



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION AND INDOOR AIR
National Air and Radiation Environmental Laboratory
540 South Morris Avenue, Montgomery, AL 36115-2601
(334) 270-3400

51-20

January 7, 2000

MEMORANDUM

SUBJECT: Radiochemical Results for }
Seneca Army Depot Samples }

FROM: John Griggs, Chief *John Griggs*
Monitoring and Analytical Services Branch

TO: Eric Simpson, Coordinator
Radiation Monitoring and Analytical Programs
Region 2

Attached is a data package for gamma analysis of soil samples collected from the Seneca Army Depot site in Romulus, NY. The samples constitute NAREL batch number 9900096. The results of further analyses will be sent as they are completed.

Radiochemical analyses usually require the subtraction of an instrument background measurement from a gross sample measurement. Both values are positive, but when the sample activity is low, random variations in the two measurements can cause the gross value to be less than the background, resulting in a measured activity less than zero. Although negative activities have no physical significance, they do have statistical significance, as for example in the evaluation of trends or the comparison of two groups of samples.

For all analyses except gamma spectroscopy, it is the policy of NAREL to report results as generated, whether positive, negative, or zero, together with the 2-sigma measurement uncertainty and a sample-specific estimate of the minimum detectable concentration (MDC). The activity, uncertainty, and MDC are given in the same units. The activity and 2-sigma uncertainty for a radionuclide measured by gamma spectroscopy are reported only if the nuclide is detected; so, the results of gamma analyses are never zero or negative. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Cs-137, I-131, K-40, Ra-226, and Ra-228. If one of these six nuclides is undetected, NAREL reports it as "Not Detected," or "ND," and provides a sample-specific estimate of the MDC.

Specific information concerning all aspects of the radiological analysis of the samples is contained in the batch case narrative of the data package. If you have any questions concerning the analytical results, please contact me at (334)270-3450.

Attachments

cc: Paul Giardina, Region 2, w/o attachments
Mary Clark, (6601J), w/o attachments
Ed Sensintaffar, NAREL

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES**

REPORT OF SAMPLE DELIVERY GROUP #9900096

Project: SENECA ARMY DEPOT
Analysis Procedure: Gamma spectroscopy
Date Reported: 01/06/2000

SAMPLES

| NAREL Sample # | Client Sample ID | Type | Matrix | Date Collected | Date Received |
|-------------------|------------------|------|--------|-------------------|------------------|
| 99.07313Y | SS12-9 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07314Z | SS12-2 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07315A | SS12-13 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07316B | SS12-14 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07317C | EPA12-1 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07318D | EPA12-2 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07319E | EPA12-3 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07320X | EPA12-4 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07321Y | EPA12-5 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07322Z | EPA12-9 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07323A | EPA12-11 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07324B | EPA12-12 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07325C | EPA12-6 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07326D | EPA12-7 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07327E | EPA12-8 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07328F | EPA12-10 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07329G | EPA12-13 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07330Z | EPA12-14 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07331A | EPA12-15 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07332B | EPA12-16 | SAM | SOIL | 12/13/1999 | 12/15/1999 |

EXCEPTIONS

1. Packaging and Shipping - No problems were observed.
2. Documentation - No problems were observed.
3. Sample Preparation - No problems were encountered.
4. Analysis - No problems were encountered.
5. Holding Times - All holding times were met.

QUALITY CONTROL

1. QC samples - All QC analysis results met NAREL acceptance criteria.
2. Instruments - Response and background checks for all instruments used in these analyses met NAREL acceptance criteria.

CERTIFICATION

I certify that this data report complies with the terms and conditions of the Quality Assurance Project Plan, except as noted above. Release of the data contained in this report has been authorized by the Chief of the Monitoring and Analytical Services Branch and the NAREL Quality Assurance Coordinator, or their designees, as verified by the following signatures.

James B. Moore 1/7/00
James B. Moore Date
Quality Assurance Coordinator

John Griggs 1/7/00
John Griggs, Ph.D. Date
Chief, Monitoring and Analytical Services Branch

GENERAL INFORMATION

SAMPLE TYPES

| | |
|-----|---------------------|
| BLD | Blind sample |
| DBD | Double blind sample |
| FBK | Field blank |
| SAM | Normal sample |

ANALYSIS QC TYPES

| | |
|-----|---|
| ANA | Normal analysis |
| DUP | Laboratory duplicate |
| LCS | Laboratory control sample (blank spike) |
| MS | Matrix spike |
| MSD | Matrix spike duplicate |
| RBK | Reagent blank |

QUALITY INDICATORS

| | |
|-----|---|
| RPD | Relative Percent Difference |
| %R | Percent Recovery |
| Z | Number of standard deviations by which a QC measurement differs from the expected value |

EVALUATION OF QC ANALYSES

A reagent blank result is considered unacceptable if it is more than 3 standard deviations below zero or more than 3 standard deviations above a predetermined upper control limit. For some analyses NAREL has set the upper control limit at zero. For others the control limit is a small positive number.

NAREL evaluates the results of duplicate and spike analyses using "Z scores." A Z score is the number of standard deviations by which the QC result differs from its ideal value. The score is considered acceptable if its absolute value is not greater than 3.

The Z score for a spiked sample is computed by dividing the difference between the measured value and the target value by the combined standard uncertainty of the difference.

The Z score for a duplicate analysis is computed by dividing the difference between the two measured values by the combined standard uncertainty of the difference. When the precision of paired MS/MSD analyses is evaluated, the native sample activity is subtracted from each measured value and the net concentrations are then converted to total activities before the Z score is computed.

Each standard uncertainty used to compute a Z score includes an additional fixed term to represent sources of measurement error other than counting error. This additional term is not used in the evaluation of reagent blanks.

NAREL reports the "relative percent difference," or RPD, between duplicate results and the "percent recovery," or %R, for spiked analyses, but does not use these values for evaluation.

GENERAL INFORMATION (CONTINUED)

GAMMA ANALYSIS

The reporting format lists the gamma emitters in alphabetical order. The activity and 2-sigma uncertainty for radionuclides measured by gamma spectroscopy are reported only if the nuclide is detected. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Co-60, Cs-137, I-131, K-40, Ra-226 and Ra-228. If one of these seven nuclides is undetected, NAREL reports it as "Not Detected" or "ND", and provides a sample-specific estimate of the MDC.

Due to potential spectral interferences and other possible problems associated with the determination of the activity of certain radionuclides, the activities for Th-234, Pa-234m, Ra-226, and U-235 are subject to greater possible error than other commonly reported radionuclides. It should be noted that this potential error is not included in the two-sigma counting error which is reported with each activity. Although in this report we do provide the calculated activities for these radionuclides, we recommend that the results be used only as a qualitative means of indicating the presence of these radionuclides and not as a quantitative measure of their concentration. The results for these nuclides are not used in the evaluation of quality control samples. Furthermore, because of mutual interference between Ra-226 and U-235, NAREL's gamma analysis software tends to overestimate the amounts of these nuclides whenever both are present in a sample. Lower estimates for Ra-226 activities can be obtained from the reported activities of its decay products, Pb-214 and Bi-214, which are likely to be somewhat less than the Ra-226 activity because of the potential escape of radon gas.

NAREL's gamma spectroscopy software corrects activities and MDCs for decay between collection and analysis, but only up to a limit of ten half-lives. So, if the decay time for a sample is more than ten half-lives of a radionuclide, that nuclide will almost always be undetected and the reported MDC will be meaningless. This is usually a problem only for short-lived radionuclides, such as I-131 and Ba-140, when there is a long delay between collection and analysis.

**U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096**

ANALYSIS SUMMARY

Analysis Procedure: GAMMA
 Title: Gamma spectroscopy

| NAREL Sample # | QC Type | Preparation Procedure | Date Completed | Prep Batch # | QC Batch # |
|----------------|---------|-----------------------|----------------|--------------|------------|
| 99.07313Y | | N/A | 12/29/1999 | 0003518Q | 0001323M |
| 99.07314Z | | N/A | 12/29/1999 | 0003518Q | 0001323M |
| 99.07315A | | N/A | 12/30/1999 | 0003518Q | 0001323M |
| 99.07316B | | N/A | 12/30/1999 | 0003518Q | 0001323M |
| 99.07317C | | N/A | 01/04/2000 | 0003518Q | 0001323M |
| 99.07318D | | N/A | 01/03/2000 | 0003518Q | 0001323M |
| 99.07319E | | N/A | 01/05/2000 | 0003527R | 0001323M |
| 99.07320X | | N/A | 01/05/2000 | 0003527R | 0001323M |
| 99.07320X | DUP | N/A | 01/06/2000 | 0003527R | 0001323M |
| 99.07321Y | | N/A | 01/05/2000 | 0003527R | 0001323M |
| 99.07322Z | | N/A | 01/05/2000 | 0003527R | 0001323M |
| 99.07323A | | N/A | 01/05/2000 | 0003527R | 0001323M |
| 99.07324B | | N/A | 01/05/2000 | 0003527R | 0001323M |
| 99.07325C | | N/A | 01/06/2000 | 0003538V | 0001323M |
| 99.07326D | | N/A | 01/06/2000 | 0003538V | 0001323M |
| 99.07327E | | N/A | 01/06/2000 | 0003538V | 0001323M |
| 99.07328F | | N/A | 01/05/2000 | 0003538V | 0001323M |
| 99.07329G | | N/A | 01/06/2000 | 0003538V | 0001323M |
| 99.07330Z | | N/A | 01/05/2000 | 0003538V | 0001323M |
| 99.07331A | | N/A | 01/06/2000 | 0003538V | 0001323M |
| 99.07332B | | N/A | 01/06/2000 | 0003538V | 0001323M |

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07313Y | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003518Q |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 4.970e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 12/29/1999 13:37 | 300.0 | GE14 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 3.8e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 8.54e-01 | 2.1e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 8.41e-01 | 3.9e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 3.5e-02 | PCI/GDRY | 12/07/1999 |
| Cs134 | ND | | 6.6e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 3.33e-01 | 2.2e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.4e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 2.34e+01 | 4.1e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 1.22e+00 | 5.2e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 9.25e-01 | 4.6e-02 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 2.18e+00 | 5.1e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 8.84e-01 | 5.7e-02 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 3.09e-01 | 2.2e-02 | | PCI/GDRY | 12/07/1999 |

* An asterisk indicates a result whose value may be significantly over or underestimated.

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 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07314Z | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003518Q |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.430e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 12/29/1999 18:40 | 300.0 | GE14 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 3.8e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 8.47e-01 | 2.0e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 8.91e-01 | 3.5e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 3.2e-02 | PCI/GDRY | 12/07/1999 |
| Cs134 | ND | | 6.4e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 1.29e-01 | 1.7e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.4e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 2.35e+01 | 4.0e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 1.31e+00 | 5.2e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 1.01e+00 | 4.7e-02 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 2.73e+00 | 5.3e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 8.63e-01 | 5.2e-02 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 3.12e-01 | 1.9e-02 | | PCI/GDRY | 12/07/1999 |

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 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07315A | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003518Q |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.140e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 12/29/1999 23:43 | 300.0 | GE14 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|------------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 4.2e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 9.31e-01 | 2.1e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 8.15e-01 | 3.7e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 3.2e-02 | PCI/GDRY | 12/07/1999 |
| Cs134 | ND | | 6.3e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 2.68e-01 | 1.9e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.5e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 2.28e+01 | 4.0e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 1.27e+00 | 5.2e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 8.73e-01 | 4.5e-02 | | PCI/GDRY | 12/07/1999 |
| Ra226 | * 1.82e+00 | 4.7e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 8.29e-01 | 5.0e-02 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 3.10e-01 | 2.1e-02 | | PCI/GDRY | 12/07/1999 |

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 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07316B | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003518Q |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.420e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 12/30/1999 04:46 | 300.0 | GE14 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 3.5e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 6.87e-01 | 1.8e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 6.54e-01 | 3.2e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 3.2e-02 | PCI/GDRY | 12/07/1999 |
| Cs134 | ND | | 5.7e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 1.83e-01 | 1.8e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.3e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 1.89e+01 | 3.6e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 9.46e-01 | 4.7e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 7.49e-01 | 4.1e-02 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 1.85e+00 | 4.5e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 6.50e-01 | 4.7e-02 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 2.28e-01 | 1.8e-02 | | PCI/GDRY | 12/07/1999 |

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 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07317C | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003518Q |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.460e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/03/2000 15:18 | 1000.0 | GE02 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 4.2e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 9.51e-01 | 2.3e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 8.54e-01 | 3.9e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 4.3e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 1.90e-02 | 1.6e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.2e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 1.99e+01 | 5.4e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 9.44e-01 | 3.3e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 9.03e-01 | 3.2e-02 | | PCI/GDRY | 12/07/1999 |
| Ra224 | 8.74e-01 | 3.2e-01 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 2.10e+00 | 2.5e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 8.41e-01 | 5.0e-02 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 3.10e-01 | 2.0e-02 | | PCI/GDRY | 12/07/1999 |

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**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07318D | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003518Q |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 4.750e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/03/2000 15:38 | 300.0 | GE14 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 4.8e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 6.75e-01 | 1.8e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 7.80e-01 | 3.5e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 3.0e-02 | PCI/GDRY | 12/07/1999 |
| Cs134 | ND | | 6.6e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 5.65e-01 | 2.5e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 3.4e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 2.12e+01 | 3.9e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 1.07e+00 | 4.9e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 8.64e-01 | 4.2e-02 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 1.58e+00 | 4.6e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 7.11e-01 | 4.6e-02 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 2.77e-01 | 1.9e-02 | | PCI/GDRY | 12/07/1999 |

* An asterisk indicates a result whose value may be significantly over or underestimated.

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 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07319E | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003527R |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.710e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/04/2000 12:56 | 1000.0 | GE04 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 4.1e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 1.09e+00 | 1.7e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 8.54e-01 | 3.3e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 3.6e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 2.25e-01 | 1.8e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.3e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 2.21e+01 | 4.5e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 1.03e+00 | 3.0e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 9.38e-01 | 3.0e-02 | | PCI/GDRY | 12/07/1999 |
| Ra223 | 1.10e-01 | 6.2e-02 | | PCI/GDRY | 12/07/1999 |
| Ra224 | 5.05e-01 | 2.5e-01 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 2.27e+00 | 3.0e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 8.95e-01 | 4.6e-02 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 3.38e-01 | 1.8e-02 | | PCI/GDRY | 12/07/1999 |
| U235 * | 1.33e-01 | 1.7e-02 | | PCI/GDRY | 12/07/1999 |

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07320X | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003527R |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.810e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/04/2000 12:56 | 1000.0 | GE05 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 2.5e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 5.90e-01 | 1.2e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 5.64e-01 | 2.5e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 2.3e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 1.67e-01 | 1.2e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 1.7e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 1.45e+01 | 3.1e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 6.83e-01 | 2.5e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 6.09e-01 | 2.4e-02 | | PCI/GDRY | 12/07/1999 |
| Ra224 | 5.21e-01 | 2.4e-01 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 1.40e+00 | 2.7e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 5.78e-01 | 3.3e-02 | | PCI/GDRY | 12/07/1999 |
| Th234 * | 4.60e-01 | 1.8e-01 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 2.02e-01 | 1.3e-02 | | PCI/GDRY | 12/07/1999 |

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**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07320X | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003527R |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.810e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | DUP |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/05/2000 13:36 | 1000.0 | GE02 | MHW |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 3.7e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 6.01e-01 | 1.9e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 6.14e-01 | 3.1e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 3.1e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 1.53e-01 | 1.6e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.3e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 1.41e+01 | 4.3e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 6.52e-01 | 2.7e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 6.62e-01 | 2.7e-02 | | PCI/GDRY | 12/07/1999 |
| Ra224 | 3.42e-01 | 2.7e-01 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 1.83e+00 | 2.4e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 5.79e-01 | 4.3e-02 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 2.12e-01 | 1.7e-02 | | PCI/GDRY | 12/07/1999 |

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U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07321Y | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003527R |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.750e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/04/2000 12:57 | 1000.0 | GE06 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 3.2e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 8.40e-01 | 1.3e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 8.16e-01 | 2.7e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 2.5e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 6.62e-02 | 1.1e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.1e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 1.97e+01 | 3.2e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 9.58e-01 | 2.8e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 8.90e-01 | 2.7e-02 | | PCI/GDRY | 12/07/1999 |
| Ra224 | 1.02e+00 | 2.6e-01 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 1.89e+00 | 2.7e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 8.40e-01 | 3.4e-02 | | PCI/GDRY | 12/07/1999 |
| Th234 * | 6.54e-01 | 2.4e-01 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 3.00e-01 | 1.4e-02 | | PCI/GDRY | 12/07/1999 |

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U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07322Z | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003527R |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.170e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/04/2000 12:57 | 1000.0 | GE07 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | ± 2σ Uncertainty | MDC | Unit | Date |
|---------|----------|------------------|---------|----------|------------|
| Ba140 | ND | | 3.7e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 1.32e+00 | 2.1e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 1.01e+00 | 3.6e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 3.1e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 4.45e-01 | 1.9e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.5e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 2.95e+01 | 4.5e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 1.51e+00 | 3.7e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 1.16e+00 | 3.5e-02 | | PCI/GDRY | 12/07/1999 |
| Ra223 | 1.62e-01 | 7.5e-02 | | PCI/GDRY | 12/07/1999 |
| Ra224 | 9.08e-01 | 3.5e-01 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 2.44e+00 | 3.3e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 1.27e+00 | 5.0e-02 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 4.58e-01 | 1.9e-02 | | PCI/GDRY | 12/07/1999 |
| U235 * | 1.48e-01 | 2.0e-02 | | PCI/GDRY | 12/07/1999 |

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U.S. ENVIRONMENTAL PROTECTION AGENCY
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 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07323A | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003527R |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 4.450e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/04/2000 22:45 | 500.0 | GE13 | MHW |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|------------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 3.8e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 9.53e-01 | 1.8e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 7.76e-01 | 3.4e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 2.8e-02 | PCI/GDRY | 12/07/1999 |
| Cs134 | ND | | 3.1e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 5.46e-01 | 2.3e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.6e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 2.48e+01 | 4.7e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 1.13e+00 | 3.7e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 8.02e-01 | 3.3e-02 | | PCI/GDRY | 12/07/1999 |
| Ra224 | 8.40e-01 | 3.6e-01 | | PCI/GDRY | 12/07/1999 |
| Ra226 | * 1.94e+00 | 3.4e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 1.02e+00 | 4.7e-02 | | PCI/GDRY | 12/07/1999 |
| Th234 | * 5.50e-01 | 3.1e-01 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 3.76e-01 | 1.9e-02 | | PCI/GDRY | 12/07/1999 |

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
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 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07324B | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003527R |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 4.930e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/04/2000 12:57 | 1000.0 | GE08 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 4.5e-01 | PCI/GDRY | 12/07/1999 |
| Bi212 | 8.54e-01 | 2.3e-01 | | PCI/GDRY | 12/07/1999 |
| Bi214 | 7.79e-01 | 3.6e-02 | | PCI/GDRY | 12/07/1999 |
| Co60 | ND | | 3.5e-02 | PCI/GDRY | 12/07/1999 |
| Cs137 | 4.11e-01 | 2.2e-02 | | PCI/GDRY | 12/07/1999 |
| I131 | ND | | 2.9e-01 | PCI/GDRY | 12/07/1999 |
| K40 | 2.06e+01 | 4.3e-01 | | PCI/GDRY | 12/07/1999 |
| Pb212 | 1.16e+00 | 4.0e-02 | | PCI/GDRY | 12/07/1999 |
| Pb214 | 9.35e-01 | 3.8e-02 | | PCI/GDRY | 12/07/1999 |
| Ra224 | 1.21e+00 | 4.5e-01 | | PCI/GDRY | 12/07/1999 |
| Ra226 * | 2.09e+00 | 3.7e-01 | | PCI/GDRY | 12/07/1999 |
| Ra228 | 9.09e-01 | 5.0e-02 | | PCI/GDRY | 12/07/1999 |
| Th234 * | 1.28e+00 | 1.7e-01 | | PCI/GDRY | 12/07/1999 |
| Tl208 | 3.44e-01 | 2.1e-02 | | PCI/GDRY | 12/07/1999 |

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U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07325C | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003538V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 6.370e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/05/2000 13:36 | 1000.0 | GE06 | MHW |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 2.0e-01 | PCI/GDRY | 12/13/1999 |
| Bi212 | 6.15e-01 | 1.1e-01 | | PCI/GDRY | 12/13/1999 |
| Bi214 | 6.60e-01 | 2.3e-02 | | PCI/GDRY | 12/13/1999 |
| Co60 | ND | | 2.2e-02 | PCI/GDRY | 12/13/1999 |
| Cs137 | 3.46e-02 | 1.1e-02 | | PCI/GDRY | 12/13/1999 |
| I131 | ND | | 1.2e-01 | PCI/GDRY | 12/13/1999 |
| K40 | 1.49e+01 | 2.7e-01 | | PCI/GDRY | 12/13/1999 |
| Pb212 | 6.90e-01 | 2.4e-02 | | PCI/GDRY | 12/13/1999 |
| Pb214 | 7.35e-01 | 2.3e-02 | | PCI/GDRY | 12/13/1999 |
| Ra224 | 5.90e-01 | 2.3e-01 | | PCI/GDRY | 12/13/1999 |
| Ra226 * | 1.50e+00 | 2.4e-01 | | PCI/GDRY | 12/13/1999 |
| Ra228 | 6.01e-01 | 2.9e-02 | | PCI/GDRY | 12/13/1999 |
| Tl208 | 2.16e-01 | 1.2e-02 | | PCI/GDRY | 12/13/1999 |
| U235 * | 9.05e-02 | 1.4e-02 | | PCI/GDRY | 12/13/1999 |

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**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07326D | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003538V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 6.390e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/05/2000 13:36 | 1000.0 | GE07 | MHW |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 2.6e-01 | PCI/GDRY | 12/13/1999 |
| Bi212 | 1.11e+00 | 1.6e-01 | | PCI/GDRY | 12/13/1999 |
| Bi214 | 9.25e-01 | 3.0e-02 | | PCI/GDRY | 12/13/1999 |
| Co60 | ND | | 2.6e-02 | PCI/GDRY | 12/13/1999 |
| Cs137 | 2.89e-01 | 1.5e-02 | | PCI/GDRY | 12/13/1999 |
| I131 | ND | | 1.4e-01 | PCI/GDRY | 12/13/1999 |
| K40 | 3.07e+01 | 4.1e-01 | | PCI/GDRY | 12/13/1999 |
| Pb212 | 1.31e+00 | 3.1e-02 | | PCI/GDRY | 12/13/1999 |
| Pb214 | 1.02e+00 | 2.9e-02 | | PCI/GDRY | 12/13/1999 |
| Ra224 | 7.40e-01 | 3.0e-01 | | PCI/GDRY | 12/13/1999 |
| Ra226 * | 2.17e+00 | 3.0e-01 | | PCI/GDRY | 12/13/1999 |
| Ra228 | 1.20e+00 | 4.1e-02 | | PCI/GDRY | 12/13/1999 |
| Th234 * | 9.14e-01 | 2.8e-01 | | PCI/GDRY | 12/13/1999 |
| Tl208 | 4.07e-01 | 1.7e-02 | | PCI/GDRY | 12/13/1999 |

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U.S. ENVIRONMENTAL PROTECTION AGENCY
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 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07327E | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003538V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.740e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/05/2000 13:36 | 1000.0 | GE08 | MHW |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|------------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 3.4e-01 | PCI/GDRY | 12/13/1999 |
| Bi212 | 1.17e+00 | 1.9e-01 | | PCI/GDRY | 12/13/1999 |
| Bi214 | 8.84e-01 | 3.5e-02 | | PCI/GDRY | 12/13/1999 |
| Co60 | ND | | 3.3e-02 | PCI/GDRY | 12/13/1999 |
| Cs137 | 1.64e-02 | 1.1e-02 | | PCI/GDRY | 12/13/1999 |
| I131 | ND | | 1.8e-01 | PCI/GDRY | 12/13/1999 |
| K40 | 2.49e+01 | 4.2e-01 | | PCI/GDRY | 12/13/1999 |
| Pb212 | 1.31e+00 | 3.6e-02 | | PCI/GDRY | 12/13/1999 |
| Pb214 | 1.04e+00 | 3.4e-02 | | PCI/GDRY | 12/13/1999 |
| Ra223 | 7.78e-02 | 7.4e-02 | | PCI/GDRY | 12/13/1999 |
| Ra224 | 1.13e+00 | 3.8e-01 | | PCI/GDRY | 12/13/1999 |
| Ra226 | * 2.66e+00 | 3.7e-01 | | PCI/GDRY | 12/13/1999 |
| Ra228 | 1.09e+00 | 4.7e-02 | | PCI/GDRY | 12/13/1999 |
| Th234 | * 1.23e+00 | 1.8e-01 | | PCI/GDRY | 12/13/1999 |
| Tl202 | 5.86e-02 | 4.8e-02 | | PCI/GDRY | 12/13/1999 |
| Tl208 | 3.93e-01 | 1.8e-02 | | PCI/GDRY | 12/13/1999 |
| U235 | * 1.59e-01 | 2.2e-02 | | PCI/GDRY | 12/13/1999 |

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 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07328F | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003538V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 4.320e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/05/2000 13:37 | 300.0 | GE14 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|------------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 3.8e-01 | PCI/GDRY | 12/13/1999 |
| Bi212 | 8.19e-01 | 2.0e-01 | | PCI/GDRY | 12/13/1999 |
| Bi214 | 7.10e-01 | 3.7e-02 | | PCI/GDRY | 12/13/1999 |
| Co60 | ND | | 3.4e-02 | PCI/GDRY | 12/13/1999 |
| Cs134 | ND | | 6.2e-02 | PCI/GDRY | 12/13/1999 |
| Cs137 | 1.25e-01 | 1.8e-02 | | PCI/GDRY | 12/13/1999 |
| I131 | ND | | 2.4e-01 | PCI/GDRY | 12/13/1999 |
| K40 | 2.28e+01 | 4.2e-01 | | PCI/GDRY | 12/13/1999 |
| Pb212 | 1.15e+00 | 5.1e-02 | | PCI/GDRY | 12/13/1999 |
| Pb214 | 7.19e-01 | 4.2e-02 | | PCI/GDRY | 12/13/1999 |
| Ra226 | * 1.57e+00 | 4.9e-01 | | PCI/GDRY | 12/13/1999 |
| Ra228 | 9.15e-01 | 5.5e-02 | | PCI/GDRY | 12/13/1999 |
| Tl208 | 2.70e-01 | 1.9e-02 | | PCI/GDRY | 12/13/1999 |

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07329G | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003538V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.160e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/05/2000 13:37 | 1000.0 | GE10 | MHW |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 2.5e-01 | PCI/GDRY | 12/13/1999 |
| Bi212 | 8.73e-01 | 1.5e-01 | | PCI/GDRY | 12/13/1999 |
| Bi214 | 7.91e-01 | 2.9e-02 | | PCI/GDRY | 12/13/1999 |
| Co60 | ND | | 2.5e-02 | PCI/GDRY | 12/13/1999 |
| Cs137 | 5.90e-01 | 1.9e-02 | | PCI/GDRY | 12/13/1999 |
| 1131 | ND | | 1.4e-01 | PCI/GDRY | 12/13/1999 |
| K40 | 1.94e+01 | 3.4e-01 | | PCI/GDRY | 12/13/1999 |
| Pb212 | 9.92e-01 | 2.9e-02 | | PCI/GDRY | 12/13/1999 |
| Pb214 | 8.97e-01 | 2.8e-02 | | PCI/GDRY | 12/13/1999 |
| Ra224 | 6.74e-01 | 2.9e-01 | | PCI/GDRY | 12/13/1999 |
| Ra226 * | 1.91e+00 | 2.7e-01 | | PCI/GDRY | 12/13/1999 |
| Ra228 | 8.59e-01 | 3.8e-02 | | PCI/GDRY | 12/13/1999 |
| Tl208 | 3.20e-01 | 1.6e-02 | | PCI/GDRY | 12/13/1999 |

* An asterisk indicates a result whose value may be significantly over or underestimated.

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07330Z | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003538V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 4.460e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/05/2000 18:40 | 300.0 | GE14 | KNG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|------------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 3.9e-01 | PCI/GDRY | 12/13/1999 |
| Bi212 | 8.35e-01 | 1.8e-01 | | PCI/GDRY | 12/13/1999 |
| Bi214 | 7.86e-01 | 3.8e-02 | | PCI/GDRY | 12/13/1999 |
| Co60 | ND | | 3.3e-02 | PCI/GDRY | 12/13/1999 |
| Cs134 | ND | | 6.2e-02 | PCI/GDRY | 12/13/1999 |
| Cs137 | 6.35e-01 | 2.6e-02 | | PCI/GDRY | 12/13/1999 |
| I131 | ND | | 2.6e-01 | PCI/GDRY | 12/13/1999 |
| K40 | 2.37e+01 | 4.2e-01 | | PCI/GDRY | 12/13/1999 |
| Pb212 | 1.26e+00 | 5.1e-02 | | PCI/GDRY | 12/13/1999 |
| Pb214 | 7.64e-01 | 4.1e-02 | | PCI/GDRY | 12/13/1999 |
| Ra226 | * 2.45e+00 | 4.9e-01 | | PCI/GDRY | 12/13/1999 |
| Ra228 | 8.45e-01 | 4.9e-02 | | PCI/GDRY | 12/13/1999 |
| Tl208 | 2.99e-01 | 2.0e-02 | | PCI/GDRY | 12/13/1999 |

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07331A | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003538V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.190e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/05/2000 13:37 | 1000.0 | GE11 | MHW |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|------------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 2.2e-01 | PCI/GDRY | 12/13/1999 |
| Bi212 | 9.66e-01 | 1.2e-01 | | PCI/GDRY | 12/13/1999 |
| Bi214 | 7.94e-01 | 2.4e-02 | | PCI/GDRY | 12/13/1999 |
| Co60 | ND | | 1.9e-02 | PCI/GDRY | 12/13/1999 |
| Cs137 | 3.53e-01 | 1.4e-02 | | PCI/GDRY | 12/13/1999 |
| I131 | ND | | 1.1e-01 | PCI/GDRY | 12/13/1999 |
| K40 | 2.07e+01 | 3.0e-01 | | PCI/GDRY | 12/13/1999 |
| Pa234m | * 1.78e+00 | 1.0e+00 | | PCI/GDRY | 12/13/1999 |
| Pb212 | 9.79e-01 | 2.5e-02 | | PCI/GDRY | 12/13/1999 |
| Pb214 | 8.88e-01 | 2.3e-02 | | PCI/GDRY | 12/13/1999 |
| Ra224 | 9.02e-01 | 2.3e-01 | | PCI/GDRY | 12/13/1999 |
| Ra226 | * 2.30e+00 | 2.5e-01 | | PCI/GDRY | 12/13/1999 |
| Ra228 | 8.70e-01 | 3.2e-02 | | PCI/GDRY | 12/13/1999 |
| Th234 | * 1.25e+00 | 1.9e-01 | | PCI/GDRY | 12/13/1999 |
| Tl208 | 3.02e-01 | 1.3e-02 | | PCI/GDRY | 12/13/1999 |
| U235 | * 1.38e-01 | 1.5e-02 | | PCI/GDRY | 12/13/1999 |

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07332B | QC batch #: | 0001323M |
| Matrix: | SOIL | Prep batch #: | 0003538V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 5.420e+02 GDRY | Analysis procedure: | GAMMA |
| Dry/wet weight: | N/A | Analyst: | N/A |
| Ash/dry weight: | N/A | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/05/2000 13:37 | 1000.0 | GE12 | MHW |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Ba140 | ND | | 2.9e-01 | PCI/GDRY | 12/13/1999 |
| Bi212 | 7.88e-01 | 1.6e-01 | | PCI/GDRY | 12/13/1999 |
| Bi214 | 7.65e-01 | 3.0e-02 | | PCI/GDRY | 12/13/1999 |
| Co60 | ND | | 2.9e-02 | PCI/GDRY | 12/13/1999 |
| Cs137 | 1.20e-01 | 1.3e-02 | | PCI/GDRY | 12/13/1999 |
| I131 | ND | | 1.7e-01 | PCI/GDRY | 12/13/1999 |
| K40 | 2.07e+01 | 3.5e-01 | | PCI/GDRY | 12/13/1999 |
| Pb212 | 8.85e-01 | 3.0e-02 | | PCI/GDRY | 12/13/1999 |
| Pb214 | 8.48e-01 | 2.9e-02 | | PCI/GDRY | 12/13/1999 |
| Ra224 | 5.52e-01 | 3.0e-01 | | PCI/GDRY | 12/13/1999 |
| Ra226 * | 1.81e+00 | 3.1e-01 | | PCI/GDRY | 12/13/1999 |
| Ra228 | 8.19e-01 | 4.1e-02 | | PCI/GDRY | 12/13/1999 |
| Tl208 | 2.87e-01 | 1.6e-02 | | PCI/GDRY | 12/13/1999 |

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 GAMMA ANALYSES
 SDG #9900096

QC BATCH SUMMARY

QC batch #: 0001323M
 Preparation procedure: N/A
 Analysis procedure: GAMMA

| NAREL Sample # | QC Type | Yield (%) | $\pm 2\sigma$ Uncertainty (%) | Analyst |
|----------------|---------|-----------|-------------------------------|---------|
| 99.07313Y | | N/A | | N/A |
| 99.07314Z | | N/A | | N/A |
| 99.07315A | | N/A | | N/A |
| 99.07316B | | N/A | | N/A |
| 99.07317C | | N/A | | N/A |
| 99.07318D | | N/A | | N/A |
| 99.07319E | | N/A | | N/A |
| 99.07320X | | N/A | | N/A |
| 99.07320X | DUP | N/A | | N/A |
| 99.07321Y | | N/A | | N/A |
| 99.07322Z | | N/A | | N/A |
| 99.07323A | | N/A | | N/A |
| 99.07324B | | N/A | | N/A |
| 99.07325C | | N/A | | N/A |
| 99.07326D | | N/A | | N/A |
| 99.07327E | | N/A | | N/A |
| 99.07328F | | N/A | | N/A |
| 99.07329G | | N/A | | N/A |
| 99.07330Z | | N/A | | N/A |
| 99.07331A | | N/A | | N/A |
| 99.07332B | | N/A | | N/A |

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

National Air and Radiation Environmental Laboratory
QC Batch Report

QC Batch #: 0001323M

Analytical Procedure: GAMMA

LABORATORY DUPLICATES (PCI/GDRY)

| Sample ID | Nuclide | Original $\pm 2\sigma$ | Duplicate $\pm 2\sigma$ | RPD | Z |
|-----------|---------|------------------------|-------------------------|-------|----------|
| 99.07320X | BA140 | | | | |
| 99.07320X | BI212 | 5.90e-01 \pm 1.2e-01 | 6.01e-01 \pm 1.9e-01 | 1.85 | 0.09 OK |
| 99.07320X | BI214 | 5.64e-01 \pm 2.5e-02 | 6.14e-01 \pm 3.1e-02 | 8.49 | 1.08 OK |
| 99.07320X | CO60 | | | | |
| 99.07320X | CS137 | 1.67e-01 \pm 1.2e-02 | 1.53e-01 \pm 1.6e-02 | 8.75 | -0.92 OK |
| 99.07320X | I131 | | | | |
| 99.07320X | K40 | 1.45e+01 \pm 3.1e-01 | 1.41e+01 \pm 4.3e-01 | 2.80 | -0.38 OK |
| 99.07320X | PB212 | 6.83e-01 \pm 2.5e-02 | 6.52e-01 \pm 2.7e-02 | 4.64 | -0.61 OK |
| 99.07320X | PB214 | 6.09e-01 \pm 2.4e-02 | 6.62e-01 \pm 2.7e-02 | 8.34 | 1.09 OK |
| 99.07320X | RA224 | 5.21e-01 \pm 2.4e-01 | 3.42e-01 \pm 2.7e-01 | 41.48 | -0.97 OK |
| 99.07320X | RA228 | 5.78e-01 \pm 3.3e-02 | 5.79e-01 \pm 4.3e-02 | 0.17 | 0.02 OK |
| 99.07320X | TL208 | 2.02e-01 \pm 1.3e-02 | 2.12e-01 \pm 1.7e-02 | 4.83 | 0.56 OK |

Analyst: N/A

QA Officer: *Kim McLean* 1/6/2000



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION AND INDOOR AIR
National Air and Radiation Environmental Laboratory
540 South Morris Avenue, Montgomery, AL 36115-2601
(334) 270-3400

January 20, 2000

MEMORANDUM

SUBJECT: Radiochemical Results for
Seneca Army Depot Samples

FROM: John Griggs, Chief *John Griggs*
Monitoring and Analytical Services Branch

TO: Eric Simpson, Coordinator
Radiation Monitoring and Analytical Programs
Region 2

Attached is a data package for plutonium analysis of soil samples collected from the Seneca Army Depot site in Romulus, NY. The samples constitute NAREL batch number 9900096.

Radiochemical analyses usually require the subtraction of an instrument background measurement from a gross sample measurement. Both values are positive, but when the sample activity is low, random variations in the two measurements can cause the gross value to be less than the background, resulting in a measured activity less than zero. Although negative activities have no physical significance, they do have statistical significance, as for example in the evaluation of trends or the comparison of two groups of samples.

For all analyses except gamma spectroscopy, it is the policy of NAREL to report results as generated, whether positive, negative, or zero, together with the 2-sigma measurement uncertainty and a sample-specific estimate of the minimum detectable concentration (MDC). The activity, uncertainty, and MDC are given in the same units. The activity and 2-sigma uncertainty for a radionuclide measured by gamma spectroscopy are reported only if the nuclide is detected; so, the results of gamma analyses are never zero or negative. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Cs-137, I-131, K-40, Ra-226, and Ra-228. If one of these six nuclides is undetected, NAREL reports it as "Not Detected," or "ND," and provides a sample-specific estimate of the MDC.

Specific information concerning all aspects of the radiological analysis of the samples is contained in the batch case narrative of the data package. If you have any questions concerning the analytical results, please contact me at (334)270-3450.

Attachments

cc: Paul Giardina, Region 2, w/o attachments
Mary Clark, (6601J), w/o attachments
Ed Sensintaffar, NAREL

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES**

REPORT OF SAMPLE DELIVERY GROUP #9900096

Project: SENECA ARMY DEPOT
Analysis Procedure: Plutonium
Date Reported: 01/19/2000

SAMPLES

| NAREL Sample # | Client Sample ID | Type | Matrix | Date Collected | Date Received |
|----------------|------------------|------|--------|----------------|---------------|
| 99.07313Y | SS12-9 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07314Z | SS12-2 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07315A | SS12-13 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07316B | SS12-14 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07317C | EPA12-1 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07318D | EPA12-2 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07319E | EPA12-3 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07320X | EPA12-4 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07321Y | EPA12-5 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07322Z | EPA12-9 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07323A | EPA12-11 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07324B | EPA12-12 | SAM | SOIL | 12/07/1999 | 12/09/1999 |
| 99.07325C | EPA12-6 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07326D | EPA12-7 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07327E | EPA12-8 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07328F | EPA12-10 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07329G | EPA12-13 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07330Z | EPA12-14 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07331A | EPA12-15 | SAM | SOIL | 12/13/1999 | 12/15/1999 |
| 99.07332B | EPA12-16 | SAM | SOIL | 12/13/1999 | 12/15/1999 |

EXCEPTIONS

1. Packaging and Shipping - No problems were observed.
2. Documentation - No problems were observed.
3. Sample Preparation - No problems were encountered.
4. Analysis - NAREL sample 99.7329 is being recounted due to the Pu-238 result of the original count.
5. Holding Times - All holding times were met.

QUALITY CONTROL

1. QC samples - All QC analysis results met NAREL acceptance criteria.
2. Yields - All chemical yields were within acceptance limits.
3. Instruments - Response and background checks for all instruments used in these analyses met NAREL acceptance criteria.

CERTIFICATION

I certify that this data report complies with the terms and conditions of the Quality Assurance Project Plan, except as noted above. Release of the data contained in this report has been authorized by the Chief of the Monitoring and Analytical Services Branch and the NAREL Quality Assurance Coordinator, or their designees, as verified by the following signatures.

 _____ 1/20/00
James B. Moore Date
Quality Assurance Coordinator

 _____ 1/20/00
John Griggs, Ph.D. Date
Chief, Monitoring and Analytical Services Branch

GENERAL INFORMATION

SAMPLE TYPES

| | |
|-----|---------------------|
| BLD | Blind sample |
| DBD | Double blind sample |
| FBK | Field blank |
| SAM | Normal sample |

ANALYSIS QC TYPES

| | |
|-----|---|
| ANA | Normal analysis |
| DUP | Laboratory duplicate |
| LCS | Laboratory control sample (blank spike) |
| MS | Matrix spike |
| MSD | Matrix spike duplicate |
| RBK | Reagent blank |

QUALITY INDICATORS

| | |
|-----|---|
| RPD | Relative Percent Difference |
| %R | Percent Recovery |
| Z | Number of standard deviations by which a QC measurement differs from the expected value |

EVALUATION OF QC ANALYSES

A reagent blank result is considered unacceptable if it is more than 3 standard deviations below zero or more than 3 standard deviations above a predetermined upper control limit. For some analyses NAREL has set the upper control limit at zero. For others the control limit is a small positive number.

NAREL evaluates the results of duplicate and spike analyses using "Z scores." A Z score is the number of standard deviations by which the QC result differs from its ideal value. The score is considered acceptable if its absolute value is not greater than 3.

The Z score for a spiked sample is computed by dividing the difference between the measured value and the target value by the combined standard uncertainty of the difference.

The Z score for a duplicate analysis is computed by dividing the difference between the two measured values by the combined standard uncertainty of the difference. When the precision of paired MS/MSD analyses is evaluated, the native sample activity is subtracted from each measured value and the net concentrations are then converted to total activities before the Z score is computed.

Each standard uncertainty used to compute a Z score includes an additional fixed term to represent sources of measurement error other than counting error. This additional term is not used in the evaluation of reagent blanks.

NAREL reports the "relative percent difference," or RPD, between duplicate results and the "percent recovery," or %R, for spiked analyses, but does not use these values for evaluation.

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096**

ANALYSIS SUMMARY

Analysis Procedure: PU
Title: Plutonium

| NAREL Sample # | QC Type | Preparation Procedure | Date Completed | Prep Batch # | QC Batch # |
|-----------------|---------|-----------------------|----------------|--------------|------------|
| 99.07313Y | | N/A | 01/11/2000 | 0003560T | 0001332N |
| 99.07313Y | DUP | N/A | 01/11/2000 | 0003560T | 0001332N |
| 99.07314Z | | N/A | 01/11/2000 | 0003560T | 0001332N |
| 99.07314Z | MS | N/A | 01/11/2000 | 0003560T | 0001332N |
| 99.07314Z | MSD | N/A | 01/11/2000 | 0003560T | 0001332N |
| 99.07315A | | N/A | 01/11/2000 | 0003560T | 0001332N |
| 99.07316B | | N/A | 01/12/2000 | 0003562V | 0001332N |
| 99.07317C | | N/A | 01/12/2000 | 0003562V | 0001332N |
| 99.07318D | | N/A | 01/12/2000 | 0003562V | 0001332N |
| 99.07319E | | N/A | 01/12/2000 | 0003562V | 0001332N |
| 99.07320X | | N/A | 01/12/2000 | 0003562V | 0001332N |
| 99.07321Y | | N/A | 01/12/2000 | 0003562V | 0001332N |
| 99.07322Z | | N/A | 01/12/2000 | 0003562V | 0001332N |
| 99.07323A | | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07324B | | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07324B | DUP | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07325C | | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07326D | | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07327E | | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07327E | MS | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07327E | MSD | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07328F | | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07329G | | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07330Z | | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07331A | | N/A | 01/19/2000 | 0003564X | 0001333P |
| 99.07332B | | N/A | 01/19/2000 | 0003564X | 0001333P |
| RBK-00403020U * | RBK | N/A | 01/11/2000 | 0003560T | 0001332N |
| RBK-00403029D * | RBK | N/A | 01/19/2000 | 0003564X | 0001333P |

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 PU ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07313Y | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003560T |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 3.628e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 68.91 % | Analyst: | SPK |
| Ash/dry weight: | 92.20 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/10/2000 15:53 | 1000.0 | AS01 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -3.85e-03 | 3.6e-02 | 7.8e-02 | PCI/GDRY | 01/10/2000 |
| Pu239 | 2.69e-02 | 2.6e-02 | 3.0e-02 | PCI/GDRY | 01/10/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07313Y | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003560T |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 4.419e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 68.91 % | Analyst: | SPK |
| Ash/dry weight: | 92.20 % | QC type: | DUP |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/10/2000 15:53 | 1000.0 | AS03 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -5.99e-03 | 2.9e-02 | 6.8e-02 | PCI/GDRY | 01/10/2000 |
| Pu239 | 9.16e-03 | 1.6e-02 | 2.9e-02 | PCI/GDRY | 01/10/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 PU ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07314Z | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003560T |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.553e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 79.23 % | Analyst: | SPK |
| Ash/dry weight: | 94.80 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/10/2000 15:53 | 1000.0 | AS04 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 2.87e-02 | 4.0e-02 | 6.5e-02 | PCI/GDRY | 01/10/2000 |
| Pu239 | 1.28e-02 | 2.9e-02 | 5.8e-02 | PCI/GDRY | 01/10/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07314Z | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003560T |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.512e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 79.23 % | Analyst: | SPK |
| Ash/dry weight: | 94.80 % | QC type: | MS |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/10/2000 15:53 | 1000.0 | AS05 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -5.46e-02 | 4.0e-02 | 1.2e-01 | PCI/GDRY | 01/10/2000 |
| Pu239 | 5.02e+00 | 5.8e-01 | 7.2e-02 | PCI/GDRY | 01/10/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07314Z | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003560T |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.542e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 79.23 % | Analyst: | SPK |
| Ash/dry weight: | 94.80 % | QC type: | MSD |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/10/2000 15:53 | 1000.0 | AS06 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -2.06e-02 | 6.6e-02 | 1.4e-01 | PCI/GDRY | 01/10/2000 |
| Pu239 | 4.76e+00 | 5.5e-01 | 6.0e-02 | PCI/GDRY | 01/10/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 PU ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07315A | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003560T |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 3.577e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 70.32 % | Analyst: | SPK |
| Ash/dry weight: | 92.80 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/10/2000 15:53 | 1000.0 | AS07 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 8.56e-03 | 1.9e-02 | 3.9e-02 | PCI/GDRY | 01/10/2000 |
| Pu239 | 1.28e-02 | 1.8e-02 | 1.9e-02 | PCI/GDRY | 01/10/2000 |

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07316B | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003562V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 3.586e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 74.10 % | Analyst: | SPK |
| Ash/dry weight: | 91.20 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/11/2000 16:54 | 1000.0 | AS01 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | 1.55e-02 | 4.7e-02 | 9.0e-02 | PCI/GDRY | 01/11/2000 |
| Pu239 | -2.21e-03 | 4.4e-03 | 3.4e-02 | PCI/GDRY | 01/11/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
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PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07317C | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003562V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.946e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 83.12 % | Analyst: | SPK |
| Ash/dry weight: | 96.40 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/11/2000 16:54 | 1000.0 | AS03 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -8.63e-03 | 4.2e-02 | 9.8e-02 | PCI/GDRY | 01/11/2000 |
| Pu239 | 1.32e-02 | 2.3e-02 | 4.1e-02 | PCI/GDRY | 01/11/2000 |

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07318D | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003562V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 3.033e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 62.13 % | Analyst: | SPK |
| Ash/dry weight: | 86.80 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/11/2000 16:54 | 1000.0 | AS04 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 1.43e-02 | 2.6e-02 | 4.9e-02 | PCI/GDRY | 01/11/2000 |
| Pu239 | 5.24e-02 | 4.1e-02 | 4.4e-02 | PCI/GDRY | 01/11/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
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PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07319E | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003562V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.663e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 81.44 % | Analyst: | SPK |
| Ash/dry weight: | 93.60 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/11/2000 16:54 | 1000.0 | AS05 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -8.66e-03 | 5.4e-02 | 1.2e-01 | PCI/GDRY | 01/11/2000 |
| Pu239 | 2.89e-03 | 2.8e-02 | 6.8e-02 | PCI/GDRY | 01/11/2000 |

**U.S. ENVIRONMENTAL PROTECTION AGENCY
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PU ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07320X | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003562V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 3.014e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 79.71 % | Analyst: | SPK |
| Ash/dry weight: | 94.20 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/11/2000 16:54 | 1000.0 | AS06 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -4.73e-02 | 4.8e-02 | 1.2e-01 | PCI/GDRY | 01/11/2000 |
| Pu239 | 7.46e-03 | 2.3e-02 | 5.1e-02 | PCI/GDRY | 01/11/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
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PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07321Y | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003562V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 3.250e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 85.57 % | Analyst: | SPK |
| Ash/dry weight: | 95.20 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/11/2000 16:54 | 1000.0 | AS07 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 9.11e-03 | 2.0e-02 | 4.2e-02 | PCI/GDRY | 01/11/2000 |
| Pu239 | 6.83e-03 | 1.4e-02 | 2.0e-02 | PCI/GDRY | 01/11/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07322Z | QC batch #: | 0001332N |
| Matrix: | SOIL | Prep batch #: | 0003562V |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.590e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 83.78 % | Analyst: | SPK |
| Ash/dry weight: | 94.00 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/11/2000 16:54 | 1000.0 | AS08 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 7.71e-03 | 5.0e-02 | 1.0e-01 | PCI/GDRY | 01/11/2000 |
| Pu239 | 7.20e-02 | 5.0e-02 | 4.7e-02 | PCI/GDRY | 01/11/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 PU ANALYSES
 SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07323A | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.526e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 65.79 % | Analyst: | AS |
| Ash/dry weight: | 86.80 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:40 | 1038.0 | AS02 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -3.32e-03 | 5.9e-02 | 1.2e-01 | PCI/GDRY | 01/18/2000 |
| Pu239 | 3.72e-02 | 3.8e-02 | 5.5e-02 | PCI/GDRY | 01/18/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07324B | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.532e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 74.83 % | Analyst: | AS |
| Ash/dry weight: | 90.40 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1037.4 | AS03 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 3.94e-03 | 4.4e-02 | 9.2e-02 | PCI/GDRY | 01/18/2000 |
| Pu239 | 6.15e-03 | 2.8e-02 | 6.2e-02 | PCI/GDRY | 01/18/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07324B | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.517e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 74.83 % | Analyst: | AS |
| Ash/dry weight: | 90.40 % | QC type: | DUP |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1036.9 | AS04 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 1.18e-02 | 2.8e-02 | 5.7e-02 | PCI/GDRY | 01/18/2000 |
| Pu239 | 0.00e+00 | 0.0e+00 | 2.8e-02 | PCI/GDRY | 01/18/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07325C | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.556e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 93.26 % | Analyst: | AS |
| Ash/dry weight: | 94.80 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1036.3 | AS05 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | 6.18e-03 | 5.6e-02 | 1.1e-01 | PCI/GDRY | 01/18/2000 |
| Pu239 | -1.22e-02 | 2.2e-02 | 7.3e-02 | PCI/GDRY | 01/18/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07326D | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.513e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 87.69 % | Analyst: | AS |
| Ash/dry weight: | 92.80 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1035.8 | AS06 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | ± 2σ Uncertainty | MDC | Unit | Date |
|---------|----------|------------------|---------|----------|------------|
| Pu238 | 2.36e-02 | 6.8e-02 | 1.3e-01 | PCI/GDRY | 01/18/2000 |
| Pu239 | 1.93e-02 | 3.8e-02 | 7.1e-02 | PCI/GDRY | 01/18/2000 |

**U.S. ENVIRONMENTAL PROTECTION AGENCY
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SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07327E | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.504e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 89.18 % | Analyst: | AS |
| Ash/dry weight: | 97.60 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1035.5 | AS07 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -5.69e-04 | 1.8e-02 | 5.4e-02 | PCI/GDRY | 01/18/2000 |
| Pu239 | 8.48e-03 | 2.4e-02 | 5.1e-02 | PCI/GDRY | 01/18/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07327E | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.525e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 89.18 % | Analyst: | AS |
| Ash/dry weight: | 97.60 % | QC type: | MS |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1034.6 | AS08 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -8.27e-04 | 5.2e-02 | 1.0e-01 | PCI/GDRY | 01/18/2000 |
| Pu239 | 6.55e+00 | 6.1e-01 | 4.9e-02 | PCI/GDRY | 01/18/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07327E | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.505e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 89.18 % | Analyst: | AS |
| Ash/dry weight: | 97.60 % | QC type: | MSD |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1033.9 | AS09 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 1.22e-02 | 7.2e-02 | 1.4e-01 | PCI/GDRY | 01/18/2000 |
| Pu239 | 7.16e+00 | 8.1e-01 | 3.2e-02 | PCI/GDRY | 01/18/2000 |

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07328F | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.528e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 80.99 % | Analyst: | AS |
| Ash/dry weight: | 94.80 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1024.9 | AS10 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | 1.40e-02 | 6.0e-02 | 1.1e-01 | PCI/GDRY | 01/18/2000 |
| Pu239 | -3.04e-03 | 1.8e-02 | 5.7e-02 | PCI/GDRY | 01/18/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07329G | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.513e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 77.56 % | Analyst: | AS |
| Ash/dry weight: | 93.00 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1031.9 | AS11 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 5.98e-02 | 4.4e-02 | 4.5e-02 | PCI/GDRY | 01/18/2000 |
| Pu239 | 2.63e-02 | 2.9e-02 | 3.8e-02 | PCI/GDRY | 01/18/2000 |

*factive plume - 238 and 239 Pu are measured by NRC -
 as a non-detect (actually, a negative value per analysis).*

- ejs

Comment? y'hoif

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07330Z | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.531e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 58.25 % | Analyst: | AS |
| Ash/dry weight: | 85.00 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:41 | 1032.3 | AS12 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 2.89e-02 | 5.3e-02 | 9.4e-02 | PCI/GDRY | 01/18/2000 |
| Pu239 | 8.25e-02 | 5.1e-02 | 4.8e-02 | PCI/GDRY | 01/18/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07331A | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.528e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 73.46 % | Analyst: | AS |
| Ash/dry weight: | 92.20 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:42 | 1031.3 | AS17 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|----------|------------|
| Pu238 | -4.17e-02 | 5.4e-02 | 1.3e-01 | PCI/GDRY | 01/18/2000 |
| Pu239 | 2.17e-02 | 3.7e-02 | 6.6e-02 | PCI/GDRY | 01/18/2000 |

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

| | | | |
|------------------|----------------|---------------------|----------|
| Sample #: | 99.07332B | QC batch #: | 0001333P |
| Matrix: | SOIL | Prep batch #: | 0003564X |
| Sample type: | SAM | Prep procedure: | N/A |
| Amount analyzed: | 2.510e-01 GASH | Analysis procedure: | PU |
| Dry/wet weight: | 85.63 % | Analyst: | AS |
| Ash/dry weight: | 96.40 % | QC type: | ANA |
| Comment: | 0"-2" | | |

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:42 | 1030.7 | AS18 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|----------|------------|
| Pu238 | 7.99e-04 | 3.6e-02 | 8.1e-02 | PCI/GDRY | 01/18/2000 |
| Pu239 | 1.27e-02 | 2.2e-02 | 4.1e-02 | PCI/GDRY | 01/18/2000 |

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

QC Sample #: RBK-00403020U

QC batch #: 0001332N
Prep batch #: 0003560T
Prep procedure: N/A
Analysis procedure: PU
Analyst: SPK
QC type: RBK

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/10/2000 15:53 | 1000.0 | AS08 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|----------|---------------------------|---------|------|------------|
| Pu238 | 2.48e-03 | 1.6e-02 | 3.2e-02 | PCI | 01/10/2000 |
| Pu239 | 3.31e-03 | 7.4e-03 | 1.5e-02 | PCI | 01/10/2000 |

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096**

SAMPLE ANALYSIS REPORT

QC Sample #: RBK-00403029D

QC batch #: 0001333P
Prep batch #: 0003564X
Prep procedure: N/A
Analysis procedure: PU
Analyst: AS
QC type: RBK

COUNTING INFORMATION

| Date and time | Duration (min) | Detector ID | Operator |
|------------------|----------------|-------------|----------|
| 01/18/2000 15:42 | 1030.2 | AS19 | DPG |

ANALYTICAL RESULTS

| Analyte | Activity | $\pm 2\sigma$ Uncertainty | MDC | Unit | Date |
|---------|-----------|---------------------------|---------|------|------------|
| Pu238 | 4.06e-03 | 2.1e-02 | 4.1e-02 | PCI | 01/18/2000 |
| Pu239 | -9.42e-04 | 5.5e-03 | 1.7e-02 | PCI | 01/18/2000 |

U.S. ENVIRONMENTAL PROTECTION AGENCY
 NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
 PU ANALYSES
 SDG #9900096

QC BATCH SUMMARY

QC batch #: 0001332N
 Preparation procedure: N/A
 Analysis procedure: PU

| NAREL Sample # | QC Type | Yield (%) | $\pm 2\sigma$ Uncertainty (%) | Analyst |
|-----------------|---------|-----------|-------------------------------|---------|
| 99.07313Y | | 84.94 % | 6.50 % | SPK |
| 99.07313Y | DUP | 74.92 % | 6.09 % | SPK |
| 99.07314Z | | 75.38 % | 6.07 % | SPK |
| 99.07314Z | MS | 78.92 % | 6.18 % | SPK |
| 99.07314Z | MSD | 82.55 % | 6.43 % | SPK |
| 99.07315A | | 79.85 % | 6.33 % | SPK |
| 99.07316B | | 74.09 % | 5.98 % | SPK |
| 99.07317C | | 81.56 % | 6.41 % | SPK |
| 99.07318D | | 77.92 % | 6.19 % | SPK |
| 99.07319E | | 77.20 % | 6.10 % | SPK |
| 99.07320X | | 81.86 % | 6.40 % | SPK |
| 99.07321Y | | 84.71 % | 6.56 % | SPK |
| 99.07322Z | | 76.89 % | 5.70 % | SPK |
| RBK-00403020U * | RBK | 65.82 % | 5.19 % | SPK |

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

National Air and Radiation Environmental Laboratory
QC Batch Report

QC Batch #: 0001332N

Analytical Procedure: PU

REAGENT BLANKS (PCI)

| Sample ID | Nuclide | Activity $\pm 2\sigma$ |
|-----------|---------|------------------------|
| 00403020U | PU238 | 2.48e-03 \pm 1.6e-02 |
| 00403020U | PU239 | 3.31e-03 \pm 7.4e-03 |

LABORATORY DUPLICATES (PCI/GASH)

| Sample ID | Nuclide | Original $\pm 2\sigma$ | Duplicate $\pm 2\sigma$ | RPD | Z |
|-----------|---------|-------------------------|-------------------------|-------|----------|
| 99.07313Y | PU238 | -4.17e-03 \pm 3.9e-02 | -6.50e-03 \pm 3.2e-02 | 0.00 | -0.09 CK |
| 99.07313Y | PU239 | 2.92e-02 \pm 2.8e-02 | 9.93e-03 \pm 1.7e-02 | 98.50 | -1.16 OK |

MATRIX SPIKES (PCI/GASH)

| Sample ID | Nuclide | Amt Added $\pm 2\sigma$ | Native $\pm 2\sigma$ | Measured $\pm 2\sigma$ | %R | Z |
|-----------|---------|-------------------------|------------------------|------------------------|-------|----------|
| 99.07314Z | PU238 | NO SPIKE DATA | | | | |
| 99.07314Z | PU239 | 5.91e+00 \pm 2.8% | 1.35e-02 \pm 3.0e-02 | 5.30e+00 \pm 6.1e-01 | 89.46 | -1.50 CK |

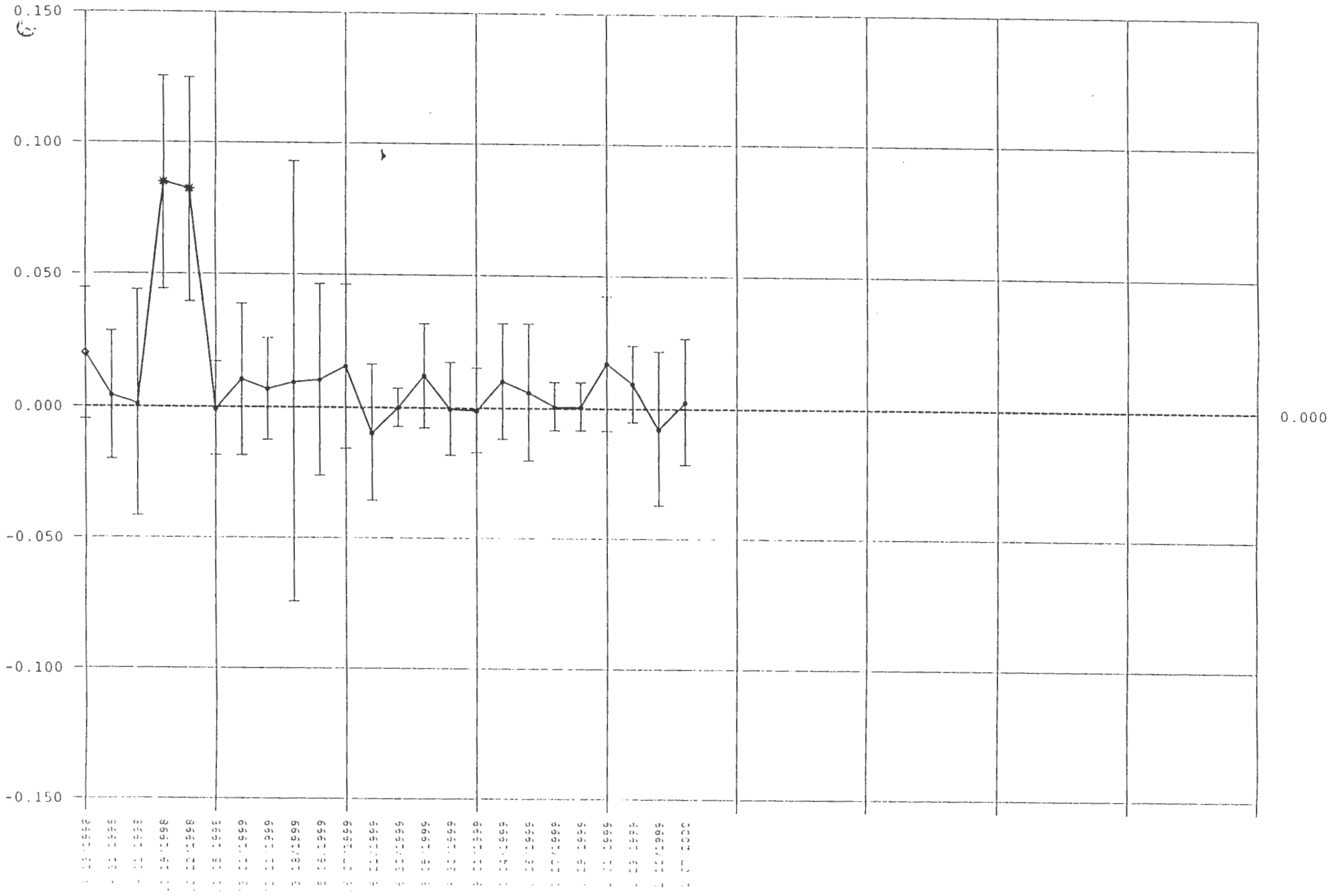
MATRIX SPIKE DUPLICATES (PCI/GASH)

| Sample ID | Nuclide | Amt Added $\pm 2\sigma$ | Measured $\pm 2\sigma$ | RPD | Z | %R | Z |
|-----------|---------|-------------------------|------------------------|------|---------|-------|----------|
| 99.07314Z | PU238 | NO SPIKE DATA | | | | | |
| 99.07314Z | PU239 | 5.34e+00 \pm 2.8% | 5.02e+00 \pm 5.3e-01 | 4.18 | 0.33 CK | 35.80 | -2.10 CK |

Analyst: Shane P. Knockemus 1/11/2000

QA Officer: Link McEwan 1/11/2000

Reagent Blanks
 Analyte: PU238
 Procedure: PU
 Analyst: Knockemus, Shane P.

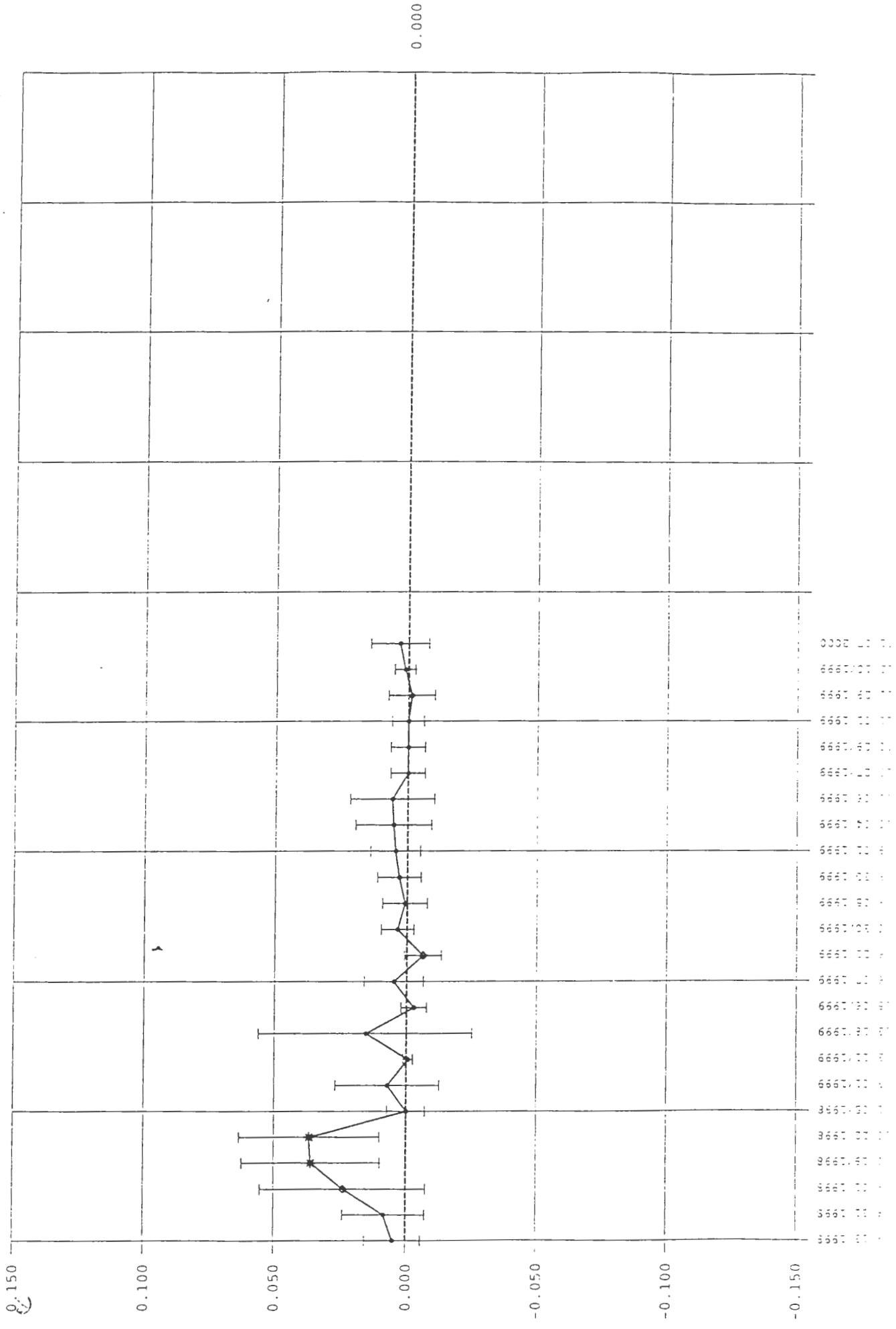


Reagent Blanks

Analyte: PU239

Procedure: PU

Analyst: Knockemus, Shane P.



**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096**

QC BATCH SUMMARY

QC batch #: 0001333P
Preparation procedure: N/A
Analysis procedure: PU

| NAREL Sample # | QC Type | Yield (%) | $\pm 2\sigma$ Uncertainty (%) | Analyst |
|-----------------|---------|-----------|-------------------------------|---------|
| 99.07323A | | 96.54 % | 6.86 % | AS |
| 99.07324B | | 93.73 % | 6.88 % | AS |
| 99.07324B | DUP | 73.32 % | 5.88 % | AS |
| 99.07325C | | 84.19 % | 6.34 % | AS |
| 99.07326D | | 79.78 % | 6.21 % | AS |
| 99.07327E | | 96.01 % | 6.99 % | AS |
| 99.07327E | MS | 94.78 % | 6.41 % | AS |
| 99.07327E | MSD | 88.44 % | 7.34 % | AS |
| 99.07328F | | 94.49 % | 6.92 % | AS |
| 99.07329G | | 95.30 % | 6.87 % | AS |
| 99.07330Z | | 91.85 % | 6.78 % | AS |
| 99.07331A | | 93.72 % | 7.05 % | AS |
| 99.07332B | | 89.82 % | 6.62 % | AS |
| RBK-00403029D * | RBK | 77.90 % | 6.02 % | AS |

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

**National Air and Radiation Environmental Laboratory
QC Batch Report**

QC Batch #: 0001333P

Analytical Procedure: PU

REAGENT BLANKS (PCI)

| Sample ID | Nuclide | Activity $\pm 2\sigma$ |
|-----------|---------|-------------------------|
| 00403029D | PU238 | 4.06e-03 \pm 2.1e-02 |
| 00403029D | PU239 | -9.42e-04 \pm 5.5e-03 |

LABORATORY DUPLICATES (PCI/GASH)

| Sample ID | Nuclide | Original $\pm 2\sigma$ | Duplicate $\pm 2\sigma$ | RPD | Z |
|-----------|---------|------------------------|-------------------------|--------|----------|
| 99.07324B | PU238 | 4.36e-03 \pm 4.9e-02 | 1.31e-02 \pm 3.0e-02 | 99.87 | 0.30 OK |
| 99.07324B | PU239 | 6.80e-03 \pm 3.1e-02 | 0.00e+00 \pm 0.0e+00 | 200.00 | -0.44 OK |

MATRIX SPIKES (PCI/GASH)

| Sample ID | Nuclide | Amt Added $\pm 2\sigma$ | Native $\pm 2\sigma$ | Measured $\pm 2\sigma$ | %R | Z |
|-----------|---------|-------------------------|------------------------|------------------------|-------|----------|
| 99.07327E | PU238 | NO SPIKE DATA | | | | |
| 99.07327E | PU239 | 7.96e+00 \pm 4.5% | 8.69e-03 \pm 2.4e-02 | 6.71e+00 \pm 6.2e-01 | 84.23 | -2.56 OK |

MATRIX SPIKE DUPLICATES (PCI/GASH)

| Sample ID | Nuclide | Amt Added $\pm 2\sigma$ | Measured $\pm 2\sigma$ | RPD | Z | %R | Z |
|-----------|---------|-------------------------|------------------------|------|---------|-------|----------|
| 99.07327E | PU238 | NO SPIKE DATA | | | | | |
| 99.07327E | PU239 | 8.02e+00 \pm 4.5% | 7.34e+00 \pm 8.3e-01 | 8.14 | 0.80 OK | 91.38 | -1.19 OK |

Analyst: Albert Smith 1/19/00
Smith, Albert

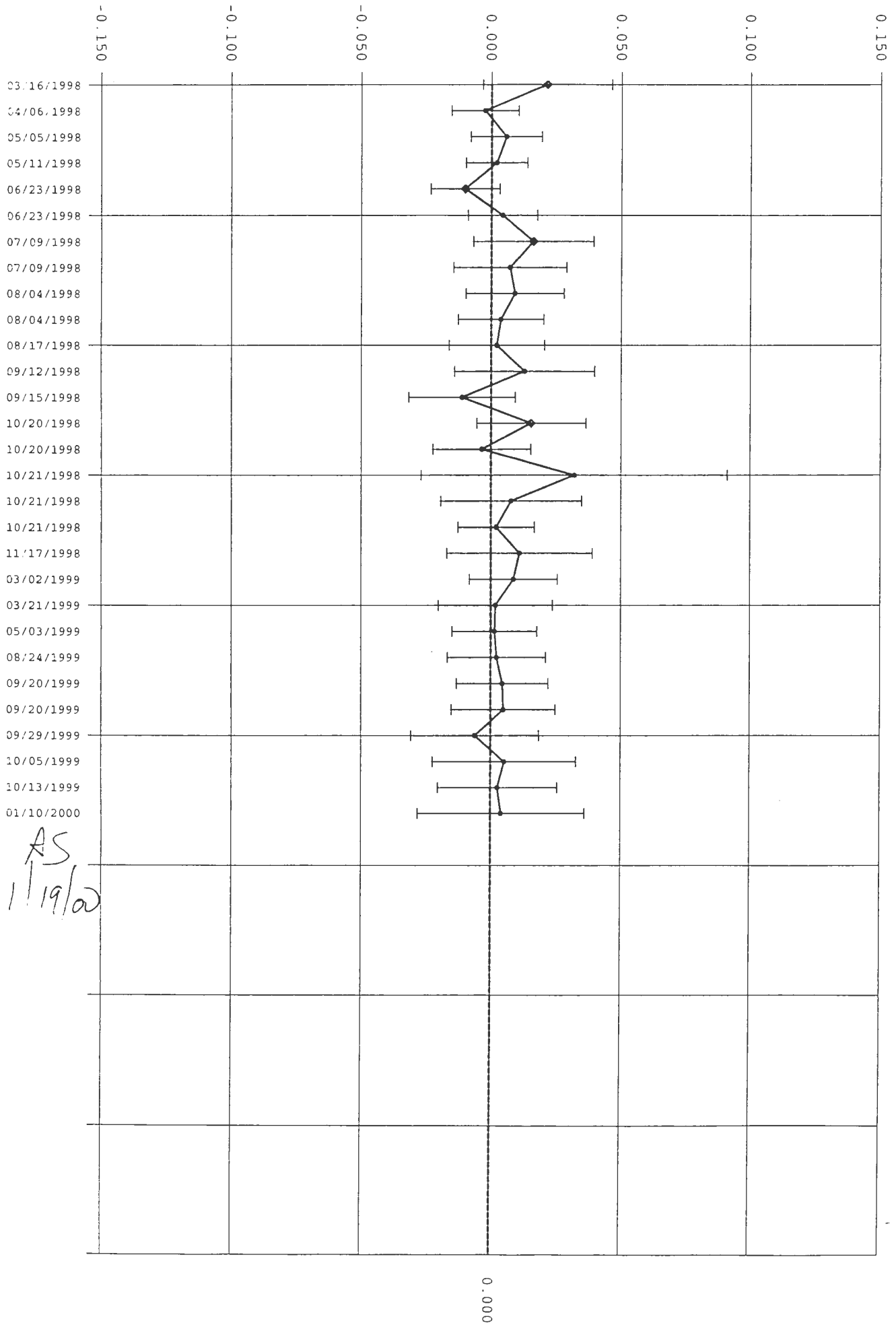
QA Officer: Paul McLean 1/19/2000

Reagent Blanks

Analyte: PU238

Procedure: PU

Analyst: Smith, Albert

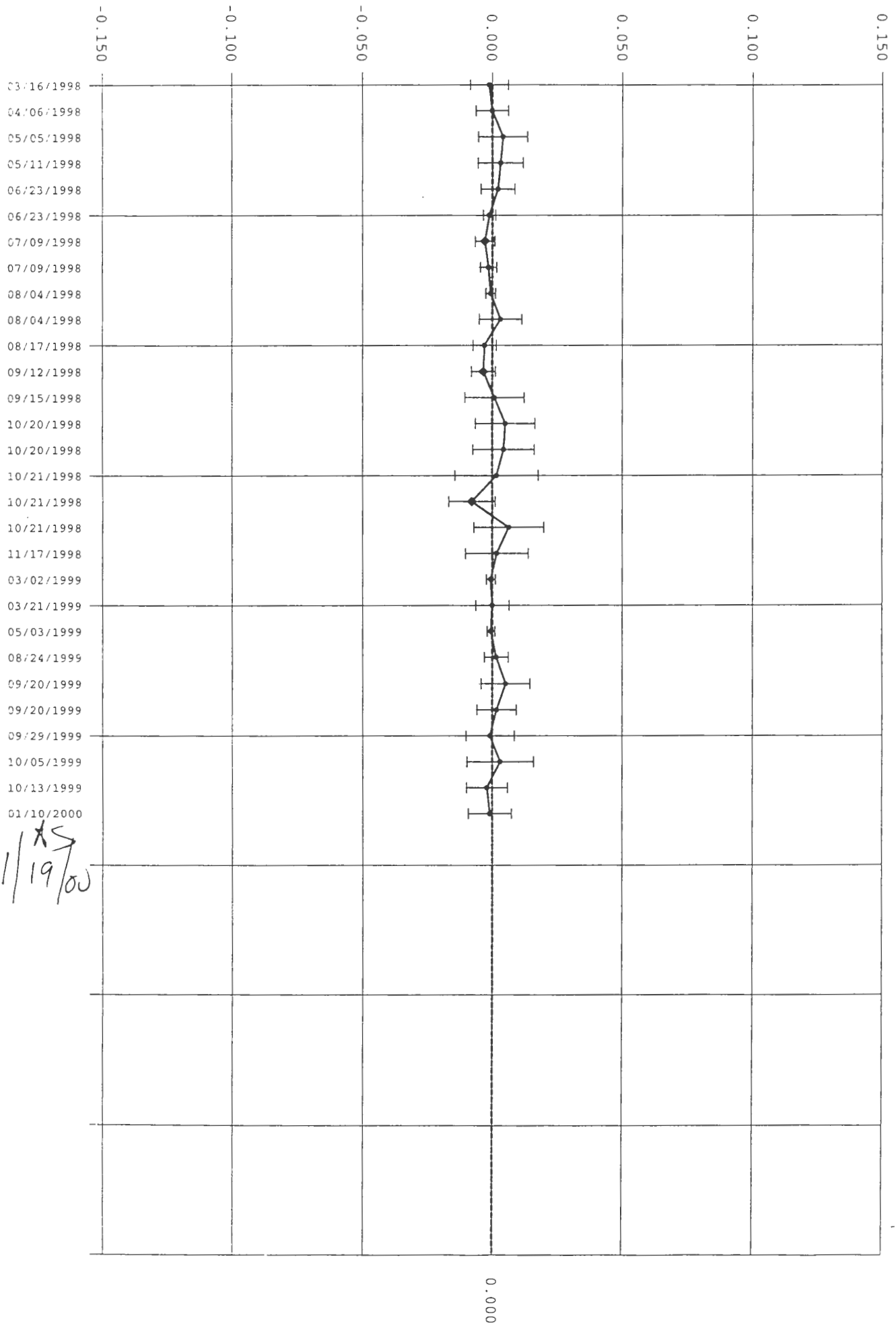


Reagent Blanks

Analyte: PU239

Procedure: PU

Analyst: Smith, Albert



PARSONS ENGINEERING SCIENCE, INC.

30 Dan Road • Canton, Massachusetts 02021-2809 • (781) 401-3200 • Fax: (781) 401-2575

February 10, 2000

Mr. Julio Vazquez
USEPA Region II
Superfund Federal Facilities Section
290 Broadway, 18th Floor
New York, NY 10007-1866

Mr. Steven Paszko
New York State Department of Environmental Conservation
Division of Hazardous Waste Remediation
Bureau of Eastern Remedial Action
50 Wolfe Road, Room 208
Albany, NY 12233-7010

SUBJECT: Location Map of EPA Samples Collected for Plutonium-239/240 at SEAD-12, Seneca Army Depot Activity, Romulus, NY

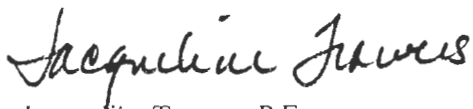
Dear Mr. Vazquez/Mr. Paszko:

Please find enclosed a map of the soil sampling locations where EPA samples were collected in December 1999 and analyzed for Plutonium-239/240. Please note that no sample was collected at MW12-6; this location is shown for reference. Sample locations SS12-9, SS12-13, and SS12-14 are Parsons ES' original sample locations that were collected and re-analyzed in December 1999 by both Parsons ES and EPA. Sample location SS12-2 is a Parsons ES original sample location and was collected and re-analyzed by EPA only. Sample location EPA12-1 was collected and re-analyzed by both EPA and Parsons ES laboratory. The remaining locations (EPA12-2 through EPA12-16) were collected for analysis by EPA only. Data from the four samples analyzed by Parsons ES are attached to this letter. Please note that this data presentation is slightly different than that distributed during the January 2000 BCT meeting.

If you have any questions or concerns regarding this figure, please do not hesitate to call me at (781) 401-2535 or Michael Duchesneau at (781) 401-2492.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.



Jacqueline Travers, P.E.
Task Order Manager

cc: Mr. Tom Enroth, CENAN-PP-HE
Mr. Stephen Absolom, SEDA
Mr. Jim Mullikin (USACHPPM)

Mr. Keith Hoddinott, USACHPPM (Prov.)
Ms. Dorothy Richards, CEHNC-PM-ND

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**Comparison of Original Sampling Data from the North End to Re-sampling data at
Four North End Locations.**

Original Pu-239/240 Data - Requested D.L = 0.1 pCi/g (November 1997)

| <i>Sample ID</i> | <i>Radionuclide</i> | <i>Value(pCi/g)</i> | <i>Error</i> | <i>Lab Qualifier</i> | <i>Parsons Qualifier</i> |
|------------------|---------------------|---------------------|--------------|----------------------|--------------------------|
| SS12-13 | Plutonium-239/240 | 0.3 | 0.1 | ND | UJ |
| SS12-2 | Plutonium-239/240 | 0.2 | 0.2 | | UJ |
| SS12-13 | Plutonium-239/240 | 0.2 | 0.1 | ND | U |
| SS12-9 | Plutonium-239/240 | 0.2 | 0.1 | ND | U |
| SS12-14 | Plutonium-239/240 | 0.3 | 0.1 | ND | UJ |

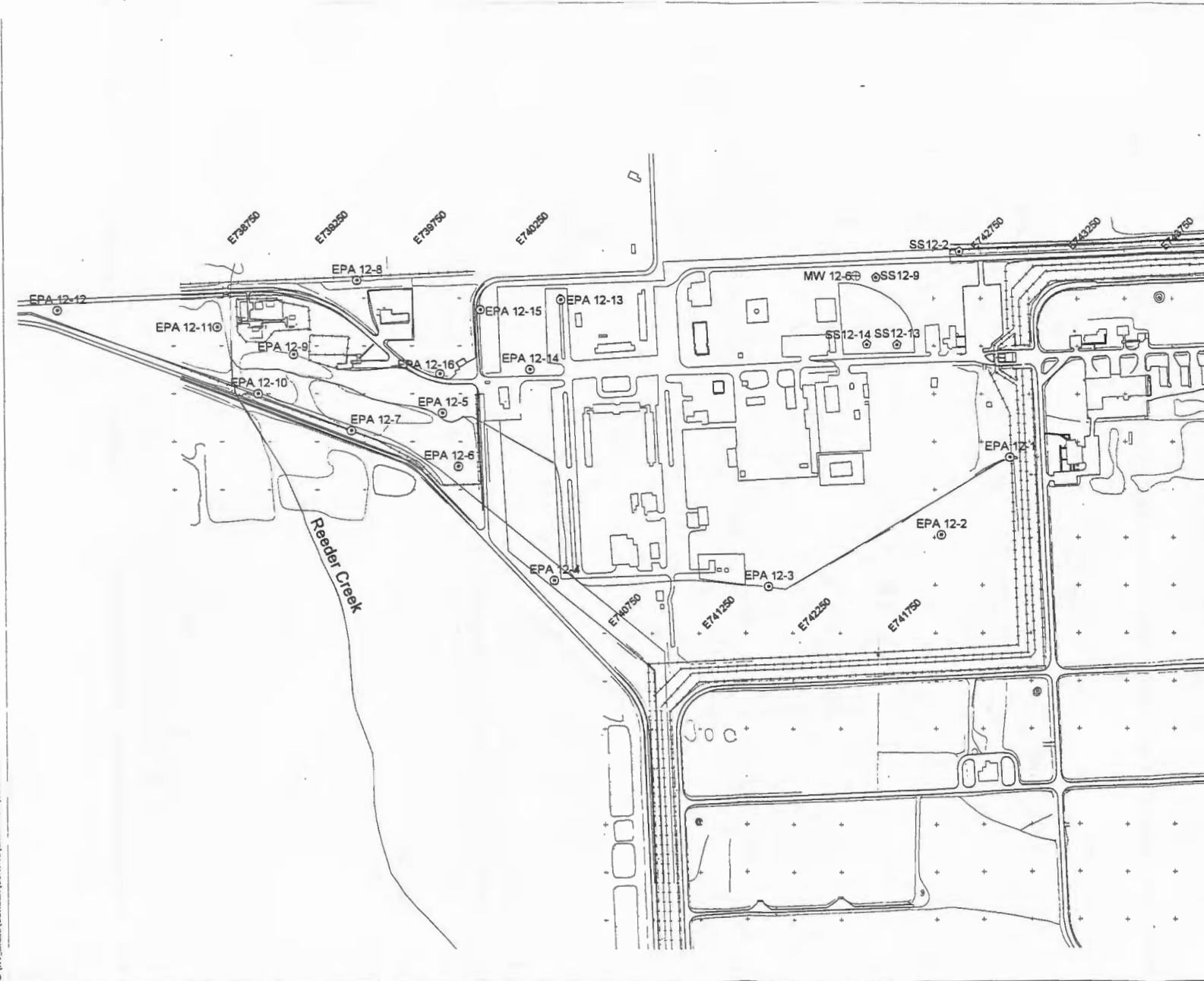
New Re-sampling Results - Requested D.L. = 0.01 pCi/g (December 1999)

| <i>Sample ID</i> | <i>Radionuclide</i> | <i>Value(pCi/g)</i> | <i>Error</i> | <i>Lab Qualifier</i> | <i>Parsons Qualifier</i> |
|------------------|---------------------|---------------------|--------------|----------------------|--------------------------|
| 123506 (SS12-14) | Plutonium-239/240 | 0.007 | 0.00412 | none | NA |
| 123508 (EPA12-1) | Plutonium-239/240 | 0.005 | 0.00348 | none | NA |
| 123504 (SS12-13) | Plutonium-239/240 | 0.077 | 0.0156 | none | NA |
| 123502 (SS12-9) | Plutonium-239/240 | 0.009 | 0.00538 | none | NA |

Notes:

NA - Not available at this time.

A sample was re-collected from SS12-2 and analyzed by EPA's laboratory only.



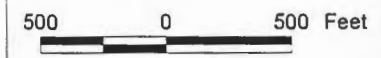
Legend

- ⊙ EPA Surface Soil Location
- ⊕ Monitoring Well Location
- ⊗ Surface Soil Re-Sampling Location
- - - Fence Line



Locations

| Loc_id | Easting | Northing | Elevation |
|-----------|------------|-------------|-----------|
| EPA 12-1 | 742840.343 | 1015174.477 | 630.506 |
| EPA 12-2 | 742826.456 | 1014746.775 | 635.632 |
| EPA 12-3 | 741616.407 | 1014446.742 | 634.851 |
| EPA 12-4 | 740484.104 | 1014320.343 | 620.422 |
| EPA 12-5 | 734401.022 | 1015404.240 | 607.315 |
| EPA 12-6 | 734481.474 | 1015125.701 | 622.746 |
| EPA 12-7 | 734422.406 | 1015311.731 | 608.018 |
| EPA 12-8 | 734456.468 | 1016046.567 | 614.474 |
| EPA 12-9 | 734123.410 | 1015708.318 | 612.884 |
| EPA 12-10 | 728432.484 | 1015504.436 | 605.034 |
| EPA 12-11 | 736724.427 | 1015852.753 | 545.166 |
| EPA 12-12 | 737844.072 | 1015934.786 | 605.716 |
| EPA 12-13 | 740526.103 | 1015444.647 | 627.731 |
| EPA 12-14 | 740363.032 | 1015630.702 | 623.714 |
| EPA 12-15 | 740102.875 | 1015442.713 | 622.582 |
| EPA 12-16 | 734888.543 | 1015608.285 | 620.158 |
| SS12-2 | 742629.450 | 1016253.000 | 645.587 |
| SS12-4 | 742192.000 | 1016116.000 | 634.040 |
| SS12-13 | 742301.500 | 1015763.000 | 634.320 |
| SS12-14 | 742143.700 | 1015764.300 | 640.400 |



PARSONS
PARSONS ENGINEERING SCIENCE, INC.

Seneca Army Depot Activity

**EPA
 SURFACE SOIL
 LOCATIONS**

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