 | pCi/g | RE21-07-75743 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27555 | 2/1/2007 | Plutonium-239/240 | 0.0167 | pCi/g | RE21-07-75744 | U | U | N | SD | REG | R | 0:00 | | N | N | 2 | 2.5 | ft |
| 21-27555 | 2/1/2007 | Plutonium-239/240 | 0.039 | pCi/g | RE21-07-75785 | | NQ | Y | SO | FD | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27556 | 5/9/2007 | Plutonium-239/240 | 0.0142 | pCi/g | RE21-07-75787 | U | U | N | SD | FD | R | 0:00 | | N | N | 12 | 13 | ft |
| 21-27556 | 2/1/2007 | Plutonium-239/240 | 0.468 | pCi/g | RE21-07-75745 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27556 | 2/1/2007 | Plutonium-239/240 | 0.0202 | pCi/g | RE21-07-75746 | | U | N | SD | REG | R | 0:00 | | N | N | 2 | 2.5 | ft |
| 21-27557 | 2/1/2007 | Plutonium-239/240 | 0.0372 | pCi/g | RE21-07-75747 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27557 | 2/1/2007 | Plutonium-239/240 | 0.0068 | pCi/g | RE21-07-75748 | U | U | N | SD | REG | R | 0:00 | | N | N | 2 | 2.5 | ft |
| 21-27558 | 2/1/2007 | Plutonium-239/240 | 0.105 | pCi/g | RE21-07-75749 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27558 | 2/1/2007 | Plutonium-239/240 | 0.0145 | pCi/g | RE21-07-75750 | U | U | N | SD | REG | R | 0:00 | | N | N | 2 | 2.5 | ft |
| 21-27559 | 5/7/2007 | Plutonium-239/240 | 0.0133 | pCi/g | RE21-07-75755 | U | U | N | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27559 | 5/7/2007 | Plutonium-239/240 | 0.0231 | pCi/g | RE21-07-75756 | U | U | N | SD | REG | R | 0:00 | | N | N | 2.5 | 3.5 | ft |
| 21-27559 | 5/7/2007 | Plutonium-239/240 | 0.00168 | pCi/g | RE21-07-75757 | U | U | N | SD | REG | R | 0:00 | | N | N | 4.5 | 5.5 | ft |
| 21-27560 | 5/3/2007 | Plutonium-239/240 | 0.00287 | pCi/g | RE21-07-75765 | U | U | N | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27560 | 5/3/2007 | Plutonium-239/240 | 0.0671 | pCi/g | RE21-07-75766 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 2 | 3 | ft |
| 21-27560 | 6/3/2009 | Plutonium-239/240 | 0.0043 | pCi/g | MD21-09-8727 | U | U | N | SD | REG | R | 10:13 | | N | N | 7 | 8 | ft |
| 21-27561 | 5/3/2007 | Plutonium-239/240 | 0.0235 | pCi/g | RE21-07-75767 | U | U | N | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27561 | 5/3/2007 | Plutonium-239/240 | 0.00161 | pCi/g | RE21-07-75768 | U | U | N | SO | REG | S | 0:00 | | N | N | 2 | 3 | ft |
| 21-27562 | 5/3/2007 | Plutonium-239/240 | 0.127 | pCi/g | RE21-07-75769 | | NQ | Y | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27562 | 5/3/2007 | Plutonium-239/240 | 0.0207 | pCi/g | RE21-07-75770 | U | U | N | SD | REG | R | 0:00 | | N | N | 2 | 3 | ft |
| 21-27563 | 5/3/2007 | Plutonium-239/240 | 0.0177 | pCi/g | RE21-07-75771 | U | U | N | SO | REG | S | 0:00 | | N | N | 0 | 0.5 | ft |
| 21-27563 | 5/3/2007 | Plutonium-239/240 | -0.012 | pCi/g | RE21-07-75772 | U | U | N | SO | REG | S | 0:00 | | N | N | 2 | 3 | ft |
| 21-27564 | 5/7/2007 | Plutonium-239/240 | 0.303 | pCi/g | RE21-07-75773 | | NQ | Y | SD | REG | R | 0:00 | | N | N | 9.5 | 10.5 | ft |
| 21-27564 | 5/7/2007 | Plutonium-239/240 | 0.0248 | pCi/g | RE21-07-75774 | U | U | N | SD | REG | R | 0:00 | | N | N | 11.5 | 12.5 | ft |
| 21-27565 | 5/8/2007 | Plutonium-239/240 | 0.0243 | pCi/g | RE21-07-75775 | U | U | N | SD | REG | R | 0:00 | | N | N | 12 | 13 | ft |
| 21-27565 | 5/8/2007 | Plutonium-239/240 | 0.0338 | pCi/g | RE21-07-75776 | | NQ | Y | SD | REG | R | 0:00 | | N | N | 14 | 15 | ft |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-27566 | 5/9/2007 | Plutonium-239/240 | 0.043 | pCi/g | RE21-07-75777 | | NQ | Y | SD | REG | R | 0:00 | N | N | 12 | 13 | ft |
| 21-27566 | 5/9/2007 | Plutonium-239/240 | 0.00678 | pCi/g | RE21-07-75778 | U | U | N | SD | REG | R | 0:00 | N | N | 14 | 15 | ft |
| 21-27566 | 5/3/2007 | Plutonium-239/240 | -0.0013 | pCi/g | RE21-07-75786 | U | U | N | SO | FD | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27568 | 6/5/2007 | Plutonium-239/240 | 0.0121 | pCi/g | RE21-07-75781 | U | U | N | SD | REG | R | 0:00 | N | N | 10 | 11 | ft |
| 21-27568 | 6/5/2007 | Plutonium-239/240 | 0.00354 | pCi/g | RE21-07-75782 | U | U | N | SD | REG | R | 0:00 | N | N | 12 | 13 | ft |
| 21-27570 | 5/7/2007 | Plutonium-239/240 | 3.74 | pCi/g | RE21-07-75804 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27570 | 5/8/2007 | Plutonium-239/240 | 0.0527 | pCi/g | RE21-07-75805 | | NQ | Y | SD | REG | R | 0:00 | N | N | 3.5 | 4.5 | ft |
| 21-27570 | 5/8/2007 | Plutonium-239/240 | 0.00178 | pCi/g | RE21-07-75806 | U | U | N | SD | REG | R | 0:00 | N | N | 5.5 | 6.5 | ft |
| 21-27571 | 5/8/2007 | Plutonium-239/240 | 0.468 | pCi/g | RE21-07-75807 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27571 | 5/8/2007 | Plutonium-239/240 | 0.109 | pCi/g | RE21-07-75808 | | NQ | Y | SD | REG | R | 0:00 | N | N | 3.5 | 4.5 | ft |
| 21-27571 | 5/8/2007 | Plutonium-239/240 | 0.0121 | pCi/g | RE21-07-75809 | U | U | N | SD | REG | R | 0:00 | N | N | 5.5 | 6.5 | ft |
| 21-27572 | 5/21/2007 | Plutonium-239/240 | 0.0016 | pCi/g | RE21-07-75810 | U | U | N | SD | REG | R | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27572 | 5/21/2007 | Plutonium-239/240 | 0.0078 | pCi/g | RE21-07-75811 | | U | N | SD | REG | R | 0:00 | N | N | 2 | 3 | ft |
| 21-27572 | 5/21/2007 | Plutonium-239/240 | 0 | pCi/g | RE21-07-75812 | U | R | N | SD | REG | R | 0:00 | N | N | 5 | 6 | ft |
| 21-27573 | 5/16/2007 | Plutonium-239/240 | 0.077 | pCi/g | RE21-07-75813 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27573 | 5/16/2007 | Plutonium-239/240 | 0.0031 | pCi/g | RE21-07-75814 | U | U | N | SD | REG | R | 0:00 | N | N | 2 | 3 | ft |
| 21-27574 | 5/16/2007 | Plutonium-239/240 | 0.0422 | pCi/g | RE21-07-75815 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27574 | 5/16/2007 | Plutonium-239/240 | 0.0089 | pCi/g | RE21-07-75816 | | U | N | SD | REG | R | 0:00 | N | N | 2 | 3 | ft |
| 21-27575 | 5/16/2007 | Plutonium-239/240 | 0.169 | pCi/g | RE21-07-75817 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27575 | 5/16/2007 | Plutonium-239/240 | 1.08 | pCi/g | RE21-07-75818 | | NQ | Y | SD | REG | R | 0:00 | N | N | 2 | 3 | ft |
| 21-27575 | 6/8/2009 | Plutonium-239/240 | 0.0205 | pCi/g | MD21-09-8726 | | U | N | SD | REG | R | 10:15 | N | N | 4 | 5 | ft |
| 21-27576 | 5/16/2007 | Plutonium-239/240 | 83.5 | pCi/g | RE21-07-75819 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27576 | 5/16/2007 | Plutonium-239/240 | 2.33 | pCi/g | RE21-07-75820 | | NQ | Y | SD | REG | R | 0:00 | N | N | 2 | 3 | ft |
| 21-27577 | 5/16/2007 | Plutonium-239/240 | 0.369 | pCi/g | RE21-07-75821 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27577 | 5/16/2007 | Plutonium-239/240 | 0.0391 | pCi/g | RE21-07-75822 | | NQ | Y | SD | REG | R | 0:00 | N | N | 2 | 3 | ft |
| 21-27578 | 5/16/2007 | Plutonium-239/240 | 0.138 | pCi/g | RE21-07-75823 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27578 | 5/16/2007 | Plutonium-239/240 | 0.0072 | pCi/g | RE21-07-75824 | U | U | N | SD | REG | R | 0:00 | N | N | 2 | 3 | ft |
| 21-27579 | 5/16/2007 | Plutonium-239/240 | 20.5 | pCi/g | RE21-07-75825 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27579 | 5/16/2007 | Plutonium-239/240 | 0.508 | pCi/g | RE21-07-75826 | | NQ | Y | SD | REG | R | 0:00 | N | N | 2 | 3 | ft |
| 21-27579 | 5/16/2007 | Plutonium-239/240 | 19 | pCi/g | RE21-07-75845 | | NQ | Y | SO | FD | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27580 | 5/16/2007 | Plutonium-239/240 | 0.126 | pCi/g | RE21-07-75827 | | NQ | Y | SO | REG | S | 0:00 | N | N | 0 | 0.5 | ft |
| 21-27580 | 5/16/2007 | Plutonium-239/240 | 0.0075 | pCi/g | RE21-07-75828 | | U | N | SD | REG | R | 0:00 | N | N | 2 | 3 | ft |
| 21-27581 | 6/5/2007 | Plutonium-239/240 | 0.00483 | pCi/g | RE21-07-75829 | U | U | N | SD | REG | R | 0:00 | N | N | 10 | 11 | ft |
| 21-27581 | 6/5/2007 | Plutonium-239/240 | 0.00713 | pCi/g | RE21-07-75830 | U | U | N | SD | REG | R | 0:00 | N | N | 12 | 13 | ft |
| 21-27581 | 6/5/2007 | Plutonium-239/240 | 0.268 | pCi/g | RE21-07-75846 | | NQ | Y | SD | FD | R | 0:00 | N | N | 10 | 11 | ft |

| *Pu-239/240* | |
|---|---|
| Mean | 1.23 |
| Standard Error | 0.74 |
| Median | 0.02 |
| Mode | 0.00 |
| Standard Deviation | 8.03 |
| Sample Variance | 64.49 |
| Kurtosis | 95.66 |
| Skewness | 9.48 |
| Range | 83.51 |
| Minimum | -0.01 |
| Maximum | 83.50 |
| Sum | 146.07 |
| Count | 119 |
| Confidence Level(95.0 | 1.46 |
| UCL Estimate | 2.69 |

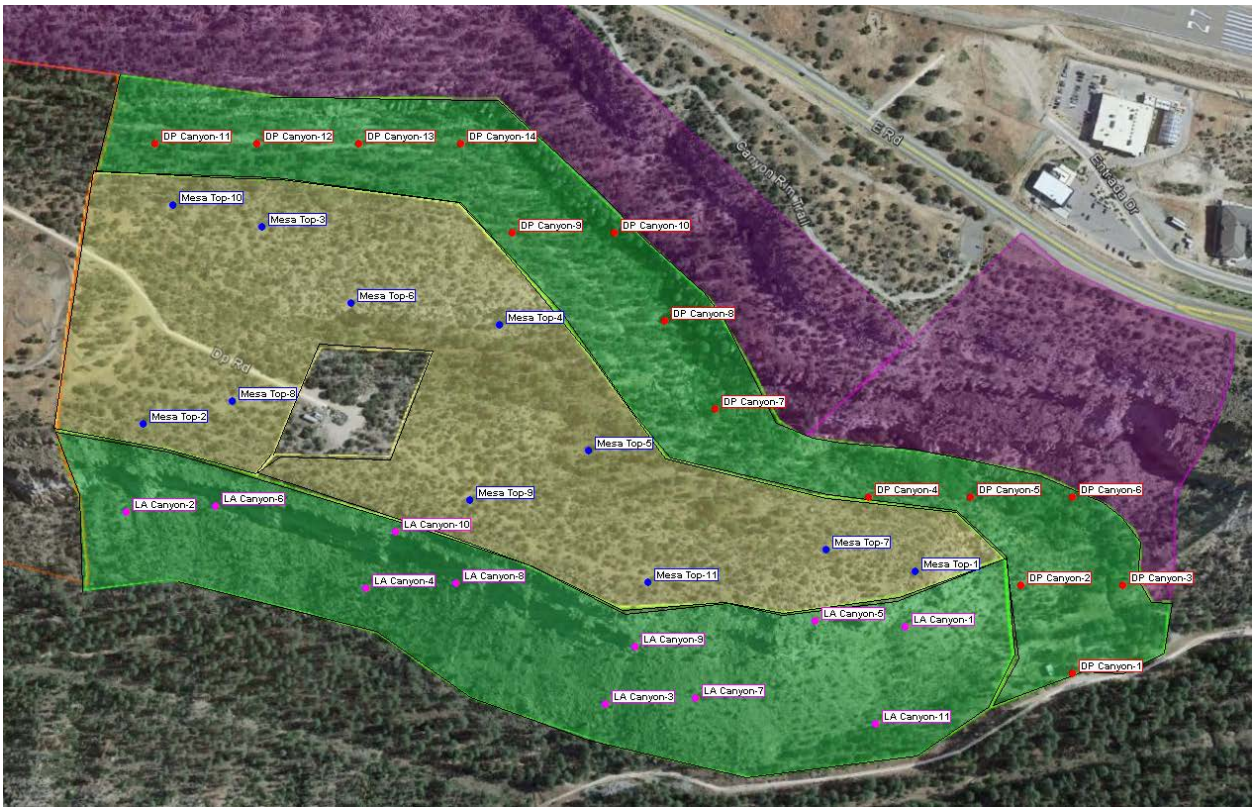
Cs-137

| Location | Field Sample ID | Date Sampled | Parameter | Result | Units | Lab Qualifier | Validation Qualifier | Detect? | Matrix | Purpose | Type | Time | Program | Filtered | Leached | Start Depth | End Depth | Depth Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-02113 | AAB9084 | 08/29/1994 | Cesium-13 | 0.334 | pCi/g | | NQ | Y | SO | REG | S | 13:50 | | N | N | 0 | 0.5 | ft |
| 21-02118 | AAB9089 | 08/26/1994 | Cesium-13 | 0.283 | pCi/g | | NQ | Y | SO | REG | S | 14:35 | | N | N | 0 | 0.5 | ft |
| 21-02118 | AAB9090 | 08/26/1994 | Cesium-13 | 0.143 | pCi/g | | NQ | Y | SO | REG | S | 14:50 | | N | N | 0.5 | 1 | ft |
| 21-02119 | AAB9093 | 08/26/1994 | Cesium-13 | 0.586 | pCi/g | | NQ | Y | SO | REG | S | 13:50 | | N | N | 0 | 0.5 | ft |
| 21-02119 | AAB9094 | 08/26/1994 | Cesium-13 | 1.11 | pCi/g | | NQ | Y | SO | REG | S | 14:05 | | N | N | 0.5 | 1 | ft |
| 21-02120 | AAB9097 | 08/26/1994 | Cesium-13 | 0.069 | pCi/g | | U | N | SO | REG | S | 13:15 | | N | N | 0 | 0.5 | ft |
| 21-02550 | AAB9828 | 09/16/1994 | Cesium-13 | 0.004 | pCi/g | | NQ | Y | SD | REG | R | 11:00 | | N | N | 5 | 10 | ft |
| 21-02550 | AAB9831 | 09/16/1994 | Cesium-13 | 0.031 | pCi/g | | NQ | Y | SD | REG | R | 13:05 | | N | N | 20 | 25 | ft |
| 21-02550 | AAB9834 | 09/16/1994 | Cesium-13 | -0.01 | pCi/g | | NQ | Y | SD | REG | R | 13:40 | | N | N | 35 | 40 | ft |
| 21-02550 | AAB9836 | 09/16/1994 | Cesium-13 | -0.04 | pCi/g | | NQ | Y | SD | REG | R | 14:30 | | N | N | 45 | 47 | ft |
| 21-02551 | AAB9837 | 09/14/1994 | Cesium-13 | 0.038 | pCi/g | | NQ | Y | SD | REG | R | 09:25 | | N | N | 2.5 | 5 | ft |
| 21-02551 | AAB9838 | 09/14/1994 | Cesium-13 | -0.01 | pCi/g | | NQ | Y | SD | REG | R | 09:40 | | N | N | 7.5 | 10 | ft |
| 21-02551 | AAB9841 | 09/14/1994 | Cesium-13 | 0.052 | pCi/g | | NQ | Y | SD | REG | R | 10:30 | | N | N | 20 | 25 | ft |
| 21-02551 | AAB9845 | 09/14/1994 | Cesium-13 | -0.01 | pCi/g | | NQ | Y | SD | REG | R | 13:30 | | N | N | 40 | 45 | ft |
| 21-02551 | AAB9846 | 09/14/1994 | Cesium-13 | -0.02 | pCi/g | | NQ | Y | SD | REG | R | 13:55 | | N | N | 45 | 50 | ft |
| 21-02551 | AAB9847 | 09/14/1994 | Cesium-13 | -0.02 | pCi/g | | NQ | Y | SD | REG | R | 14:10 | | N | N | 50 | 52 | ft |
| 21-02552 | AAB9850 | 09/15/1994 | Cesium-13 | 0.016 | pCi/g | | NQ | Y | SD | REG | R | 13:10 | | N | N | 10 | 15 | ft |
| 21-02552 | AAB9852 | 09/15/1994 | Cesium-13 | -0.04 | pCi/g | | NQ | Y | SD | REG | R | 13:35 | | N | N | 20 | 25 | ft |
| 21-02552 | AAB9858 | 09/15/1994 | Cesium-13 | -0.03 | pCi/g | | NQ | Y | SD | REG | R | 15:55 | | N | N | 50 | 52 | ft |
| 21-02552 | AAB9859 | 09/15/1994 | Cesium-13 | 9E-04 | pCi/g | | NQ | Y | SD | FD | R | 15:55 | | N | N | 50 | 52 | ft |
| 21-02565 | AAB9873 | 09/15/1994 | Cesium-13 | -0.02 | pCi/g | | NQ | Y | SD | REG | R | 08:25 | | N | N | 5 | 10 | ft |
| 21-02565 | AAB9876 | 09/15/1994 | Cesium-13 | -0 | pCi/g | | NQ | Y | SD | REG | R | 09:00 | | N | N | 20 | 25 | ft |
| 21-27550 | RE21-07-75726 | 05/15/2007 | Cesium-13 | 0.023 | pCi/g | U | U | N | SO | REG | S | 00:00 | | N | N | 0 | 0.5 | ft |
| 21-27550 | RE21-07-75727 | 05/15/2007 | Cesium-13 | -0.01 | pCi/g | U | U | N | SD | REG | R | 00:00 | | N | N | 4.33 | 5.33 | ft |
| 21-27550 | RE21-07-75728 | 05/15/2007 | Cesium-13 | -0.04 | pCi/g | U | U | N | SD | REG | R | 00:00 | | N | N | 6.33 | 7.33 | ft |
| 21-27550 | RE21-07-75729 | 05/15/2007 | Cesium-13 | 0.006 | pCi/g | U | U | N | SD | REG | R | 00:00 | | N | N | 9.33 | 10.33 | ft |
| 21-27551 | RE21-07-75730 | 06/05/2007 | Cesium-13 | 0.051 | pCi/g | U | U | N | SD | REG | R | 00:00 | | N | N | 10 | 11 | ft |
| 21-27551 | RE21-07-75731 | 06/05/2007 | Cesium-13 | 0.057 | pCi/g | U | U | N | SD | REG | R | 00:00 | | N | N | 15 | 16 | ft |
| 21-27551 | RE21-07-75732 | 06/05/2007 | Cesium-13 | 0.005 | pCi/g | U | U | N | SD | REG | R | 00:00 | | N | N | 20 | 21 | ft |
| 21-27552 | RE21-07-75734 | 05/03/2007 | Cesium-13 | 0.038 | pCi/g | U | U | N | SO | REG | S | 00:00 | | N | N | 0 | 0.5 | ft |
| 21-27552 | RE21-07-75735 | 05/03/2007 | Cesium-13 | 0.108 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | | N | N | 2 | 3 | ft |
| 21-27552 | RE21-07-75736 | 05/03/2007 | Cesium-13 | 0.018 | pCi/g | U | U | N | SD | REG | R | 00:00 | | N | N | 5 | 6 | ft |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21-27553 | RE21-07-75737 | 05/03/2007 | Cesium-137 | 0.038 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27553 | RE21-07-75738 | 05/03/2007 | Cesium-137 | 0.06 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 2 | 3 | ft |
| 21-27553 | RE21-07-75739 | 05/03/2007 | Cesium-137 | 0.006 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 5 | 6 | ft |
| 21-27554 | RE21-07-75752 | 05/07/2007 | Cesium-137 | -0 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27554 | RE21-07-75753 | 05/07/2007 | Cesium-137 | 0.017 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2.5 | 3.5 | ft |
| 21-27554 | RE21-07-75754 | 05/07/2007 | Cesium-137 | -0.01 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 4.5 | 5.5 | ft |
| 21-27555 | RE21-07-75743 | 02/01/2007 | Cesium-137 | 0.201 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27555 | RE21-07-75744 | 02/01/2007 | Cesium-137 | 0.33 | pCi/g | | NQ | Y | SD | REG | R | 00:00 | N | N | 2 | 2.5 | ft |
| 21-27555 | RE21-07-75785 | 02/01/2007 | Cesium-137 | 0.227 | pCi/g | | NQ | Y | SO | FD | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27556 | RE21-07-75745 | 02/01/2007 | Cesium-137 | 0.238 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27556 | RE21-07-75746 | 02/01/2007 | Cesium-137 | 0.032 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 2.5 | ft |
| 21-27556 | RE21-07-75787 | 05/09/2007 | Cesium-137 | 0.047 | pCi/g | U | U | N | SD | FD | R | 00:00 | N | N | 12 | 13 | ft |
| 21-27557 | RE21-07-75747 | 02/01/2007 | Cesium-137 | 0.094 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27557 | RE21-07-75748 | 02/01/2007 | Cesium-137 | 0.02 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 2.5 | ft |
| 21-27558 | RE21-07-75749 | 02/01/2007 | Cesium-137 | 0.556 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27558 | RE21-07-75750 | 02/01/2007 | Cesium-137 | 0.083 | pCi/g | | U | N | SD | REG | R | 00:00 | N | N | 2 | 2.5 | ft |
| 21-27559 | RE21-07-75755 | 05/07/2007 | Cesium-137 | 0.012 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27559 | RE21-07-75756 | 05/07/2007 | Cesium-137 | 0.012 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2.5 | 3.5 | ft |
| 21-27559 | RE21-07-75757 | 05/07/2007 | Cesium-137 | 0.022 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 4.5 | 5.5 | ft |
| 21-27560 | RE21-07-75765 | 05/03/2007 | Cesium-137 | 0.026 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27560 | RE21-07-75766 | 05/03/2007 | Cesium-137 | 0.122 | pCi/g | | U | N | SO | REG | S | 00:00 | N | N | 2 | 3 | ft |
| 21-27561 | RE21-07-75767 | 05/03/2007 | Cesium-137 | 0.078 | pCi/g | UI | R | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27561 | RE21-07-75768 | 05/03/2007 | Cesium-137 | 0.139 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 2 | 3 | ft |
| 21-27561 | MD21-09-8728 | 06/03/2009 | Cesium-137 | 0.008 | pCi/g | U | U | N | SO | REG | S | 09:35 | N | N | 7 | 8 | ft |
| 21-27562 | RE21-07-75769 | 05/03/2007 | Cesium-137 | 0.476 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27562 | RE21-07-75770 | 05/03/2007 | Cesium-137 | 0.04 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27563 | RE21-07-75771 | 05/03/2007 | Cesium-137 | 0.043 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27563 | RE21-07-75772 | 05/03/2007 | Cesium-137 | 0.069 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 2 | 3 | ft |
| 21-27564 | RE21-07-75773 | 05/07/2007 | Cesium-137 | 0.119 | pCi/g | | NQ | Y | SD | REG | R | 00:00 | N | N | 9.5 | 10.5 | ft |
| 21-27564 | RE21-07-75774 | 05/07/2007 | Cesium-137 | 0.008 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 11.5 | 12.5 | ft |
| 21-27565 | RE21-07-75775 | 05/08/2007 | Cesium-137 | -0.04 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 12 | 13 | ft |
| 21-27565 | RE21-07-75776 | 05/08/2007 | Cesium-137 | 0.027 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 14 | 15 | ft |
| 21-27566 | RE21-07-75777 | 05/09/2007 | Cesium-137 | -0.04 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 12 | 13 | ft |
| 21-27566 | RE21-07-75778 | 05/09/2007 | Cesium-137 | -0 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 14 | 15 | ft |
| 21-27566 | RE21-07-75786 | 05/03/2007 | Cesium-137 | 0.047 | pCi/g | U | U | N | SO | FD | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27568 | RE21-07-75781 | 06/05/2007 | Cesium-137 | 0.04 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 10 | 11 | ft |
| 21-27568 | RE21-07-75782 | 06/05/2007 | Cesium-137 | 0.13 | pCi/g | UI | R | N | SD | REG | R | 00:00 | N | N | 12 | 13 | ft |
| 21-27570 | RE21-07-75804 | 05/07/2007 | Cesium-137 | -0.01 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27570 | RE21-07-75805 | 05/08/2007 | Cesium-137 | 0.023 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 3.5 | 4.5 | ft |
| 21-27570 | RE21-07-75806 | 05/08/2007 | Cesium-137 | 0.007 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 5.5 | 6.5 | ft |
| 21-27571 | RE21-07-75807 | 05/08/2007 | Cesium-137 | 0.023 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27571 | RE21-07-75808 | 05/08/2007 | Cesium-137 | -0.02 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 3.5 | 4.5 | ft |
| 21-27571 | RE21-07-75809 | 05/08/2007 | Cesium-137 | 0.031 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 5.5 | 6.5 | ft |
| 21-27572 | RE21-07-75810 | 05/21/2007 | Cesium-137 | 0.027 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27572 | RE21-07-75811 | 05/21/2007 | Cesium-137 | 0.03 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27572 | RE21-07-75812 | 05/21/2007 | Cesium-137 | 0.043 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 5 | 6 | ft |
| 21-27573 | RE21-07-75813 | 05/16/2007 | Cesium-137 | 0.314 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27573 | RE21-07-75814 | 05/16/2007 | Cesium-137 | 0.019 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27574 | RE21-07-75815 | 05/16/2007 | Cesium-137 | 0.067 | pCi/g | U | U | N | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27574 | RE21-07-75816 | 05/16/2007 | Cesium-137 | -0 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27575 | RE21-07-75817 | 05/16/2007 | Cesium-137 | 0.305 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27575 | RE21-07-75818 | 05/16/2007 | Cesium-137 | -0 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27576 | RE21-07-75819 | 05/16/2007 | Cesium-137 | 0.216 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27576 | RE21-07-75820 | 05/16/2007 | Cesium-137 | 0.017 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27577 | RE21-07-75821 | 05/16/2007 | Cesium-137 | 0.371 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27577 | RE21-07-75822 | 05/16/2007 | Cesium-137 | 0.041 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27578 | RE21-07-75823 | 05/16/2007 | Cesium-137 | 0.267 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27578 | RE21-07-75824 | 05/16/2007 | Cesium-137 | 0.015 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27579 | RE21-07-75825 | 05/16/2007 | Cesium-137 | 0.785 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27579 | RE21-07-75826 | 05/16/2007 | Cesium-137 | 0.023 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27579 | RE21-07-75845 | 05/16/2007 | Cesium-137 | 0.635 | pCi/g | | NQ | Y | SO | FD | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27580 | RE21-07-75827 | 05/16/2007 | Cesium-137 | 0.525 | pCi/g | | NQ | Y | SO | REG | S | 00:00 | N | N | 0 | 0.5 | ft |
| 21-27580 | RE21-07-75828 | 05/16/2007 | Cesium-137 | 0.011 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 2 | 3 | ft |
| 21-27581 | RE21-07-75829 | 06/05/2007 | Cesium-137 | 0.077 | pCi/g | UI | R | N | SD | REG | R | 00:00 | N | N | 10 | 11 | ft |
| 21-27581 | RE21-07-75830 | 06/05/2007 | Cesium-137 | 0.026 | pCi/g | U | U | N | SD | REG | R | 00:00 | N | N | 12 | 13 | ft |
| 21-27581 | RE21-07-75846 | 06/05/2007 | Cesium-137 | 0.147 | pCi/g | UI | R | N | SD | FD | R | 00:00 | N | N | 10 | 11 | ft |
| 21-605239 | MD21-09-8732 | 06/08/2009 | Cesium-137 | 0.002 | pCi/g | U | U | N | SD | REG | R | 09:00 | N | N | 2 | 3 | ft |
| 21-605239 | MD21-09-8733 | 06/08/2009 | Cesium-137 | -0.02 | pCi/g | U | U | N | SD | REG | R | 11:15 | N | N | 7 | 8 | ft |

| *Cs-137* | |
|---|---|
| Mean | 0.10 |
| Standard Error | 0.02 |
| Median | 0.03 |
| Mode | -0.01 |
| Standard Deviat | 0.19 |
| Sample Variance | 0.04 |
| Kurtosis | 9.84 |
| Skewness | 2.88 |
| Range | 1.15 |
| Minimum | -0.04 |
| Maximum | 1.11 |
| Sum | 10.01 |
| Count | 100 |
| Confidence Leve | 0.04 |
| UCL Estimate | 0.14 |

# Appendix B – VSP Outputs




## DP Canyon

**Systematic sampling locations for comparing a median with a fixed threshold (nonparametric - MARSSIM)**

**Summary**

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

| SUMMARY OF SAMPLING DESIGN | |
|---|---|
| Primary Objective of Design | Compare a site mean or median to a fixed threshold |
| Type of Sampling Design | Nonparametric |
| Sample Placement (Location) in the Field | Systematic with a random start location |
| Working (Null) Hypothesis | The median(mean) value at the site exceeds the threshold |
| Formula for calculating number of sampling locations | Sign Test - MARSSIM version |
| Calculated total number of samples | 11 |

| | |
|---|---|
| Number of samples on map [a] | 14 |
| Number of selected sample areas [b] | 1 |
| Specified sampling area [c] | 87859.84 $m^2$ |

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.

| Area: DP Canyon | | | | | |
|---|---|---|---|---|---|
| **X Coord** | **Y Coord** | **Label** | **Value** | **Type** | **Historical** |
| 386207.2974 | 3970601.3060 | DP Canyon-1 | | Systematic | |
| 386163.6447 | 3970676.9146 | DP Canyon-2 | | Systematic | |
| 386250.9500 | 3970676.9146 | DP Canyon-3 | | Systematic | |
| 386032.6867 | 3970752.5233 | DP Canyon-4 | | Systematic | |
| 386119.9920 | 3970752.5233 | DP Canyon-5 | | Systematic | |
| 386207.2974 | 3970752.5233 | DP Canyon-6 | | Systematic | |
| 385901.7286 | 3970828.1319 | DP Canyon-7 | | Systematic | |
| 385858.0760 | 3970903.7406 | DP Canyon-8 | | Systematic | |
| 385727.1179 | 3970979.3492 | DP Canyon-9 | | Systematic | |
| 385814.4233 | 3970979.3492 | DP Canyon-10 | | Systematic | |
| 385421.5492 | 3971054.9579 | DP Canyon-11 | | Systematic | |
| 385508.8546 | 3971054.9579 | DP Canyon-12 | | Systematic | |
| 385596.1599 | 3971054.9579 | DP Canyon-13 | | Systematic | |
| 385683.4653 | 3971054.9579 | DP Canyon-14 | | Systematic | |

**Primary Sampling Objective**
The primary purpose of sampling at this site is to compare a site median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

**Selected Sampling Approach**
A nonparametric systematic sampling approach with a random start was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points over a systematic grid with a random start ensures spatial coverage of the site. Statistical analyses of systematically collected data are valid if a random start to the grid is used. One disadvantage of systematically collected samples is that spatial variability or patterns may not be discovered if the grid spacing is large relative to the spatial patterns.

**Number of Total Samples: Calculation Equation and Inputs**
The equation used to calculate the number of samples is based on a Sign test (see PNNL 13450 for discussion). For this site, the null hypothesis is rejected in favor of the alternative one if the

median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{4(SignP - 0.5)^2}$$

where

$$SignP = \Phi\left(\frac{\Delta}{s_{total}}\right)$$

$\Phi(z)$ is the cumulative standard normal distribution on $(-\infty,z)$ (see PNNL-13450 for details),
$n$ is the number of samples,
$S_{total}$ is the estimated standard deviation of the measured values including analytical error,
$\Delta$ is the width of the gray region,
$\alpha$ is the acceptable probability of incorrectly concluding the site median(mean) is less than the threshold,
$\beta$ is the acceptable probability of incorrectly concluding the site median(mean) exceeds the threshold,
$Z_{1-\alpha}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is $1-\alpha$,
$Z_{1-\beta}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is $1-\beta$.

Note: MARSSIM suggests that the number of samples should be increased by at least 20% to account for missing or unusable data and uncertainty in the calculated value of n. VSP allows a user-supplied percent overage as discussed in MARSSIM (EPA 2000, p. 5-33).

The values of these inputs that result in the calculated number of sampling locations are:

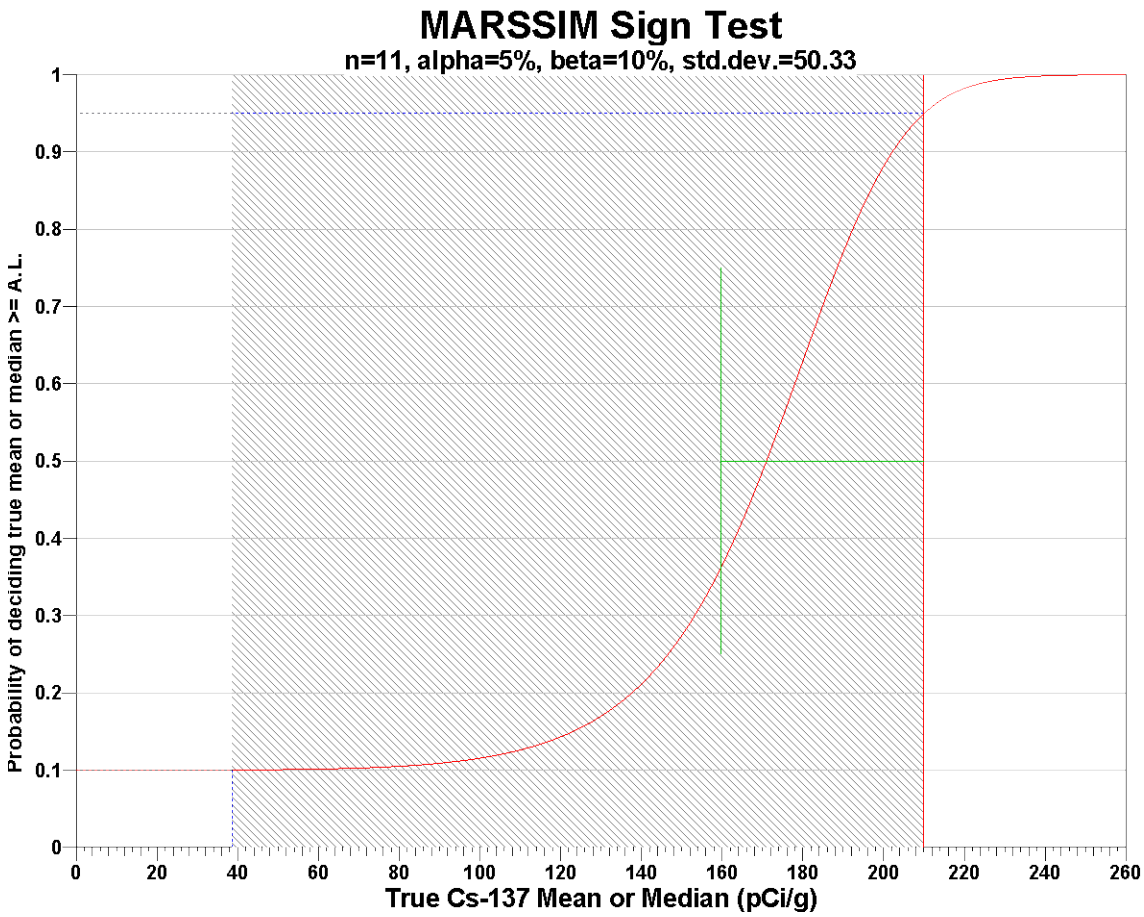
| Analyte | n[a] | Parameter | | | | | |
|---|---|---|---|---|---|---|---|
| | | *S* | $\Delta$ | $\alpha$ | $\beta$ | $Z_{1-\alpha}$ [b] | $Z_{1-\beta}$ [c] |
| Pu-239 | 11 | 7.28 pCi/g | 766.48 pCi/g | 0.05 | 0.1 | 1.64485 | 1.28155 |
| Cs-137 | 11 | 50.33 pCi/g | 171.37 pCi/g | 0.05 | 0.1 | 1.64485 | 1.28155 |

[a] The final number of samples has been increased by the MARSSIM Overage of 20%.
[b] This value is automatically calculated by VSP based upon the user defined value of $\alpha$.
[c] This value is automatically calculated by VSP based upon the user defined value of $\beta$.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true median(mean) values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to $\Delta$; the upper horizontal dashed blue line is positioned at $1-\alpha$ on the vertical axis; the lower horizontal dashed blue line is positioned at $\beta$ on the vertical axis. The vertical green line is positioned at one standard deviation below the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the

lower bound of $\Delta$ at $\beta$ and the upper bound of $\Delta$ at 1-$\alpha$. If any of the inputs change, the number of samples that result in the correct curve changes.




**Statistical Assumptions**

The assumptions associated with the formulas for computing the number of samples are:

1. the computed sign test statistic is normally distributed,
2. the variance estimate, $S^2$, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected probabilistically.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the gridded sample locations were selected based on a random start.

**Sensitivity Analysis**

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, lower bound of gray region (% of action level), beta (%), probability of mistakenly concluding that $\mu$ > action level and alpha (%), probability of mistakenly concluding that $\mu$ < action level. The following table shows the results of this analysis.

| Number of Samples | | | | | | | |
|---|---|---|---|---|---|---|---|
| AL=770 | | α=5 | | α=10 | | α=15 | |
| | | s=14.56 | s=7.28 | s=14.56 | s=7.28 | s=14.56 | s=7.28 |
| LBGR=90 | β=5 | 18 | 14 | 15 | 11 | 12 | 10 |
| | β=10 | 15 | 11 | 12 | 9 | 10 | 8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **β=15** | 12 | 10 | 10 | 8 | 8 | 6 |
| **LBGR=80** | **β=5** | 14 | 14 | 11 | 11 | 10 | 10 |
| | **β=10** | 11 | 11 | 9 | 9 | 8 | 8 |
| | **β=15** | 10 | 10 | 8 | 8 | 6 | 6 |
| **LBGR=70** | **β=5** | 14 | 14 | 11 | 11 | 10 | 10 |
| | **β=10** | 11 | 11 | 9 | 9 | 8 | 8 |
| | **β=15** | 10 | 10 | 8 | 8 | 6 | 6 |

s = Standard Deviation
LBGR = Lower Bound of Gray Region (% of Action Level)
$\beta$ = Beta (%), Probability of mistakenly concluding that $\mu$ > action level
$\alpha$ = Alpha (%), Probability of mistakenly concluding that $\mu$ < action level
AL = Action Level (Threshold)

**Recommended Data Analysis Activities**

Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

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# Mesa Top

**Random sampling locations for comparing a median with a fixed threshold (nonparametric - MARSSIM)**

**Summary**

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

| SUMMARY OF SAMPLING DESIGN | |
|---|---|
| Primary Objective of Design | Compare a site mean or median to a fixed threshold |
| Type of Sampling Design | Nonparametric |
| Sample Placement (Location) in the Field | Simple random sampling |
| Working (Null) Hypothesis | The median(mean) value at the site exceeds the threshold |
| Formula for calculating number of sampling locations | Sign Test - MARSSIM version |
| Calculated total number of samples | 11 |

| Area: Mesa Top | | | | | |
|---|---|---|---|---|---|
| **X Coord** | **Y Coord** | **Label** | **Value** | **Type** | **Historical** |
| 386072.8704 | 3970689.1700 | Mesa Top-1 | | Random | |
| 385411.1587 | 3970815.6757 | Mesa Top-2 | | Random | |
| 385512.9605 | 3970984.3500 | Mesa Top-3 | | Random | |
| 385716.5641 | 3970900.0129 | Mesa Top-4 | | Random | |
| 385792.9154 | 3970792.2487 | Mesa Top-5 | | Random | |
| 385589.3118 | 3970918.7545 | Mesa Top-6 | | Random | |
| 385996.5191 | 3970707.9116 | Mesa Top-7 | | Random | |
| 385487.5100 | 3970834.4173 | Mesa Top-8 | | Random | |
| 385691.1136 | 3970750.0802 | Mesa Top-9 | | Random | |
| 385436.6091 | 3971003.0916 | Mesa Top-10 | | Random | |
| 385843.8163 | 3970679.7992 | Mesa Top-11 | | Random | |

**Primary Sampling Objective**

The primary purpose of sampling at this site is to compare a site median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

**Selected Sampling Approach**

A nonparametric random sampling approach was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

**Number of Total Samples: Calculation Equation and Inputs**

The equation used to calculate the number of samples is based on a Sign test (see PNNL 13450 for discussion). For this site, the null hypothesis is rejected in favor of the alternative one if the median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

Note: MARSSIM suggests that the number of samples should be increased by at least 20% to account for missing or unusable data and uncertainty in the calculated value of n. VSP allows a user-supplied percent overage as discussed in MARSSIM (EPA 2000, p. 5-33).

The values of these inputs that result in the calculated number of sampling locations are:

| Analyte | n[a] | Parameter | | | | | |
|---|---|---|---|---|---|---|---|
| | | $S$ | $\Delta$ | $\alpha$ | $\beta$ | $Z_{1-\alpha}$ [b] | $Z_{1-\beta}$ [c] |
| Pu-239 | 11 | 7.28 pCi/g | 766.48 pCi/g | 0.05 | 0.1 | 1.64485 | 1.28155 |
| Cs-137 | 11 | 50.33 pCi/g | 171.37 pCi/g | 0.05 | 0.1 | 1.64485 | 1.28155 |

[a] The final number of samples has been increased by the MARSSIM Overage of 20%.
[b] This value is automatically calculated by VSP based upon the user defined value of $\alpha$.
[c] This value is automatically calculated by VSP based upon the user defined value of $\beta$.

**Statistical Assumptions**

The assumptions associated with the formulas for computing the number of samples are:

1. the computed sign test statistic is normally distributed,
2. the variance estimate, $S^2$, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected randomly.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the sample locations were selected using a random process.

**Sensitivity Analysis**

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, lower bound of gray region (% of action level), beta (%), probability of mistakenly concluding that $\mu >$ action level and alpha (%), probability of mistakenly concluding that $\mu <$ action level. The following table shows the results of this analysis.

| Number of Samples | | | | | | | |
|---|---|---|---|---|---|---|---|
| AL=770 | | $\alpha$=5 | | $\alpha$=10 | | $\alpha$=15 | |
| | | s=14.56 | s=7.28 | s=14.56 | s=7.28 | s=14.56 | s=7.28 |
| LBGR=90 | $\beta$=5 | 18 | 14 | 15 | 11 | 12 | 10 |
| | $\beta$=10 | 15 | 11 | 12 | 9 | 10 | 8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **β=15** | 12 | 10 | 10 | 8 | 8 | 6 |
| **LBGR=80** | **β=5** | 14 | 14 | 11 | 11 | 10 | 10 |
| | **β=10** | 11 | 11 | 9 | 9 | 8 | 8 |
| | **β=15** | 10 | 10 | 8 | 8 | 6 | 6 |
| **LBGR=70** | **β=5** | 14 | 14 | 11 | 11 | 10 | 10 |
| | **β=10** | 11 | 11 | 9 | 9 | 8 | 8 |
| | **β=15** | 10 | 10 | 8 | 8 | 6 | 6 |

s = Standard Deviation
LBGR = Lower Bound of Gray Region (% of Action Level)
$\beta$ = Beta (%), Probability of mistakenly concluding that $\mu$ > action level
$\alpha$ = Alpha (%), Probability of mistakenly concluding that $\mu$ < action level
AL = Action Level (Threshold)

**Recommended Data Analysis Activities**

Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

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# LA Canyon

**Random sampling locations for comparing a median with a fixed threshold (nonparametric - MARSSIM)**

**Summary**

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

| SUMMARY OF SAMPLING DESIGN | |
|---|---|
| Primary Objective of Design | Compare a site mean or median to a fixed threshold |
| Type of Sampling Design | Nonparametric |
| Sample Placement (Location) in the Field | Simple random sampling |
| Working (Null) Hypothesis | The median(mean) value at the site exceeds the threshold |
| Formula for calculating number of sampling locations | Sign Test - MARSSIM version |
| Calculated total number of samples | 11 |

| Area: LA Canyon | | | | | |
|---|---|---|---|---|---|
| **X Coord** | **Y Coord** | **Label** | **Value** | **Type** | **Historical** |
| 386064.0861 | 3970641.2405 | LA Canyon-1 | | Random | |
| 385396.4190 | 3970740.0561 | LA Canyon-2 | | Random | |
| 385807.2911 | 3970575.3634 | LA Canyon-3 | | Random | |
| 385601.8550 | 3970674.1790 | LA Canyon-4 | | Random | |
| 385987.0476 | 3970646.1203 | LA Canyon-5 | | Random | |
| 385473.4575 | 3970744.9359 | LA Canyon-6 | | Random | |
| 385884.3296 | 3970580.2432 | LA Canyon-7 | | Random | |
| 385678.8935 | 3970679.0588 | LA Canyon-8 | | Random | |
| 385832.9706 | 3970624.1612 | LA Canyon-9 | | Random | |
| 385627.5345 | 3970722.9769 | LA Canyon-10 | | Random | |
| 386038.4066 | 3970558.2842 | LA Canyon-11 | | Random | |

**Primary Sampling Objective**

The primary purpose of sampling at this site is to compare a site median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

**Selected Sampling Approach**

A nonparametric random sampling approach was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and

historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

**Number of Total Samples: Calculation Equation and Inputs**

The equation used to calculate the number of samples is based on a Sign test (see PNNL 13450 for discussion). For this site, the null hypothesis is rejected in favor of the alternative one if the median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The values of these inputs that result in the calculated number of sampling locations are:

| Analyte | n[a] | Parameter | | | | | |
|---|---|---|---|---|---|---|---|
| | | $S$ | $\Delta$ | $\alpha$ | $\beta$ | $Z_{1-\alpha}$ [b] | $Z_{1-\beta}$ [c] |
| Pu-239 | 11 | 7.28 pCi/g | 766.48 pCi/g | 0.05 | 0.1 | 1.64485 | 1.28155 |
| Cs-137 | 11 | 50.33 pCi/g | 171.37 pCi/g | 0.05 | 0.1 | 1.64485 | 1.28155 |

[a] The final number of samples has been increased by the MARSSIM Overage of 20%.
[b] This value is automatically calculated by VSP based upon the user defined value of $\alpha$.
[c] This value is automatically calculated by VSP based upon the user defined value of $\beta$.

**Statistical Assumptions**

The assumptions associated with the formulas for computing the number of samples are:
1. the computed sign test statistic is normally distributed,
2. the variance estimate, $S^2$, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected randomly.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the sample locations were selected using a random process.

**Sensitivity Analysis**

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, lower bound of gray region (% of action level), beta (%), probability of mistakenly concluding that $\mu >$ action level and alpha (%), probability of mistakenly concluding that $\mu <$ action level. The following table shows the results of this analysis.

| Number of Samples | | | | | | | |
|---|---|---|---|---|---|---|---|
| AL=770 | | $\alpha$=5 | | $\alpha$=10 | | $\alpha$=15 | |
| | | s=14.56 | s=7.28 | s=14.56 | s=7.28 | s=14.56 | s=7.28 |
| LBGR=90 | $\beta$=5 | 18 | 14 | 15 | 11 | 12 | 10 |
| | $\beta$=10 | 15 | 11 | 12 | 9 | 10 | 8 |
| | $\beta$=15 | 12 | 10 | 10 | 8 | 8 | 6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **LBGR=80** | **β=5** | 14 | 14 | 11 | 11 | 10 | 10 |
| | **β=10** | 11 | 11 | 9 | 9 | 8 | 8 |
| | **β=15** | 10 | 10 | 8 | 8 | 6 | 6 |
| **LBGR=70** | **β=5** | 14 | 14 | 11 | 11 | 10 | 10 |
| | **β=10** | 11 | 11 | 9 | 9 | 8 | 8 |
| | **β=15** | 10 | 10 | 8 | 8 | 6 | 6 |

s = Standard Deviation
LBGR = Lower Bound of Gray Region (% of Action Level)
$\beta$ = Beta (%), Probability of mistakenly concluding that $\mu$ > action level
$\alpha$ = Alpha (%), Probability of mistakenly concluding that $\mu$ < action level
AL = Action Level (Threshold)

**Recommended Data Analysis Activities**

Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

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# Addendum to

## Sampling and Analysis Plan (SAP) for Assessment of LANL-Derived Residual Radionuclides in Soils within Tract A-16-d for Land Conveyance and Transfer

## for Sewage Treatment Facility Area

February 2016

## 1.0 Background

This addendum to the Sampling and Analysis Plan (SAP) for Tract A-16-d includes the area around the former sanitary waste treatment facility (STF) which was not sampled with the rest of the Tract (see Figure 1 of the SAP). The STF area is approximately 10,000 $m^2$ (2.5 acres). The full area of Tract A-16-d with the STF area included is approximately 380,000 $m^2$ (93 acres).

### 1.1 Site Location

The STF area and former LANL structures are indicated in Figure 3 of the SAP. Three buildings, a drying bed with concrete stem walls, and two concrete sumps were removed from the property in late 2015/early 2016. Five potential release sites associated with the STF were identified in the area, as described in Section 1.4 of the original SAP.

### 1.2 Radiological Release of Footprint Reduction Materials

Radiological characterization of the structural material of the decommissioned STF was conducted to satisfy the requirements of DOE Order 458.1 for release of personal property (i.e. building materials such as concrete and metal) to the public. The following two reports presented the results of characterization:

- MARSAME Release Report for TA-21 Buildings 227 (superstructure), 229, and 387 (November 2015)
- MARSAME Release Report for TA-21 Building 227 below-grade tanks and sumps (January 2016)

DOE concurrence was documented in emails referencing each release report (Rex Borders, DOE/NNSA NA-553, November 10, 2015 and January 26, 2016).

## 2.0 Data Quality Objectives for Sampling

The objective of sampling, fundamental statistical basis, and decision inputs for Tract A-16-d are provided in the original SAP. This Addendum adds the following decision area:

- STF Area – Class 2 Construction

The additional decision area is treated as Class 2 (due to elevated historical measurements in the outfall described in Section 3.1 below), and a construction scenario is used for consistency with the rest of the DP mesa top. Soil screening action levels (SALs) for construction users are more conservative than commercial/industrial SALs and include potential exposures due to future development of the property. If land use requirements change in the future, sampling could be targeted to the specific area of the proposed activity.

## 2.1 Quality Assurance

Measurement quality objectives, including sample collection and analysis procedures, are described in the original SAP. Statistical evaluation of the survey results will include data from the original three decision units in Tract A-16-d (DP Canyon, Mesa Top, and LA Canyon) as well as the STF area decision unit. For consistency with the stated approach in the original SAP, soil concentrations will be evaluated using Table B-1 of "Derivation and Use of Radionuclide Screening Action Levels, Revision 3" (LA-UR-014-29225, EP2014-0547).

## 3.0 Results of the Analysis for Sampling Number and Locations

Preliminary results were input into Visual Sample Plan to define sampling at 12 locations in the STF area decision unit. Additionally, a review of preliminary data and historical information indicate a potential for elevated radionuclide concentrations in the outfall, justifying biased samples at 4 additional locations.

## 3.1 Preliminary Results

The preliminary data included soil samples collected primarily in 2007 (2 measurements of Cs-137 were recorded in 2009) at various depths. Surface samples at two locations in the outfall area north of the sumps indicated elevated readings of Pu-239 above the levels anticipated for the mesa top: 84 pCi/g in one surface sample from location 21-27576 and 20 pCi/g in two surface samples from location 21-27579 (see Figure A1). The Am-241 results for these same locations were similarly elevated, with maximum values of 58.1 pCi/g and 8.41 pCi/g for 21-27576 and 21-27579, respectively. These results compare to construction worker SALs of 72 pCi/g for Pu-239 and 85 pCi/g for Am-241.

Historical information on the STF indicates that water containing process radionuclides may have traveled through the sanitary waste water system during early DP Mesa operations. In the outfall, seepage from leaks in the sewage line could have contributed to elevated soil concentrations of Pu-239 and Am-241.

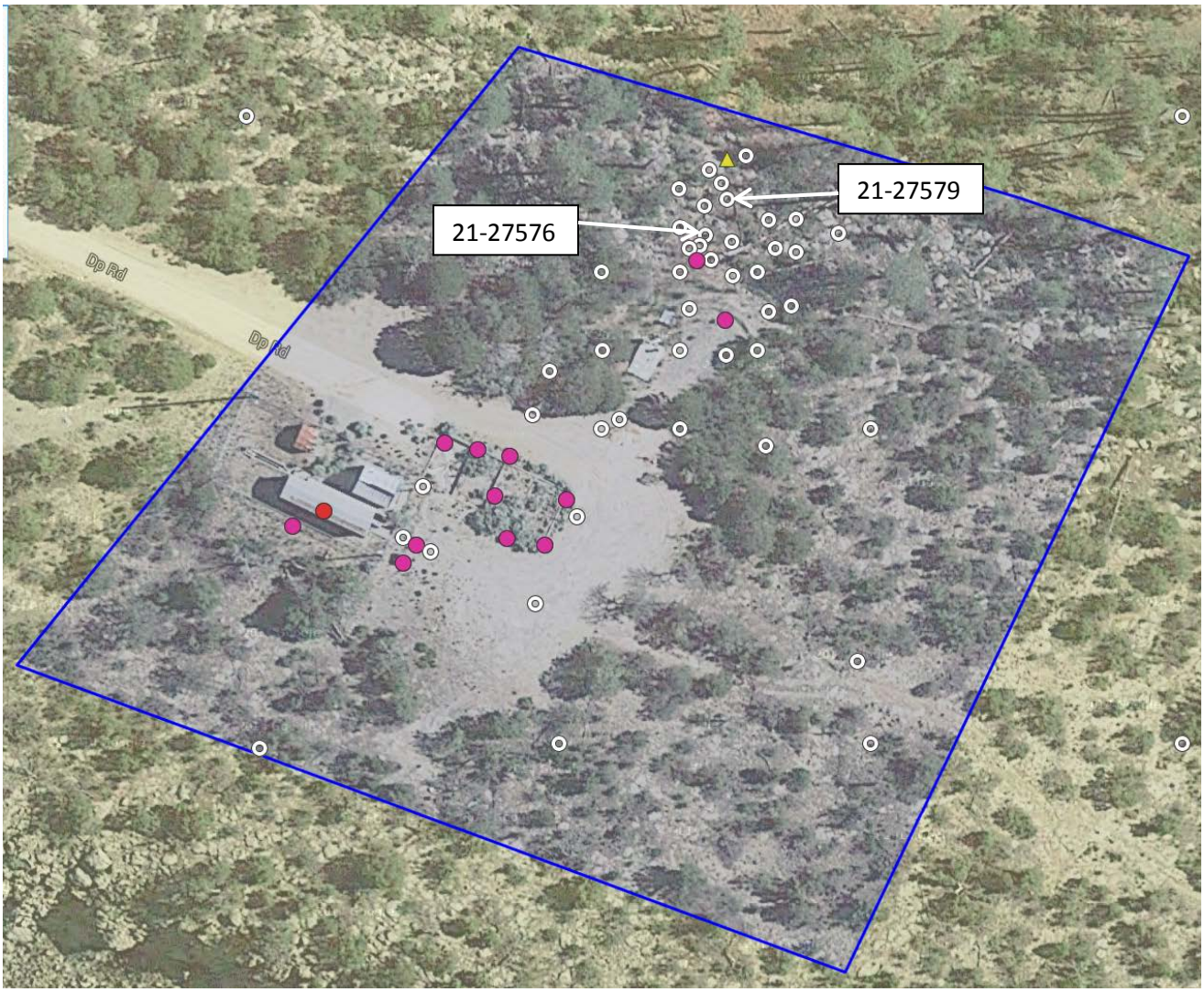



Figure A1. Preliminary sample locations from Intellus 2015 used to generate the tables below and define input parameters for this sampling plan addendum. Locations 21-27576 and 21-27579 had elevated results for Pu-239 and Am-241. ***Note***: STF area boundary is approximate.

| *Pu-239 [pCi/g]* | |
|---|---|
| Mean | 1.78 |
| Standard Error | 1.13 |
| Median | 0.02 |
| Standard Deviation | 9.96 |
| Minimum | -0.01 |
| Maximum | 83.50 |
| Count | 77 |
| Confidence Level(95.0%) | 2.26 |
| UCL Estimate | 4.04 |

| *Cs-137 [pCi/g]* | |
|---|---|
| Mean | 0.10 |
| Standard Error | 0.02 |
| Median | 0.03 |
| Standard Deviation | 0.16 |
| Minimum | 0.04 |
| Maximum | 0.79 |
| Count | 78 |
| Confidence Level(95.0%) | 0.04 |
| UCL Estimate | 0.13 |

| *Am-241 [pCi/g]* | |
|---|---|
| Mean | 0.83 |
| Standard Error | 0.40 |
| Median | 0.03 |
| Standard Deviation | 5.27 |
| Minimum | -0.27 |
| Maximum | 58.10 |
| Count | 174 |
| Confidence Level(95.0%) | 0.79 |
| UCL Estimate | 1.62 |

| *Sr-90 [pCi/g]* | |
|---|---|
| Mean | 0.01 |
| Standard Error | 0.01 |
| Median | 0.00 |
| Standard Deviation | 0.12 |
| Minimum | 0.49 |
| Maximum | 0.39 |
| Count | 75 |
| Confidence Level(95.0%) | 0.03 |
| UCL Estimate | 0.02 |

### 3.2 Sample Locations

Sampling in the STF area decision unit will include 12 samples on a triangular grid pattern (Class 2), and 4 biased samples in the former STF outfall. The approximate sample locations are indicated in Figure A2.


Figure A2. Map of sampling locations in the STF decision area for tract A-16-d. Grid locations are indicated with pink dots. Biased locations are indicated for STF-13 and STF-14 in the dash-outlined outfall area. Two additional biased locations should be field-located within the dash-outlined area. ***Note***: Map locations and boundaries are approximate.

### 3.2.1 Grid Locations

Grid location coordinates are provided in the following table. Locations were selected using a quasi-random number generator for x and y coordinates. VSP outputs are provided in Section 4.0.

Note: due to potential image distortion in VSP, some of the coordinates listed in the table may not accurately reflect the point shown in the image. Additionally, some of the locations may not be readily accessible. Samples may be field located or moved based on accessibility; accurate GPS locations should be recorded with the sample data.

| Tract A-16-d<br>STF Area Class 2 Construction<br>(Systematic Triangular Grid Sampling – UTM Coordinates) | | |
|---|---|---|
| | X Coordinate (m) | Y Coordinate (m) |
| STF-1 | 385532.7234 | 3970791.9149 |
| STF-2 | 385563.5326 | 3970791.9149 |
| STF-3 | 385594.3417 | 3970791.9149 |
| STF-4 | 385548.1280 | 3970818.5964 |
| STF-5 | 385578.9371 | 3970818.5964 |
| STF-6 | 385609.7463 | 3970818.5964 |
| STF-7 | 385563.5326 | 3970845.2779 |
| STF-8 | 385594.3417 | 3970845.2779 |
| STF-9 | 385625.1509 | 3970845.2779 |
| STF-10 | 385578.9371 | 3970871.9594 |
| STF-11 | 385609.7463 | 3970871.9594 |
| STF-12 | 385640.5555 | 3970871.9594 |

### 3.2.2 Biased Locations

In addition to the 12 grid locations provided by VSP, biased sampling is proposed to better inform radiological release decisions based on the current state of the Tract. An additional 4 soil samples will be collected in the outfall as follows:

- STF-13: 1 sample at Location 21-27576 (*-106.26731, 35.87525*)
- STF-14: 1 sample at Location 21-27579 (*-106.26728, 35.87529*)
- STF-15&16: 2 samples at locations chosen by the sampling team to represent high-risk areas in the outfall (e.g. where the discharged water may have flowed or leaked from pipes)

## 4.0 VSP Output for A-16-d STF Area (Grid locations)

# STF Area

**Systematic sampling locations for comparing a median with a fixed threshold (nonparametric - MARSSIM)**

**Summary**

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

| SUMMARY OF SAMPLING DESIGN | |
|---|---|
| Primary Objective of Design | Compare a site mean or median to a fixed threshold |
| Type of Sampling Design | Nonparametric |
| Sample Placement (Location) in the Field | Systematic with a random start location |
| Working (Null) Hypothesis | The median(mean) value at the site exceeds the threshold |
| Formula for calculating number of sampling locations | Sign Test - MARSSIM version |
| Calculated total number of samples | 11 |
| Number of samples on map [a] | 12 |

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.

**Primary Sampling Objective**

The primary purpose of sampling at this site is to compare a site median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

**Selected Sampling Approach**

A nonparametric systematic sampling approach with a random start was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points over a systematic grid with a random start ensures spatial coverage of the site. Statistical analyses of systematically collected data are valid if a random start to the grid is used. One disadvantage of systematically collected samples is that spatial variability or patterns may not be discovered if the grid spacing is large relative to the spatial patterns.

**Number of Total Samples: Calculation Equation and Inputs**

The equation used to calculate the number of samples is based on a Sign test (see PNNL 13450 for discussion). For this site, the null hypothesis is rejected in favor of the alternative one if the median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{4(SignP - 0.5)^2}$$

where

$$SignP = \Phi\left(\frac{\Delta}{s_{total}}\right)$$

$\Phi(z)$ is the cumulative standard normal distribution on $(-\infty,z)$ (see PNNL-13450 for details),
$n$ is the number of samples,
$S_{total}$ is the estimated standard deviation of the measured values including analytical error,
$\Delta$ is the width of the gray region,
$\alpha$ is the acceptable probability of incorrectly concluding the site median(mean) is less than the threshold,
$\beta$ is the acceptable probability of incorrectly concluding the site median(mean) exceeds the threshold,
$Z_{1-\alpha}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is $1-\alpha$,
$Z_{1-\beta}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is $1-\beta$.

Note: MARSSIM suggests that the number of samples should be increased by at least 20% to account for missing or unusable data and uncertainty in the calculated value of n. VSP allows a user-supplied percent overage as discussed in MARSSIM (EPA 2000, p. 5-33).

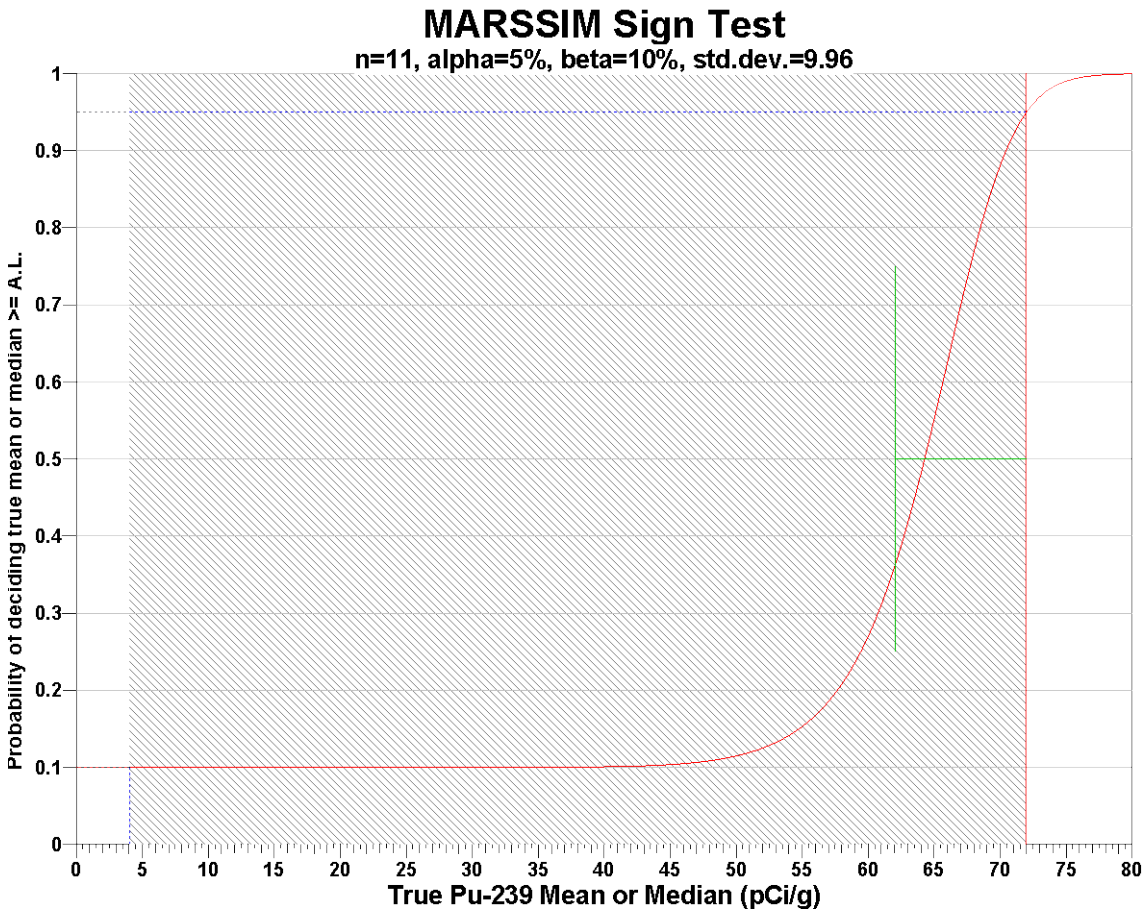
The values of these inputs that result in the calculated number of sampling locations are:

| Analyte | n[a] | Parameter | | | | | |
|---|---|---|---|---|---|---|---|
| | | *S* | Δ | α | β | $Z_{1-\alpha}$ [b] | $Z_{1-\beta}$ [c] |
| Pu-239 | 11 | 9.96 pCi/g | 67.96 pCi/g | 0.05 | 0.1 | 1.64485 | 1.28155 |
| Cs-137 | 11 | 0.16 pCi/g | 17.87 pCi/g | 0.05 | 0.1 | 1.64485 | 1.28155 |

[a] The final number of samples has been increased by the MARSSIM Overage of 20%.
[b] This value is automatically calculated by VSP based upon the user defined value of $\alpha$.
[c] This value is automatically calculated by VSP based upon the user defined value of $\beta$.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true median(mean) values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to $\Delta$; the upper horizontal dashed blue line is positioned at $1-\alpha$ on the vertical axis; the lower horizontal dashed blue line is positioned at $\beta$ on the vertical axis. The vertical green line is positioned at one standard deviation below the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of $\Delta$ at $\beta$ and the upper bound of $\Delta$ at $1-\alpha$. If any of the inputs change, the number of samples that result in the correct curve changes.




**Statistical Assumptions**

The assumptions associated with the formulas for computing the number of samples are:

1. the computed sign test statistic is normally distributed,
2. the variance estimate, $S^2$, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected probabilistically.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the gridded sample locations were selected based on a random start.

**Sensitivity Analysis**

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, lower bound of gray region (% of action level), beta (%), probability of mistakenly concluding that $\mu >$ action level and alpha (%), probability of mistakenly concluding that $\mu <$ action level. The following table shows the results of this analysis.

| Number of Samples | | | | | | | |
|---|---|---|---|---|---|---|---|
| AL=18 | | α=5 | | α=10 | | α=15 | |
| | | s=0.32 | s=0.16 | s=0.32 | s=0.16 | s=0.32 | s=0.16 |
| LBGR=90 | β=5 | 14 | 14 | 11 | 11 | 10 | 10 |
| | β=10 | 11 | 11 | 9 | 9 | 8 | 8 |
| | β=15 | 10 | 10 | 8 | 8 | 6 | 6 |
| LBGR=80 | β=5 | 14 | 14 | 11 | 11 | 10 | 10 |
| | β=10 | 11 | 11 | 9 | 9 | 8 | 8 |
| | β=15 | 10 | 10 | 8 | 8 | 6 | 6 |
| LBGR=70 | β=5 | 14 | 14 | 11 | 11 | 10 | 10 |
| | β=10 | 11 | 11 | 9 | 9 | 8 | 8 |
| | β=15 | 10 | 10 | 8 | 8 | 6 | 6 |

s = Standard Deviation
LBGR = Lower Bound of Gray Region (% of Action Level)
β = Beta (%), Probability of mistakenly concluding that μ > action level
α = Alpha (%), Probability of mistakenly concluding that μ < action level
AL = Action Level (Threshold)

**Recommended Data Analysis Activities**

Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

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