REQUEST FOR PROPOSAL
FOR
DETERMINATION OF RADIONUCLIDES
BY
IN SITU HPGe GAMMA SPECTROMETRY

Prepared By:

Rocky Mountain Remediation Services L.L.C.

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DETERMINATION OF RADIONUCLIDES BY *IN SITU* HPGe GAMMA SPECTROMETRY

INTRODUCTION

This request for proposal (RFP) describes the Rocky Flats Environmental Technology Site's (Site) deliverable, technical, quality control (QC) and preliminary requirements that will identify and quantify Am-241, U-235 and U-238 in soils using *in situ* High Purity Germanium Detector technique and commercially available spectral acquisition and processing software. Sample matrices for this RFP are limited to soils.

In addition to Site-specific quality requirements, the measurement protocols and deliverables described herein are intended to comply with guidance provided in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (EPA et al, 1997). This document has recently been promulgated by consensus between the regulatory agencies (EPA and NRC) and the DOE and DOD. The MARSSIM provides extensive information about in situ gamma spectroscopy surveys.

This RFP is comprised of eight exhibits which provide the requirements for the *in situ* gamma spectrometry effort The exhibits are described below:

- Exhibit A provides an overview of the RFP and its general requirements.
- Exhibit B contains all reporting and deliverables requirements for the contract.
- Exhibit C contains the Target Analyte List (TAL) and the required detection limits (RDL) for all target analytes matrices and turn-around-times.
- Exhibit D contains method specifications and required analyses under this contract.
- Exhibit E contains general and specific QA/QC requirements.
- Exhibit F contains prerequisite requirements.
- Exhibit G contains Site-specific data available to establish and corroborate depth profiling of actinides in surficial soils at the Site.
- Exhibit H contains references.

OBJECTIVE

This RFP outlines the required activities and performance specifications for *in situ* gamma spectroscopy characterization of the 903 Pad Lip Area and Americium Zone at the Rocky Flats Environmental Technology Site (RFETS). The 903 Pad Lip Area and Americium Zone contain radionuclide contamination, specifically americium-241 (^{241}Am) and plutonium-239/240 ($^{239/240}$Pu) in excess of action levels defined in Attachment 5 to the Rocky Flats Cleanup Agreement (RFCA)(DOE 1996). Surface soils are defined in RFCA as the top six inches of soil. However, soils have historically been

activities east and southeast of the Lip Area are known as the Americium Zone (Figure 1.1). The Americium Zone is posted as a radiological Soil Contamination Area per the Site Radiological Controls Manual.

In situ gamma-ray spectrometry surveys (i.e., HPGe surveys) were conducted in 1990 and 1994 using a truck-mounted HPGe array to collect data on the activity of ^{241}Am in surface soils in the Americium Zone. Data was collected from a grid consisting of a 45.7 m (150 ft) diameter circle for the truck mounted array's field of view (FOV) of 1,642 m^2 (17,671ft^2 or 0.4 acre). The HPGe measurements identified ^{241}Am activities ranging from 84.7 pCi/g to less than 10 pCi/g.

As detailed in the OU2 Phase II RFI/RI (DOE, 1995), surface soil samples were collected for analysis using wet chemistry from 124 plots utilizing two sampling methods: Colorado Department of Health (CDH) and the Rocky Flats (RF) sampling methods which are presented in standard operating procedure GT.08 Surface Soil Sampling. Surface soil sample results ranged from 380 to 7,300 pCi/g $^{239/240}Pu$ and 34 to 160 pCi/g ^{241}Am. Results were compared with RFCA Tier I surface soil action levels and the HPGe survey results. The comparison indicated that samples collected from five 2.5-acre plots exceed the Tier I soil action levels which correlated well with the HPGe results. These plots include two 2.5-acre plots (PT028 and PT034) sampled under the CDH sampling program and three 2.5-acre plots (PT029, PT036, and PT046) sampled under the RF sampling program. Surface soil plots PT034, PT035, PT045, PT046, PT047, PT048, PT054, PT055, PT062 were included within the Investigation Area because previous HPGe measurements detected ^{241}Am in excess of 10 pCi/g.

Other Site-specific documents that are applicable include:

- *Final Phase II RFI/RI Report 903 Pad, Mound, and East Trenches Area, Operable Unit No.2* (DOE, 1995);
- *Annual Update for the Historical Release Report for the Rocky Flats Environmental Technology Site* (DOE, 1997); and
- *Final Rocky Flats Cleanup Agreement* (DOE 1996).

RMRS will provide pertinent sections of these documents to the subcontractor's at their request.

Task 1 Document/Data Review

This task shall include subcontractor labor hours, labor categories, and other direct costs (ODCs) necessary for the review and modification of project-specific documentation listed below:

Health and Safety Plan

The Health and Safety Plan addresses risks and concerns identified during the preliminary hazard assessment. The preliminary hazard assessment is an initial review of the potential hazards present in implementing SAP activities. The Health and Safety Plan must include all risks identified by the subcontractor and shall also include detailed descriptions of appropriate responses at the site in the event of an accident or emergency.

The subcontractor shall review the final RMRS Task-Specific Health and Safety Plan (HASP) addressing worker health and safety during field activities. The subcontractor shall perform an Activity Hazard Analysis (AHA) for each activity or task required for performance of the subcontractors work scope that are not previously covered and provide appropriate responses to ensure these hazards are not encountered. These activities will be included into the HASP as revisions and will be approved by the CTR prior to mobilization of equipment and materials to the site.

Site Specific Data

The subcontractor shall review existing Site-specific depth profile data to determine their usability for generating a depth distribution model. These data are provided in Exhibit G. If these data are determined unusable, the subcontractor shall propose the method the subcontractor will use to determine the depth distribution model.

Task 2 Training

This task shall include all subcontractor labor hours, labor categories, and ODCs for training subcontractor personnel for working at the Site. All subcontractor personnel shall receive the required indoctrination and training specific to the tasks each individual will be performing at the Site. Personnel qualifications shall comply with the quality assurance requirements listed in this SOW. The subcontractor shall provide site supervisors and workers that have the minimum training requirements listed in Table 1.0 prior to arrival at Site.

TABLE 1.0 MINIMUM SUBCONTRACTOR-PROVIDED TRAINING REQUIREMENTS

Training	Stipulation for RMRS Approval
OSHA 40-Hour	OSHA 1926.65
OSHA 8-Hour Refresher	OSHA 1926.65
OSHA 8-Hour Supervisor	OSHA 1926.65
Medical Monitoring	Subcontractor Medical Monitoring Program shall be approved by RMRS

passes for members of the field crew, equipment inspection before entering the site, establishing appropriate work control zones per the HASP, posting signs for control of the project, setting up a subcontractor field office, and installing all required support equipment for data acquisition and reduction. Members of the field crew shall obtain Site badges and electronic gate passes the first day they arrive at the site. Vendors, suppliers, trade persons, etc. that must visit the site infrequently to support the project shall obtain temporary "day badges" the day of the visit. The subcontractor shall give the CTR a minimum of 24 hours notice prior to such an individual arriving at the site. This advance notice is necessary for RMRS to obtain clearance for the individual to enter the site. Individuals requesting "permanent" or "day badges" shall be U.S. citizens and shall present a valid drivers license.

All equipment and materials mobilized to the Site shall have been previously decontaminated and shall be free of contamination, dirt, etc. The subcontractor shall provide documentation to ensure the equipment is contamination free. RMRS will inspect equipment at the entrance gate to ensure that this requirement is met. The inspections will include baseline radiological surveys. RMRS reserves the right to prohibit any equipment or materials not meeting this requirement from entering the site. Any expense resulting from such disallowance shall be borne by the subcontractor. All equipment mobilized to the Site shall be in good working order and shall be free of operational defects (e.g., faulty components, leaks, etc.).

Grid Layout

RMRS will provide the subcontractor with state planar coordinates for all measurement locations. The subcontractor shall be responsible for setup of survey instrumentation and subsequent measurements at coordinate locations within $\pm$ one foot. Measurement locations will be staked, flagged, and numbered for future reference by the subcontractor or RMRS. Subcontractor shall provide wooden stakes or equivalent for reference of measurement location. The survey will be initiated in the Americium Zone adjacent to the Lip Area's eastern boundary and proceed eastward. Individual measurement locations and elevations shall be surveyed by the subcontractor by standard land survey methods or with a Global Positioning System (GPS) within a $\pm$ one foot tolerance.

HPGe Survey

The subcontractor shall determine activities of ^{241}Am, ^{235}U, and ^{238}U activity over a FOV with a diameter of 10 meters (m) (33ft). The subcontractor shall propose a detector height to accommodate this field of view. The subcontractor shall perform approximately 1,000 in situ gamma-ray spectroscopy measurements using high purity germanium detectors to determine the activity of ^{241}Am, ^{235}U and ^{238}U in surface soils within the project Investigation Area. The subcontractor shall also provide activities of $^{239/240}$Pu and ^{234}U based on activity ratios for ^{241}Am and ^{238}U provided to the subcontractor from RMRS.

The Subcontractor shall be responsible for all aspects of the HPGe survey including the providing of validated Standard Operating Procedures for the characterization and calibration of detectors, collecting or evaluating existing data required for conversion factor parameters of the spectral software, verifying conversion factor parameters, and providing verified and validated spectral software. The subcontractor shall provide information on how such effects as building shine would be handled during data acquisition and analysis processes. Exhibit E provides the Quality Assurance/Quality Control requirements of in situ gamma spectrometry.

RMRS has proposed a 10m grid spacing to achieve 74% coverage in the Investigation Area which translates to approximately 81 HPGe measurements for complete coverage of a 2.5-acre area plot. The subcontractor may propose a different grid spacing and detector configuration to achieve a minimum of 74% coverage of the Investigation Area. Approximately 1,000 measurements are estimated to provide

Task 5 Technical Support

The subcontractor will provide technical support with presentations at meeting between RMRS, their client, and the regulators. The subcontractor shall, if requested, present technical aspects associated with the collection, analysis, and reporting of the in situ gamma spectrometry measurements. For proposal purposes the subcontractor shall assume a total of 24 hours for senior level personnel to support this task.

FACILITY, INSTRUMENTATION AND KEY POSITION REQUIREMENTS

The Subcontractor shall have sufficient analytical capacity and capability to meet all terms and conditions of the SOW.

Key Position Requirements: The Subcontractor shall assign individuals the responsibilities for the key technical positions listed below and to perform the minimum functional requirements necessary to meet the terms and conditions of this subcontract. Minimum academic training and experience qualifications for positions specific to this SOW are identified below. A qualifying individual may fill more than one of the key positions.

Project Manger

- Responsibility: Responsible for all aspects of this SOW and serves as the primary contact for the CTR.
- Academic Training: A minimum of a bachelor's degree in a science discipline.
- Experience: A minimum of ten years of project management experience.

Gamma Spectrometry Specialist I

- Responsibility: Responsible for all aspects of gamma spectrometry data interpretation in conjunction with the spectral analysis software and for the proper operation and maintenance of gamma spectrometry instrumentation
- Academic Training: A minimum of a bachelors degree in a science discipline.
- Experience: A minimum of ten years of work experience with gamma spectrometry data interpretation with formal vendor supported or accredited training, or like experience using the spectral acquisition and analysis software.

Gamma Spectrometry Specialist II

- Responsibility: Responsible for collection of gamma spectrometry data and for the proper operation and maintenance of gamma spectrometry instrumentation.
- Academic Training: A minimum of a bachelors degree in a science discipline or equivalent related work experience.
- Experience: A minimum of one year of work experience with gamma spectrometry data interpretation with formal vendor supported or accredited training, or like experience.

Health and Safety Specialist

- Responsibility: Responsible for all ensuring requirements of the Site Radiological Control Manual and task-specific HASP are following for the project.
- Academic Training: A minimum of a bachelor's degree in a science discipline or equivalent related work experience.

The subcontractor shall complete all tasks associated with this SOW including transmittal of deliverables and demobilization from the Site by July 17, 1998.

2.4. DATA PACKAGE REQUIREMENTS

The general data package deliverable requirements for this project are provided in Table B-1. The requirements set forth for the final data packages in this section include; Cover Page, Case Narratives, Sample and QC results, Raw data Summary and the Electronic Data Deliverable. All deliverables consisting of final data shall be transmitted to the CTR and will be provided within 14 calendar days of the "shot". This time frame will allow for verification/validation of the data while the project is still in progress.

Preliminary data, which consists only of isotopic results by location, is required within 24 hours. Preliminary data shall be submitted to the CTR or his/her designee. Although preliminary data does not require peer review, any changes to preliminary data shall be documented and discussed in the final data package's case narrative.

TABLE B-1 DATA PACKAGE DELIVERABLES

Deliverable Section Number	Deliverable Section Title
1	Cover Page
2	Narrative
3	Sample and QC Sample Results Summary
4	Instrument Calibration Summary
5	Counting Raw Data Summary
6	Electronic Data Deliverable (EDD)

2.5. Data Package Cover Page Requirements

All Data Packages shall have a Cover Page that includes the following: site location, title, subcontractor name, subcontract number, report date, author's authentication and peer review authentication.

2.6. Data Package Narrative

Data Package Narratives shall be included in the data package and shall include a description of all problems, unusual circumstances and weather conditions encountered during the measurement process. At a minimum this shall include: descriptions of interferences, an explanation of any QC deficiencies, reasons for re-shooting a location, SOP title and revision, an explanation of any deviations from SOPs or protocols and any other information that might affect the data quality. Additionally, the spectral acquisition and processing software and version used to acquire and process data shall be provided.

2.7. Results Summary, Real & QC measurements

All measurement results shall be arranged by Site location identification number. All QC measurements shall be identified as QC measurements and identify the batch of real measurements the QC measurement is associated with. The Site will retain all original data generated during the course of this project, including:

- CA standard value
- CA standard value uncertainty at 3-sigma
- CA "% Recovery"

2.7.6. For the background measurement the following additional information shall be reported:

- "MDA" (same units as the reported activity) shall also be reported for each radionuclide detected at the location.
- location of background measurement

2.7.7. Significant Figures: The target analyte activities, QC results, measurement uncertainties and MDAs shall be reported to a number of significant digits commensurate with associated in situ accuracy and precision (typically 3 significant figures).

2.8. Instrument Calibration Summary

2.8.1. The Instrument Calibration Summary is a summary of the energy calibration, backgrounds and efficiency determinations for all HPGe detectors used to analyze Site locations and the associated QC areas.

2.8.2. The following information shall be reported for the energy calibration:

- Instrument and detector ID
- Date of the energy calibration
- "Calibration Source" ID
- Energy Span used and geometry used.
- linear response of system over range of energy spectrum
- Gain expressed as keV/Channel

2.8.3. The following information shall be reported for the background shots:

- Instrument and detector ID
- Date of the background shot
- Respective "Start" and "End" "ROI" (region of interest) in channels or energy for the determination of the specific radionuclides requested
- Respective ROI "Background" for the determination of the specific radionuclides requested

2.8.4. The following information shall be reported for the detector efficiency determinations:

- Instrument and detector ID
- Date of the efficiency analysis
- "Calibration Source" ID
- Matrix
- Geometry
- Detector characterization data
- Characterization verification data

2.8.5. The gamma spectrometry instrumentation, analysis, and preparation SOP(s) shall be listed.

Space	Field	Format	Comment
141-150	F/E	Number (10)	Precision measure used for comparison with a test statistic.
151-155	Control Area Yield	Number (5)	Percentage of the established control area value.
156-175	CAS Number	Character (20)	See table below.
176-185	Total Propagated Error	Number (10)	(TBD by SME; to be used in evaluating precision control)
186-210	Test Method	Character (25)	a referenceable Method type, e.g., the procedure title, revision #, and date used by the subcontractor
211-220	Source Check	Number (10)	value in energy units (keV)
221-225	Count Time	Number (5)	count time of measurement, in minutes
226-230	Efficiency	Number (5)	efficiency of the detector system, in percent
231-245	Instrumentation/ System ID #	Character (15)	identification of the measurement system
Note: All parameter fields are left-justified and padded to the right with blanks.			

TABLE B-3 CAS Numbers

CAS No	Analyte
14596-10-2	AM241
15117-96-1	U235
7440-61-1	U238
10-12-8	PU239/240

Result Identifiers

QC Item types

BG - Background Area.

CA- Control Area.

SC- Source Check

RP- Replicate Area

REAL- Target Analyte.

Units of Measure

pCi/g - Picocuries per gram

% - percent recovery or efficiency

EXHIBIT C

RADIONUCLIDE TARGET ANAYLTE LIST

RADIONUCLIDE TARGET ANAYLTE LIST

1. INTRODUCTION

This SOW sets general requirements for the target analyte RDLs for in situ soil HPGe measurements.

Target analytes for this SOW are listed below. The RDL for these radionuclides are listed in the accompanying tables:

Americium -241

Uranium -235

Uranium-238

2. RADIONUCLIDE TARGET ANAYLTE LISTS AND REQUIRED DETECTION LIMIT (RDL)

Table C-1 gives the RDL for target analytes in soils.

TABLE C1 Required Detection Limits for Soils

CAS No.	Isotope	RDL	Unit
14596-10-2	^{241}Am	1.0	pCi/g
1511-96-1	^{235}U	0.5	pCi/g
7440-61-1	^{238}U	5.0	pCi/g

- A historical file of software revisions and associated validation documentation shall be maintained. The historical file shall be maintained in chronological order.

- Computer program and analytical data on electronic media shall be handled, stored, safeguarded, and controlled to prevent damage and deterioration.

2.5. **Spectral Libraries:** The Site is aware that some commercial spectral analysis software requires that a spectral library be established and searched to identify peaks present in a sample spectrum. The isotopes, gamma energies and search order of such libraries shall be reviewed by the CTR prior to use by the Subcontractor. Any changes to the content, gamma energies or search order of an approved library must be approved, in writing, by the CTR prior to use on samples.

tolerance, corrective action shall be implemented before any further real (in situ) measurements are performed.

2.6. **Energy Calibration/Detector Characterization Requirements** The peak shape, as defined by the full width half maximum (FWHM) and full width tenth maximum (FWTM) specification of the detector, shall be supplied. The resolution of the detector shall not exceed 10% of the manufacturer's original specification. Any geometric arrangements of sources or treatments within software reduction shall be documented.

2.6.1. The energy calibration for each detector shall be performed. A linear curve shall be fit for Energy (Y-axis) versus Channel (X-axis) of the curve, and the constants for the equation shall be documented. The goodness of fit (r^2) shall be provided.

2.6.2. The slope of the equation shall approximate 0.375 keV/Channel for a 8192 channel analyzer.

2.6.3. Effective area for each detector shall be documented as a function of gamma energy and angle of incidence.

2.7. Efficiency Determination Requirements

2.7.1. The efficiency determinations shall be performed on each detector using matrix and geometry specific NIST traceable calibration source(s). After consultation with the CTR and project personnel , problems with difficult matrices will be resolved and documented.

2.7.2. Americium-241 shall be included in the efficiency calibration source.

2.7.3. It is expected that the certified value for each isotope in the efficiency standard has been determined at a specific energy, therefore the efficiency determination shall also use that specific energy.

2.7.4. The Subcontractor shall document the reason that any of the peaks present in the original efficiency calibration source are not used to determine the efficiency curves above or below the knee.

2.7.5. The efficiency error and confidence level shall be documented.

2.8. **Background Measurements**: At least one background measurement shall be performed for every measurement set. The background is constituted by measuring a fixed area as defined by the CTR. The location of the background measurement is to be determined, however, it shall be on Site. Background measurements shall be measured in the same manner as all other standard in situ measurements.

2.9. **Replicate Measurements**: At least one replicate measurement shall be performed for every measurement set. The replicate is constituted by remeasuring an in situ measurement within the measurement set of interest. Error tolerance must comply with the statistically-based comparison (equivalence test) given below:

$$F = |S - R| \qquad \text{Eq. E-2}$$

$$E = \sqrt{E_S^2 + E_R^2} \qquad \text{Eq. E-3}$$

$$F/E \leq 1.42$$

the completion of routine in situ measurements. Rather than specified a set tolerance range of acceptable, error will be quantified by THE CTR to define an upper confidence limit in the measurements to support project decisions

In summary, the following general sequence of quality control measurements is required: daily source check, background measurement, calibration (as needed per each measurement set), real measurements, replicate, and control area measurement. After all real measurements are completed, five calibration verification measurements, as described above are required.

6. GENERAL QC REQUIREMENTS

6.1. **Control of Key Parameters:** several parameters directly influence data reduction and final gamma spectroscopy values (Argall, 1997). For the values listed below, and any others the subcontractor deems necessary, determination of values shall be clearly explained and documented with final deliverables:

- actinide depth distribution in soil profile (Exhibit G) and averaging depth
- soil density
- soil moisture
- air density

6.2. **Total Propagated Uncertainty (TPU):** Total propagated uncertainty, not just the counting error, will be reported with the result for each target analyte. The total propagated error is the square root of the sum of the squares of the 1 sigma error of each measurement or process that contributes to the measurement. TPU shall be determined consistent with the MARSSIM, Section 6.8.3.

6.3. **Traceability of Measuring and Testing Equipment (M&TE):** Any ancillary measurement or testing equipment used to support HPGe measurements shall traceable to associated calibration logs and standards.

6.4. **Final Acceptability of Deliverables:** Final acceptability of deliverables from the subcontractor are constituted by approval of the CTR in writing. Noncompliance with any of the requirements set forth in this SOW provide the basis for rejection of the associated deliverable(s).

6.5. **Completeness:** Data submitted must be 95% complete to be considered acceptable, i.e., 95% of the data produced must be usable for project decisions based on the Quality requirements set forth in this SOW.

7. MDA DETERMINATION

The initial MDA determinations for the subcontract shall be consistent with Section 6.7 of the MARSSIM using a 95% confidence level and at least 5 replicate measurements. The Subcontractor shall provide the algorithm and all necessary information used to calculate the MDAs. MDAs should meet the DQOs set forth in Section 2.4 of the SAP; if not, rationale must be provided.

EXHIBIT F

PREREQUISITES

1. INTRODUCTION

The purpose of this exhibit is to describe the prerequisite documents and information, necessary to meet minimum quality requirements, related to in-situ gamma spectroscopy data. Alternatives to the requirements listed below may be satisfactory if equivalence can be demonstrated and written approval is documented by the CTR prior to data acquisition by the HPGe system.

Any changes in the controls listed below, following contract procurement, shall be approved by the CTR in writing prior to implementation in the field.

2. DOCUMENT & SOFTWARE CONTROL

Documents and software that control data collection and/or data quality must be formally controlled by subcontractor or via the RMRS Document Control procedure "Document Control Program", DC-06.01 (Rev. 0, 2/17/97). Examples of documents requiring control include the following:

- Data acquisition forms
- Logbooks
- Consistency of Documentation;

Should the subcontractor control their own documentation and/or software, the process must meet or exceed the document and software control requirements established by RMRS, which includes:

- Document Numbering and Inventory Procedures;
- Storage of files/data; and
- Inventory of Data Packages

Adequate documentation, verification, and validation of software must also be provided and be compliant with ANSI/ANS-10.3-1995, "American National Standard for Documentation of Computer Software" and ANSI/ANS-10.4-1987, "American National Standard Guidelines for the Verification and Validation of Scientific and Engineering Computer Programs for the Nuclear Industry".

3. STANDARD OPERATING PROCEDURES

The Site shall be provided with a copy of all SOPs used for all HPGe system measurements, including system standardization and calibration associated with the instrumentation used for the analysis of Site samples. Requirements for SOPs are specified in the General Laboratory Requirements Module, GR01:

- SOP Specifications and Format;
- Required Evidentiary SOPs;
- Required Analytical SOPs;
- Required Quality Management SOPs;

Exhibit G

Site-Specific Depth Profile Data

LOCATION	SAMPLE	START	END	UNITS	QC	ID	ANALYTE	RESULT	UNITS	QUAL	VAL
TR04	TR00422WCU2	0.0	3.0	cm	REAL	TRG	AM-241	109.9000	PCI/G		R
TR04	TR00422WCU2	0.0	3.0	cm	REAL	TRG	PU239/40	535.3000	PCI/G		A
TR04	TR00422WCU2	0.0	3.0	cm	REAL	TRG	U-235	0.0819	PCI/G	J	A
TR04	TR00422WCU2	0.0	3.0	cm	REAL	TRG	U-238DA	1.3520	PCI/G		A
TR04	TR00422WCU2	0.0	3.0	cm	REAL	TRG	U-233,-234	1.0080	PCI/G		A
TR04	TR00421WCU2	3.0	6.0	cm	REAL	TRG	AM-241	63.7300	PCI/G		R
TR04	TR00421WCU2	3.0	6.0	cm	REAL	TRG	PU239/40	459.9000	PCI/G		A
TR04	TR00421WCU2	3.0	6.0	cm	REAL	TRG	U-235	0.0359	PCI/G	J	A
TR04	TR00421WCU2	3.0	6.0	cm	REAL	TRG	U-238DA	1.5680	PCI/G		A
TR04	TR00421WCU2	3.0	6.0	cm	REAL	TRG	U-233,-234	1.2540	PCI/G		A
TR04	TR00420WCU2	6.0	9.0	cm	REAL	TRG	AM-241	49.2800	PCI/G		R
TR04	TR00420WCU2	6.0	9.0	cm	REAL	TRG	PU239/40	312.8000	PCI/G		A
TR04	TR00420WCU2	6.0	9.0	cm	REAL	TRG	U-235	0.0669	PCI/G	J	A
TR04	TR00420WCU2	6.0	9.0	cm	REAL	TRG	U-238DA	1.4090	PCI/G		A
TR04	TR00420WCU2	6.0	9.0	cm	REAL	TRG	U-233,-234	1.1630	PCI/G		A
TR04	TR00419WCU2	9.0	12.0	cm	REAL	TRG	AM-241	14.8600	PCI/G		R
TR04	TR00419WCU2	9.0	12.0	cm	REAL	TRG	PU239/40	90.4600	PCI/G		A
TR04	TR00419WCU2	9.0	12.0	cm	REAL	TRG	U-235	0.1015	PCI/G	J	A
TR04	TR00419WCU2	9.0	12.0	cm	REAL	TRG	U-238DA	1.6120	PCI/G		A
TR04	TR00419WCU2	9.0	12.0	cm	REAL	TRG	U-233,-234	1.3840	PCI/G		A
TR04	TR00418WCU2	12.0	18.0	cm	REAL	TRG	AM-241	1.0730	PCI/G		R
TR04	TR00418WCU2	12.0	18.0	cm	REAL	TRG	PU239/40	6.5650	PCI/G		A
TR04	TR00418WCU2	12.0	18.0	cm	REAL	TRG	U-235	0.0947	PCI/G	J	A
TR04	TR00418WCU2	12.0	18.0	cm	REAL	TRG	U-238DA	1.0740	PCI/G		A
TR04	TR00418WCU2	12.0	18.0	cm	REAL	TRG	U-233,-234	1.3460	PCI/G		A
TR04	TR00417WCU2	21.0	27.0	cm	REAL	TRG	AM-241	0.2205	PCI/G		R
TR04	TR00417WCU2	21.0	27.0	cm	REAL	TRG	PU239/40	3.4240	PCI/G		A
TR04	TR00417WCU2	21.0	27.0	cm	REAL	TRG	U-235	0.0457	PCI/G	J	A
TR04	TR00417WCU2	21.0	27.0	cm	REAL	TRG	U-238DA	1.5010	PCI/G		A
TR04	TR00417WCU2	21.0	27.0	cm	REAL	TRG	U-233,-234	1.3410	PCI/G		A
TR04	TR00416WCU2	33.0	39.0	cm	REAL	TRG	AM-241	0.0070	PCI/G	J	R
TR04	TR00416WCU2	33.0	39.0	cm	REAL	TRG	PU239/40	0.0831	PCI/G		A
TR04	TR00416WCU2	33.0	39.0	cm	REAL	TRG	U-235	0.0640	PCI/G	J	A
TR04	TR00416WCU2	33.0	39.0	cm	REAL	TRG	U-238DA	1.2940	PCI/G		A
TR04	TR00416WCU2	33.0	39.0	cm	REAL	TRG	U-233,-234	1.2280	PCI/G		A
TR04	TR00415WCU2	45.0	51.0	cm	REAL	TRG	AM-241	0.0439	PCI/G		R
TR04	TR00415WCU2	45.0	51.0	cm	REAL	TRG	PU239/40	0.3925	PCI/G		A
TR04	TR00415WCU2	45.0	51.0	cm	REAL	TRG	U-235	0.0442	PCI/G	J	A
TR04	TR00415WCU2	45.0	51.0	cm	REAL	TRG	U-238DA	1.2510	PCI/G		A
TR04	TR00415WCU2	45.0	51.0	cm	REAL	TRG	U-233,-234	1.0160	PCI/G		A
TR04	TR00414WCU2	64.0	75.0	cm	REAL	TRG	AM-241	0.0145	PCI/G	J	R
TR04	TR00414WCU2	64.0	75.0	cm	REAL	TRG	PU239/40	0.0453	PCI/G		A
TR04	TR00414WCU2	64.0	75.0	cm	REAL	TRG	U-235	0.0976	PCI/G	J	A
TR04	TR00414WCU2	64.0	75.0	cm	REAL	TRG	U-238DA	1.0040	PCI/G		A
TR04	TR00414WCU2	64.0	75.0	cm	REAL	TRG	U-233,-234	1.1160	PCI/G		A
TR04	TR00413WCU2	93.0	99.0	cm	REAL	TRG	AM-241	0.0070	PCI/G	J	R
TR04	TR00413WCU2	93.0	99.0	cm	REAL	TRG	PU239/40	0.0283	PCI/G	J	A
TR04	TR00413WCU2	93.0	99.0	cm	REAL	TRG	U-235	0.0247	PCI/G	J	A
TR04	TR00413WCU2	93.0	99.0	cm	REAL	TRG	U-238DA	0.5862	PCI/G		A
TR04	TR00413WCU2	93.0	99.0	cm	REAL	TRG	U-233,-234	0.4099	PCI/G		A

Exhibit G
Site-Specific Depth Profile Data

LOCATION	SAMPLE	START	END	UNITS	QC	LD	ANALYTE	RESULT	UNITS	QUAL	VAL
TR09	TR00300WCU2	0.0	3.0	cm	REAL	TRG	AM-241	23.3700	PCI/G		JA
TR09	TR00300WCU2	0.0	3.0	cm	REAL	TRG	PU239/40	198.7000	PCI/G		A
TR09	TR00300WCU2	0.0	3.0	cm	REAL	TRG	U-235	0.0636	PCI/G	J	A
TR09	TR00300WCU2	0.0	3.0	cm	REAL	TRG	U-238DA	1.3920	PCI/G		A
TR09	TR00300WCU2	0.0	3.0	cm	REAL	TRG	U-233,-234	1.1960	PCI/G		A
TR09	TR00299WCU2	3.0	6.0	cm	REAL	TRG	AM-241	22.2800	PCI/G		JA
TR09	TR00299WCU2	3.0	6.0	cm	REAL	TRG	PU239/40	204.4000	PCI/G		A
TR09	TR00299WCU2	3.0	6.0	cm	REAL	TRG	U-235	0.0439	PCI/G	J	R
TR09	TR00299WCU2	3.0	6.0	cm	REAL	TRG	U-238DA	1.6620	PCI/G		R
TR09	TR00299WCU2	3.0	6.0	cm	REAL	TRG	U-233,-234	2.0480	PCI/G		R
TR09	TR00298WCU2	6.0	9.0	cm	REAL	TRG	AM-241	11.2400	PCI/G		JA
TR09	TR00298WCU2	6.0	9.0	cm	REAL	TRG	PU239/40	59.2200	PCI/G		A
TR09	TR00298WCU2	6.0	9.0	cm	REAL	TRG	U-235	0.0265	PCI/G	J	A
TR09	TR00298WCU2	6.0	9.0	cm	REAL	TRG	U-238DA	1.1870	PCI/G		A
TR09	TR00298WCU2	6.0	9.0	cm	REAL	TRG	U-233,-234	1.2140	PCI/G		A
TR09	TR00297WCU2	9.0	12.0	cm	REAL	TRG	AM-241	3.6800	PCI/G		R
TR09	TR00297WCU2	9.0	12.0	cm	REAL	TRG	PU239/40	33.4600	PCI/G		A
TR09	TR00297WCU2	9.0	12.0	cm	REAL	TRG	U-235	0.0336	PCI/G	J	A
TR09	TR00297WCU2	9.0	12.0	cm	REAL	TRG	U-238DA	1.4500	PCI/G		A
TR09	TR00297WCU2	9.0	12.0	cm	REAL	TRG	U-233,-234	1.4270	PCI/G		A
TR09	TR00296WCU2	15.0	21.0	cm	REAL	TRG	AM-241	1.0050	PCI/G		A
TR09	TR00296WCU2	15.0	21.0	cm	REAL	TRG	PU239/40	7.4510	PCI/G		A
TR09	TR00296WCU2	15.0	21.0	cm	REAL	TRG	U-235	0.1045	PCI/G	J	A
TR09	TR00296WCU2	15.0	21.0	cm	REAL	TRG	U-238DA	1.5840	PCI/G		A
TR09	TR00296WCU2	15.0	21.0	cm	REAL	TRG	U-233,-234	1.2540	PCI/G		A
TR09	TR00295WCU2	21.0	27.0	cm	REAL	TRG	AM-241	0.2668	PCI/G		A
TR09	TR00295WCU2	21.0	27.0	cm	REAL	TRG	PU239/40	2.4090	PCI/G		A
TR09	TR00295WCU2	21.0	27.0	cm	REAL	TRG	U-235	0.0410	PCI/G	J	A
TR09	TR00295WCU2	21.0	27.0	cm	REAL	TRG	U-238DA	1.1810	PCI/G		A
TR09	TR00295WCU2	21.0	27.0	cm	REAL	TRG	U-233,-234	0.8531	PCI/G		A
TR09	TR00294WCU2	33.0	39.0	cm	REAL	TRG	AM-241	0.0632	PCI/G		A
TR09	TR00294WCU2	33.0	39.0	cm	REAL	TRG	PU239/40	0.4227	PCI/G		A
TR09	TR00294WCU2	33.0	39.0	cm	REAL	TRG	U-235	0.0152	PCI/G	J	A
TR09	TR00294WCU2	33.0	39.0	cm	REAL	TRG	U-238DA	0.9739	PCI/G		A
TR09	TR00294WCU2	33.0	39.0	cm	REAL	TRG	U-233,-234	1.3500	PCI/G		A
TR09	TR00293WCU2	45.0	51.0	cm	REAL	TRG	AM-241	0.0303	PCI/G		A
TR09	TR00293WCU2	45.0	51.0	cm	REAL	TRG	PU239/40	0.2207	PCI/G		A
TR09	TR00293WCU2	45.0	51.0	cm	REAL	TRG	U-235	0.0771	PCI/G	J	A
TR09	TR00293WCU2	45.0	51.0	cm	REAL	TRG	U-238DA	1.1350	PCI/G		A
TR09	TR00293WCU2	45.0	51.0	cm	REAL	TRG	U-233,-234	0.9421	PCI/G		A
TR09	TR00292WCU2	69.0	75.0	cm	REAL	TRG	AM-241	0.0066	PCI/G	J	A
TR09	TR00292WCU2	69.0	75.0	cm	REAL	TRG	PU239/40	0.0191	PCI/G	J	A
TR09	TR00292WCU2	69.0	75.0	cm	REAL	TRG	U-235	0.0000	PCI/G	J	A
TR09	TR00292WCU2	69.0	75.0	cm	REAL	TRG	U-238DA	0.9048	PCI/G		A
TR09	TR00292WCU2	69.0	75.0	cm	REAL	TRG	U-233,-234	0.9238	PCI/G		A
TR09	TR00291WCU2	93.0	99.0	cm	REAL	TRG	AM-241	0.0140	PCI/G	J	R
TR09	TR00291WCU2	93.0	99.0	cm	REAL	TRG	PU239/40	0.0784	PCI/G		A
TR09	TR00291WCU2	93.0	99.0	cm	REAL	TRG	U-235	0.1095	PCI/G	J	A
TR09	TR00291WCU2	93.0	99.0	cm	REAL	TRG	U-238DA	1.1890	PCI/G		A
TR09	TR00291WCU2	93.0	99.0	cm	REAL	TRG	U-233,-234	1.2840	PCI/G		A

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LOCATION	SAMPLE	START	END	UNITS	QC	ID	ANALYTE	RESULT	UNITS	QUAL	VAL
TR11	TR00274WCU2	93.0	99.0	cm	REAL	TRG	AM-241	0.0033	PCI/G	J	A
TR11	TR00274WCU2	93.0	99.0	cm	REAL	TRG	PU239/40	0.0279	PCI/G	J	A
TR11	TR00274WCU2	93.0	99.0	cm	REAL	TRG	U-235	0.0238	PCI/G	J	V
TR11	TR00274WCU2	93.0	99.0	cm	REAL	TRG	U-238DA	1.0940	PCI/G		V
TR11	TR00274WCU2	93.0	99.0	cm	REAL	TRG	U-233,-234	1.1460	PCI/G		V
TR12	TR00267WCU2	0.0	3.0	cm	REAL	TRG	AM-241	34.1700	PCI/G		JA
TR12	TR00267WCU2	0.0	3.0	cm	REAL	TRG	PU239/40	591.2000	PCI/G		A
TR12	TR00267WCU2	0.0	3.0	cm	REAL	TRG	U-235	0.1239	PCI/G	J	A
TR12	TR00267WCU2	0.0	3.0	cm	REAL	TRG	U-238DA	1.8320	PCI/G		A
TR12	TR00267WCU2	0.0	3.0	cm	REAL	TRG	U-233,-234	1.0140	PCI/G		A
TR12	TR00266WCU2	3.0	6.0	cm	REAL	TRG	AM-241	13.5300	PCI/G		A
TR12	TR00266WCU2	3.0	6.0	cm	REAL	TRG	PU239/40	93.0900	PCI/G		A
TR12	TR00266WCU2	3.0	6.0	cm	REAL	TRG	U-235	0.0323	PCI/G	J	V
TR12	TR00266WCU2	3.0	6.0	cm	REAL	TRG	U-238DA	1.3680	PCI/G		V
TR12	TR00266WCU2	3.0	6.0	cm	REAL	TRG	U-233,-234	0.7726	PCI/G		V
TR12	TR00265WCU2	6.0	9.0	cm	REAL	TRG	AM-241	4.5880	PCI/G		A
TR12	TR00265WCU2	6.0	9.0	cm	REAL	TRG	PU239/40	38.4000	PCI/G		A
TR12	TR00265WCU2	6.0	9.0	cm	REAL	TRG	U-235	0.0433	PCI/G	J	V
TR12	TR00265WCU2	6.0	9.0	cm	REAL	TRG	U-238DA	0.8397	PCI/G		V
TR12	TR00265WCU2	6.0	9.0	cm	REAL	TRG	U-233,-234	0.6721	PCI/G		V
TR12	TR00264WCU2	9.0	12.0	cm	REAL	TRG	AM-241	4.3870	PCI/G		A
TR12	TR00264WCU2	9.0	12.0	cm	REAL	TRG	PU239/40	28.7000	PCI/G		A
TR12	TR00264WCU2	9.0	12.0	cm	REAL	TRG	U-235	0.0370	PCI/G	J	V
TR12	TR00264WCU2	9.0	12.0	cm	REAL	TRG	U-238DA	0.9627	PCI/G		V
TR12	TR00264WCU2	9.0	12.0	cm	REAL	TRG	U-233,-234	0.6735	PCI/G		V
TR12	TR00263WCU2	15.0	21.0	cm	REAL	TRG	AM-241	0.7345	PCI/G		A
TR12	TR00263WCU2	15.0	21.0	cm	REAL	TRG	PU239/40	4.9130	PCI/G		A
TR12	TR00263WCU2	15.0	21.0	cm	REAL	TRG	U-235	0.0501	PCI/G	J	V
TR12	TR00263WCU2	15.0	21.0	cm	REAL	TRG	U-238DA	0.7159	PCI/G		V
TR12	TR00263WCU2	15.0	21.0	cm	REAL	TRG	U-233,-234	0.8730	PCI/G		V
TR12	TR00262WCU2	21.0	27.0	cm	REAL	TRG	AM-241	0.1227	PCI/G		A
TR12	TR00262WCU2	21.0	27.0	cm	REAL	TRG	PU239/40	0.7079	PCI/G		A
TR12	TR00262WCU2	21.0	27.0	cm	REAL	TRG	U-235	0.0127	PCI/G	J	V
TR12	TR00262WCU2	21.0	27.0	cm	REAL	TRG	U-238DA	0.5568	PCI/G		V
TR12	TR00262WCU2	21.0	27.0	cm	REAL	TRG	U-233,-234	0.5593	PCI/G		V
TR12	TR00260WCU2	33.0	39.0	cm	REAL	TRG	AM-241	0.0353	PCI/G		A
TR12	TR00260WCU2	33.0	39.0	cm	REAL	TRG	PU239/40	0.1633	PCI/G		A
TR12	TR00260WCU2	33.0	39.0	cm	REAL	TRG	U-235	0.0691	PCI/G	J	V
TR12	TR00260WCU2	33.0	39.0	cm	REAL	TRG	U-238DA	0.7254	PCI/G		V
TR12	TR00260WCU2	33.0	39.0	cm	REAL	TRG	U-233,-234	0.5147	PCI/G		V
TR12	TR00258WCU2	45.0	51.0	cm	REAL	TRG	AM-241	0.0504	PCI/G		A
TR12	TR00258WCU2	45.0	51.0	cm	REAL	TRG	PU239/40	0.2425	PCI/G		A
TR12	TR00258WCU2	45.0	51.0	cm	REAL	TRG	U-235	0.0355	PCI/G	J	V
TR12	TR00258WCU2	45.0	51.0	cm	REAL	TRG	U-238DA	0.7570	PCI/G		V
TR12	TR00258WCU2	45.0	51.0	cm	REAL	TRG	U-233,-234	0.5615	PCI/G		V
TR12	TR00257WCU2	69.0	75.0	cm	REAL	TRG	AM-241	0.1117	PCI/G		A
TR12	TR00257WCU2	69.0	75.0	cm	REAL	TRG	PU239/40	0.8490	PCI/G		A
TR12	TR00257WCU2	69.0	75.0	cm	REAL	TRG	U-235	0.0148	PCI/G	J	V
TR12	TR00257WCU2	69.0	75.0	cm	REAL	TRG	U-238DA	0.5752	PCI/G		V
TR12	TR00257WCU2	69.0	75.0	cm	REAL	TRG	U-233,-234	0.6637	PCI/G		V