2151

PROJECT SPECIFIC PLAN FOR

RADIATION SCANNING SYSTEM (RSS) CALIBRATION

Project Number: 50.03.58

Revision: 0

Date: July 21, 1997

Prepared by: Fluor Daniel Fernald

Prepared for: U.S. Department of Energy
Fernald Field Office

Under Contract DE-AC05-92OR21972

INFORMATION ONLY
CONTROLLED

APPROVAL:

7/21/97
Chris Sutton, Project Lead — Date
Soil Characterization Excavation Project

for 7/21/97
Reinhard Friske, Quality Assurance — Date
Soil Characterization Excavation Project

7/21/97
Joan White, Field Manager — Date
Soil Characterization Excavation Project

20701-PSP-0001

VARIANCE / FIELD CHANGE NOTICE

V/F 50.03.58-1

WBS NO.: 50.03.58

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PROJECT TITLE: Radiation Scanning System Calibration

Date: 7/28/97

VARIANCE / FIELD CHANGE NOTICE (Include justification):

Field Change Notice:

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1. Section 2.1.2 As written, this section requires HPGe characterization through a 180° arc.prior to making field measurements. The first sentence will be deleted and this section will be changed so that:

   a. An HPGe crystal will be characterized through a 180° arc to ensure that there are no angular response differences within the HPGe crystals as currently characterized in procedure EQT-22.

   b. This 180° characterization of the HPGe corresponds to the 180° characterization applied to the RSS.

2. Section 2.2.2 will be modified. One measurement will be collected at RSS-A11-1 using a 4 second acquistion time over a period of 400 seconds to permit real-time strip conversion factors.This 400 seconds measurement yields 100 four second spectra. The last sentence of the current section will be modified to read "using a 300 second acquisiton time" for consistency in time terminology.

3. Section 2.5 will be modified to reflect the changes in Section 2.2.2. The second sentence of this section will be changed to state "One duplicate RSS static 300 second measurement will be collected for each RSS study area". A second sentence will be added here to to state that "No duplicate RSS measurement using the 4 second acquisiton time for a total of 400 seconds will be necessary since duplication is built in".

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4. Section 2.2.3. This section will be modified to require a Field Control Station (FSS) measurement at point FSS-A11-1 on a daily basis for each HPGe if multiple HPGe detectors are used for location measurements. A sentence will be added which states " If multiple HPGe units are used for location measurements a Field Control Station (FCS) measurement shall be performed at point RSS-A11-1 daily for each detector".

5. Section 3.2. The first sentence of this section will be modified to state "verbal approval". The sentence as currently written states "written approval" which is incorrect.

REQUESTED BY: Dale Seiller Date: 7/28/97

X IF REQD	VARIANCE/FCN APPROVAL	DATE	X IF REQD	VARIANCE/FCN APPROVAL	DATE
X	QUALITY ASSURANCE	7-29-97	X	PROJECT MANAGER	7/28/97
	DATA QUALITY MANAGEMENT		X	FIELD MANAGER	7/28/97
	ANALYTICAL CUSTOMER SUPPORT			OTHER for Joan White	
	OTHER			OTHER	

VARIANCE/FCN APPROVED [X]YES [ ]NO

REVISION REQUIRED: [ ]YES [x]NO

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PROJECT MANAGER:	DOCUMENT CONTROL: Esther Dittmer	OTHER:
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FIELD MANAGER:	OTHER:	OTHER:

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Justification:

1. Modification of Section 2.1.2 permits field measurements with currently characterized HPGe detectors.

2. Modification of Section 2.2.2 permits collecting data needed for formulating real-time strip conversion factors. This information was not included in the PSP.

3. Modification of Section 2.5 states why the 4 second acquisition count for a total of 400 seconds does not require a duplicate measurement for quality control.

4. Modification of Section 2.2.3 to include FCS measurement when using multiple HPGe detectors is added to allow any differences in the detector's measurement ability to be quantified and corrected.

5. Modification of Section 3.2 correctly allows a variance to the PSP to be obtained verbally up to 7 days prior to obtaining written approval.

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WBS NO.: 50.03.58 20701-PSP-RE-0001	Page 1 of ~~12~~ 9
PROJECT TITLE: Radiation Scanning System Calibration	Date: 8/25/97

VARIANCE / FIELD CHANGE NOTICE (Include justification):

Field Change Notice: 2151

Section 2.3 :Add section 2.3.2 to read as follows:

2.3.2 Alternate Mobil RSS Measurement Collection Area

If conditions in the South Field Test Area are unsuitable for collection of mobil RSS data, an alternate area or alternate areas may be chosen to perform the mobil measurements. If measurement of an alternate area is required, the first choice will be in the USID area north of the Sewage Treatment Plant as identified as Test Area 1 in Variance 50.03.49-2 figure 2-3. The RSS operation parameters for alternate test areas will be as described in section 2.3.1, a) through d). The project lead will decide if data collection using RTRAK will be required in alternate test areas. If RTRAK data collection is necessary, the RTRAK will be operated in the same environmental conditions and under the same parameters as RSS as described in section 2.3.1, a) through d).

Section 2.4 modify second paragragh to read:

Mobil measurement collection using the RSS does not require moisture/density gauge or HPGe measurements unless requested by the Project Lead. If additional static test areas, in addition to those identified in this PSP are identified as being needed, physical samples, RTRAK, HPGe, RSS, and environmental conditions will be collected as determined by the Project Lead.

INFORMATION ONLY

Justification:

1. Modification of Section 2.3 permits the selection of an alternate mobile RSS measurement test area.

2. Modification of Section2.4 clarifies the supprting information required for static and mobil RSS measurements.

3. Addition of figure 2-3 supports modification of section 2.3.

ORIGINAL

REQUESTED BY: Dale Seiller Date: 8/25/97

X IF REQD	VARIANCE/FCN APPROVAL	DATE	X IF REQD	VARIANCE/FCN APPROVAL	DATE
X	QUALITY ASSURANCE	8-26-97	X	PROJECT MANAGER	8/25/97
	DATA QUALITY MANAGEMENT		X	FIELD MANAGER	8/25/97
	ANALYTICAL CUSTOMER SUPPORT			OTHER	
	OTHER			OTHER	

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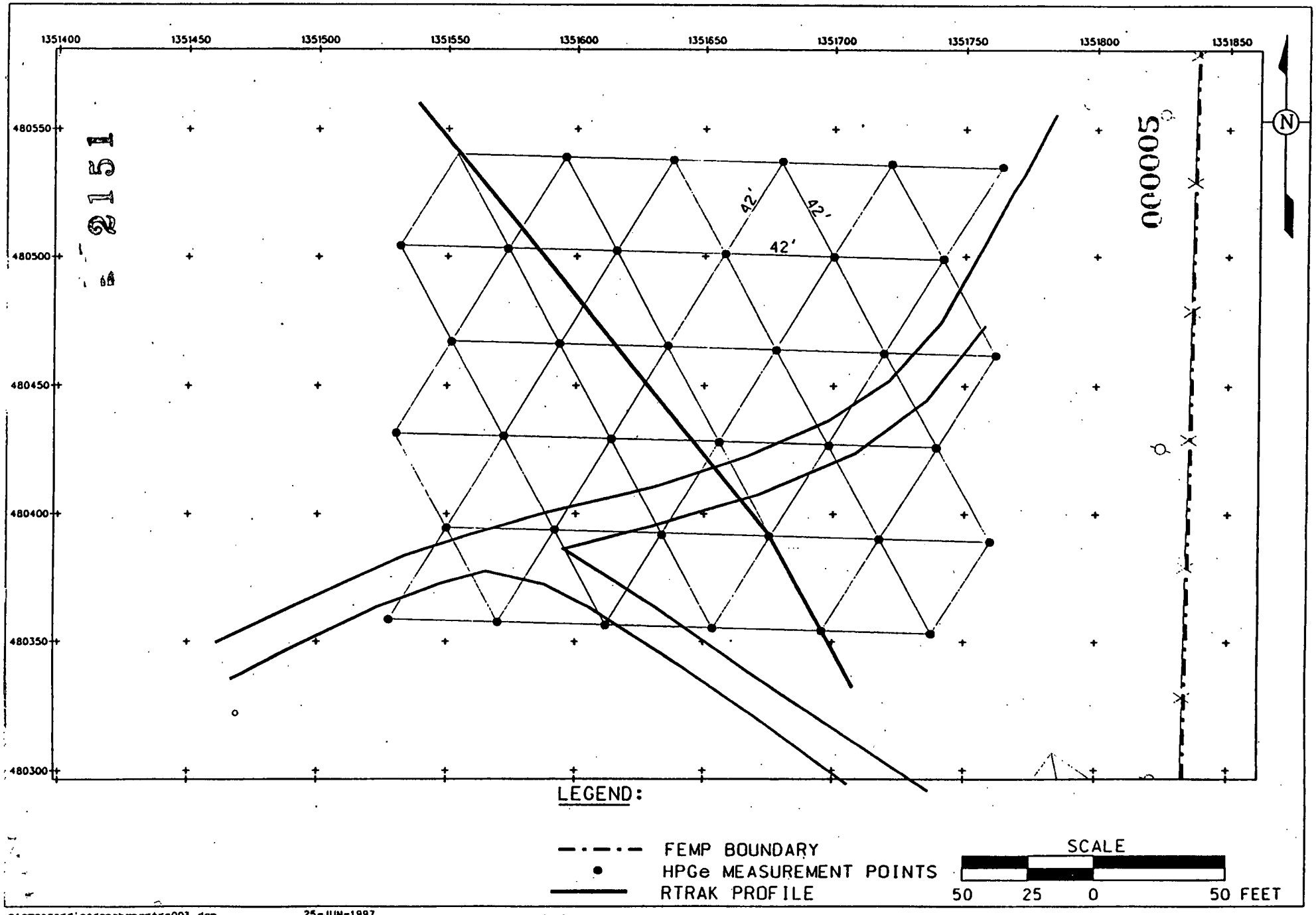

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FIGURE 2-3 RTRAK AND USID TEST AREA

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VARIANCE / FIELD CHANGE NOTICE (Include justification):

Justification:

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This variance addressed a repeat of portions of the project for the calibration of the RSS, an extension of the moving verification of the RSS/RTRAK systems to an area of higher activity concentrations. The initial calibration measurements provided results that raised questions because the regression equations were unexpectedly different from those generated for the similar RTRAK system and because the intercept differed significantly from zero. In addition this variance modifies the locations for the measurements to extend the range of the calibration and reduce data gaps across that range.

Field Change Notice:

See attached

INFORMATION ONLY

REQUESTED BY: Dale Seiller Date: 10/28/97

X IF REQD	VARIANCE/FCN APPROVAL	DATE	X IF REQD	VARIANCE/FCN APPROVAL	DATE
X	QUALITY ASSURANCE	10-28-97	X	PROJECT MANAGER	10/28/97
	DATA QUALITY MANAGEMENT		X	FIELD MANAGER	10/28/97
	ANALYTICAL CUSTOMER SUPPORT		X	CHAR. & SAMLING MGR.	10/28/97
	OTHER			OTHER	10/28/97

VARIANCE/FCN APPROVED [X]YES [ ]NO

REVISION REQUIRED: [ ]YES [x]NO

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QUALITY ASSURANCE:	OTHER:	OTHER:
FIELD MANAGER:	OTHER:	OTHER:

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ORIGINAL

Field Change Notice:

All supporting information defined in Section 2.4 of the PSP for Project 50.03.58 shall be collected during the measurements described in this variance.

1. REPEAT OF STATIC RSS CALIBRATION MEASUREMENTS

A-CALIBRATION MEASUREMENTS

Static calibration measurements will be made at the 10 locations identified in Table 1.

TABLE 1
STATIC RSS CALIBRATION LOCATIONS

HPGe Comp Study Area Name	Area Description	Measurement Location I.D.	Northing	Easting
Area 9	SR128 and South Entrance Road	RSS-A9-1	476872.35	1350550.20
Area 15	South Center Side of South Field	RSS-A15-2	477818.50	1347958.00
Area 13	Northwest Center Side of South Field	RSS-A13-3	478011.00	1347804.00
Area 11	USID Sample Point and Field Quality Control Point 15	RSS-A11-3	480391.41	1351675.86
Area 3	Drum Bailing Area	RSS-A3-6	481797.43	1350516.45
		RSS-A3-7	481660.93	1350511.74
		RSS-A3-8	481786.12	1350517.31
		RSS-A3-9	481661.23	1350514.29
		RSS-A3-10	481670.74	1350512.82
		RSS-A3-11	481724.58	1350515.82

Measurements will be performed at ALL locations using the RSS, RTRAK, and the HPGe. Measurements must be collected after 11:00 AM (to avoid elevated natural radon concentrations).

1. The RSS measurements will be performed in two orientations, first with the RSS in a normal operating orientation, then rotated 90 degrees. In the second orientation, the R.S. crystal will be in an orientation equivalent to that of the RTRAK. The RSS and RTRAK measurements will be conducted using continuous acquisition times of 300 sec. ONE duplicate measurement will be collected in EACH study area using only the RSS.

2. HPGe measurements will be made at heights of 1 meter, 31 cm, and 15 cm at each location. A 15 minute acquisition time will be used. ONE duplicate measurement will be made at the 31 cm height in EACH study area. The measurement numbering system will follow the design of section 2.4.5 in the PSP.

3. Moisture gauge measurements will be made for all HPGe measurement points.

B-STATIC CALIBRATION VERIFICATION

Following the measurements for recalibration, RSS, RTRAK, and HPGe measurements will be made in locations different from those used for the calibration to provide a verification of the calibration. These measurements will be made after 11:00 AM (to avoid natural elevated radon concentrations). The calibration verification measurements will be performed at the locations described in Table 2.

1. RSS and RTRAK measurements will be collected using a continuous acquisition period of 300 sec. The RSS will be operated in its normal orientation. In EACH study area ONE duplicate measurement, using the RSS will be made using 75 sequential 4 sec acquisition time periods, for a total acquisition time of 300 sec each.

2. HPGe measurements will be collected using a 15 minute acquisition period at a height of 31 cm. In EACH study area ONE duplicate measurement using HPGe will be made. The HPGe measurement numbering system will follow the design of section 2.4.5 of the PSP.

3. Moisture gauge measurements will be taken at all USID HPGe measurement locations. Moisture cores will be taken in the Drum Bailing Area at a minimum of two per the test area. The Project Coordinator will determine representative locations for the two cores in the USID area. The Project Coordinator will determine wether additional cores should be collected in the field based on the soil conditions at the time of the measurements.

TABLE 2
LOCATIONS FOR RSS STATIC VERIFICATION MEASUREMENTS

HPGe Comp Study Area Name	Area Description	RSS Study Area Name	Northing	Easting
Area 11	USID Study Area	RSS-A11-4	480538.78	1351532.61
		RSS-A11-5	480466.29	1351593.76
Area 3	Drum Bailing Area	RSS-A3-12	481667.06	1350514.15
		RSS-A3-13	481787.23	1350516.49
		RSS-A3-14	481719.84	1350515.99

2. MOVING RSS VERIFICATION - REPEATED PROFILE MEASUREMENTS

A moving verification of the RSS calibration will be conducted in the USID Area. The measurements will be made along a straight-line profile similar to that described in V/F50.03.58-1. The actual profile path will be displaced to the West of the profile path described in that variance to avoid the depressions created in the soil by the previous RTRAK measurements. The profile path and accompanying coordinates are shown in Figure 1. To allow comparisons with RTRAK data, measurements will also be performed using the RTRAK. The travel speed of the RSS will be controlled by having the RSS operator follow closely behind the RTRAK while it travels along the profile path collecting data at the prescribed speed. The measurements will performed as a series of 20 straight-line passes along the profile path. The following operating parameters will be used for both the RTRAK and the RSS:

- Travel speed: 1 mph
- Acquisition time: 4 seconds
- Detector Height: 31 cm

3. MOVING CALIBRATION VERIFICATION - FULL AREA SCAN

Full-area scans will be performed within the Drum Bailing Area to serve as an additional verification of the RSS/RTRAK detector systems. The area to be scanned and accompanying coordinates are shown in Figure 2. The area to be scanned will encompass the profile path defined in Variance 50.03.49-3. Measurements will be performed using the RSS, RTRAK, and HPGe.

1. HPGe measurements will be performed at a detector height of 1 meter. Measurements will be located on a triangular grid at a spacing radius of approximately 6 meters between grid intersection points. The acquisition time for each measurement will be 15 minutes (900 sec). The measurement numbering system will follow the design given in section 2.4.5 of the PSP and use the sequential numbers provided in Figure 2 of this variance.

2. RSS and RTRAK measurements will be performed under the following operating parameters:

   - Travel speed: 1 mph
   - Acquisition time: 4 seconds
   - Detector Height: 31 cm

   The RSS will be operated independently of the RTRAK with the travel speed controlled by the operator, supported by observations of the Field Supervisor. The walking speed will be determined using data from the GPS and periodic measurements of the time period required for the operator to traverse a known distance.

3. An additional test of the RTRAK will be performed to determine whether measurements using a 2 sec acquisition time with a 4 sec moving filter will provide the same results as the 4 sec acquisition time measurements. The RTRAK will be operated using the following operating parameters:

   - Travel speed: 1 mph
   - Acquisition time: 2 seconds
   - Detector Height: 31 cm
   - The data will be processed using a 4 sec moving filter.

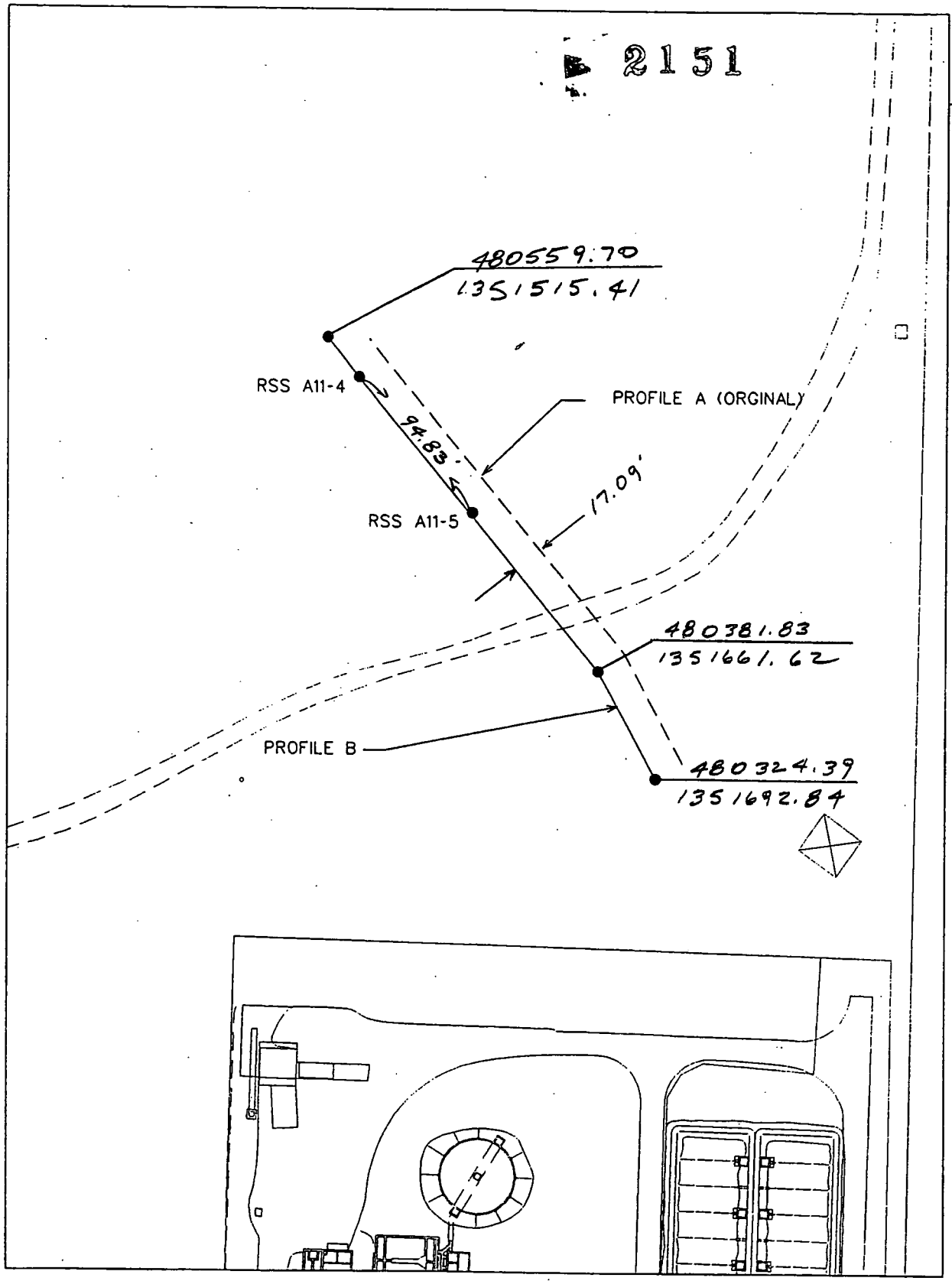

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FIGURE 1 - AREA 11 (USID STUDY AREA)

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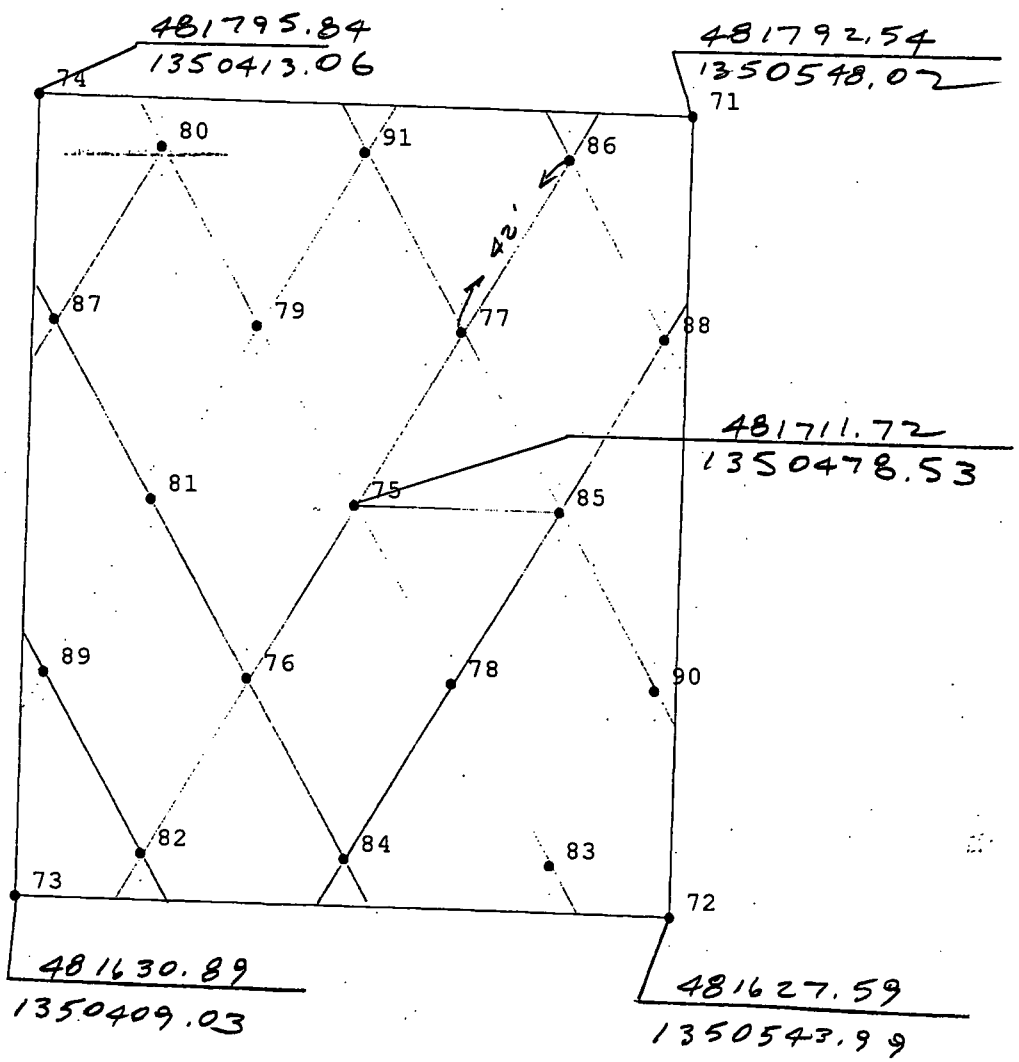

Figure 2. Drum Bailing Area 3

VARIANCE / FIELD CHANGE NOTICE	V/F 50.03.58-4
WBS NO.: 50.03.58	Page 1 of 2
PROJECT TITLE: Radiation Scanning System Calibration Document #20701-PSP-0001	Date: 12/8/97

VARIANCE / FIELD CHANGE NOTICE (Include justification):

Justification:

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This variance clarifies soil moisture measurements required and relocates the full area scan acreage described by Figure 2 in variance V/F 50.03.58-3. The full area scan must be relocated to prevent using the RTRAK and RSS devices in a High Contamination Area. This will prevent unecessary decontamination and waste generation.

Field Change Notice:

1. Change paragraph 3. In the **STATIC CALIBRATION VERIFICATION** section of varience V/F 50.03.58-3 to read:

   Moisture gauge measurements will be taken at all HPGe measurement locations. If conditions preclude the use of the *in situ* moisture gauge, moisture cores may be taken.

2. Add a paragraph to the **MOVING RSS VERIFICATION** section which reads:

   Moisture gauge measurements will be taken at all HPGe measurement locations. If conditions preclude the use of the *in situ* moisture gauge, moisture cores may be taken.

3. Change all references to Figure 2 in the **MOVING CALIBRATION VERIFICATION** section to Figure 3.

4. See attached Figure 3.

INFORMATION ONLY

REQUESTED BY: Dale Seiller Date: 12/8/97

X IF REQD	VARIANCE/FCN APPROVAL	DATE	X IF REQD	VARIANCE/FCN APPROVAL	DATE
X	QUALITY ASSURANCE	12-10-97	X	PROJECT LEAD	12/10/97
	DATA QUALITY MANAGEMENT		X	FIELD MANAGER	12/15/97
	ANALYTICAL CUSTOMER SUPPORT		X	CHAR. & SAMLING MGR.	12/9/97
	OTHER			OTHER	

VARIANCE/FCN APPROVED [X]YES [ ]NO

REVISION REQUIRED: [ ]YES [x]NO

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QUALITY ASSURANCE:	OTHER:	OTHER:
FIELD MANAGER:	OTHER:	OTHER:

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ORIGINAL

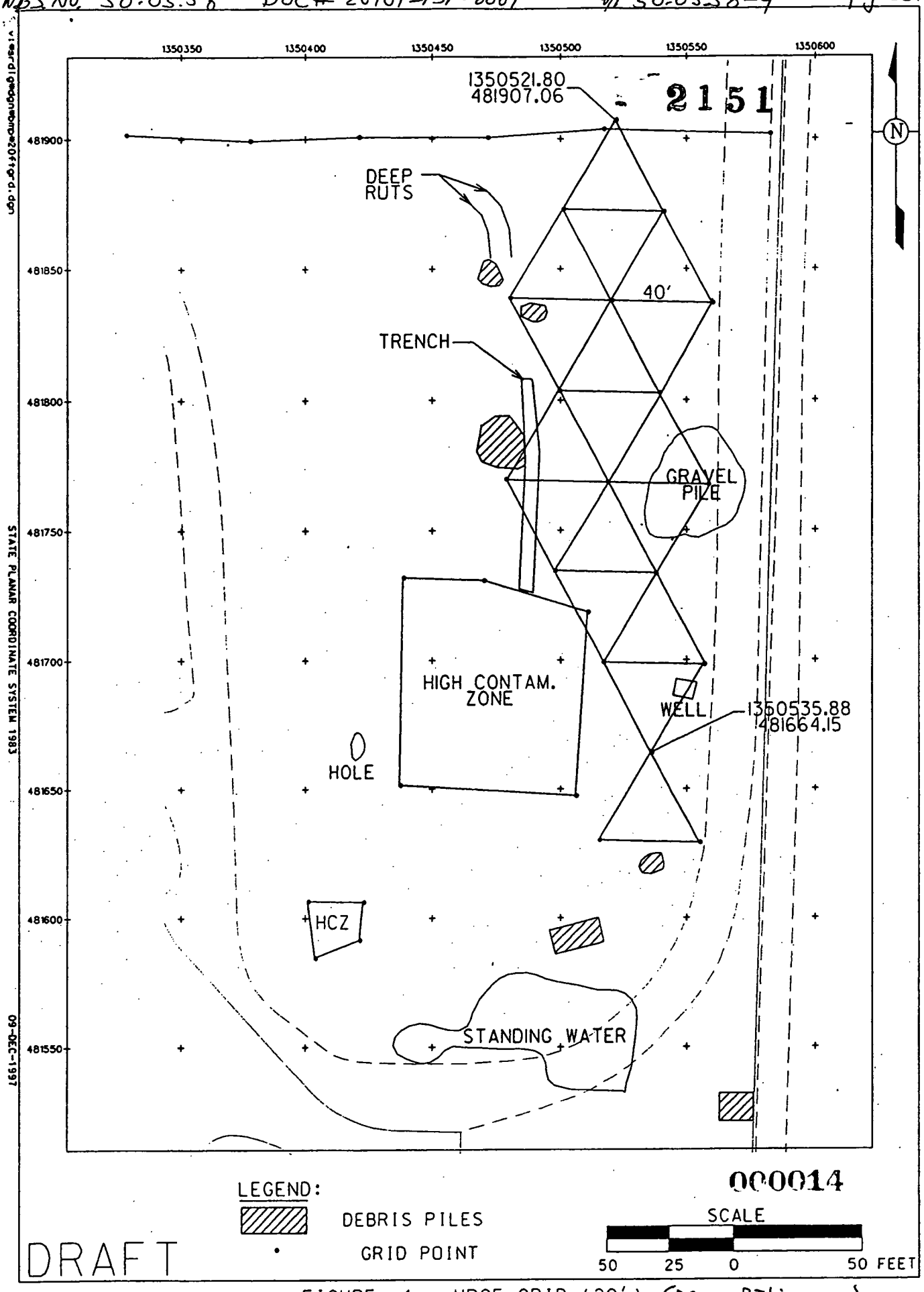

FIGURE 1. HPGE GRID (20') (Drum Bailing area)

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A	Data Quality Objective

1.0 INTRODUCTION

1.1 PURPOSE

This Project Specific Plan describes certain activities needed to characterize, calibrate, and verify calibration of the newly constructed Radiation Scanning System (RSS).

Real-time monitoring capability currently consists of a sodium iodide detector mounted on a John Deer™ tractor (RTRAK system) and a high purity germanium crystal mounted on a tripod (HPGE system). The need to have a portable tool to quickly scan small areas inaccessible to the large RTRAK became apparent during recent field activities. As a result of this need, the same type of NaI crystal currently mounted on the RTRAK, a 4-x-4-x-16-inch crystal, was mounted on a three wheeled jogging stroller for increased accessibility to small, or wooded areas. Before the tool can be used in support of soil remediation activities, the crystal needs to be characterized, the system calibrated to the HPGe, and the calibration verified. Successful completion of these tests will render the RSS applicable for use in soil characterization for applications where the RTRAK has been determined acceptable, as described in the RTRAK Applicability Study, Rev.0, July 1997.

As identified in the RTRAK Applicability Study, the RTRAK NaI system is calibrated to the HPGe system. To ensure comparability of measurements between the RTRAK and the RSS, the RSS also needs to be calibrated to the HPGe system.

Therefore, the work to be performed under this PSP is:

a) To CHARACTERIZE the Radiation Scanning System (RSS) sodium iodide (NaI) crystal to determine its angular response to gamma rays.

b) To CALIBRATE the RSS to the High Purity Germanium (HPGe) system.

c) To VERIFY CALIBRATION of the RSS by comparing measurements collected by the RSS NaI and the Radiation Tracking (RTRAK) NaI system, at a location chosen from the RTRAK Applicability Study.

Work will be performed in accordance with the Sitewide Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Quality Assurance Project Plan (SCQ), and Data Quality Objective (DQO) SL-045 (Appendix A).

1.2 SCOPE

The testing for this project will consist of conducting real-time measurements with the HPGe and RSS systems in the areas previously studied under the A1PI Remedial Action Work Plan Comparability Study, Part B (50.03.40) and Variances 50.03.40.03-2 and 3; and the PSP for Determining the Optimal RTRAK Detector Speed and Acquisition Time (50.03.49) and Variances 50.30.49-2 and 3. From theses studies and Variances, the following areas were chosen:

Area 3	Drum Bailing Area
Area 9	Near the SR128 and the South Entrance Road
Area 11	Near the Sewage Treatment Plant Road (Field Quality Control Point 15)
Area 13	Northwest Center Side of South Field
Area 15	South Center Side of South Field
Area 16	North Center Side of South Field

Troxler moisture/density measurements will be collected at each HPGe location to enable the user of the data to convert the field HPGe measurements to a dry weight measurements. If conditions are not suitable for the use of the Troxler, a moisture core will be taken for on site moisture analysis.

If during the course of conducting this test, the need to collect data from additional areas is identified, the data collection will consist of a combination of HPGe, RSS, RTRAK and physical samples as needed. General guidance to be followed is given in this PSP, however the details of any additional testing will be specified in an approved variance to this PSP.

1.3 KEY PERSONNEL

Key personnel responsible for conducting work in accordance with this PSP consist of team members from the Soils Characterization and Excavation Project (SCEP), Soils and Miscellaneous Media Projects (SMMP), and the FEMP Laboratory. Listed on Table 1-1 below are the key personnel.

CONTROLLED

TABLE 1-1
KEY PERSONNEL

TITLE	PRIMARY	ALTERNATE
Project Lead	Chris Sutton	Tom Cox
Project Coordinator	Joan White	Dale Seiller
Field Sampling Lead	Mike Frank	Tom Buhrlage
Laboratory Contact	Bill Westerman	Al Bacon
Quality Assurance Contact	Reinhart Friske	Harold Swiger
Health and Safety Contact	Jack Patrick	Kevin Tschaenn
Data Management Contact	Jeff Maple	Susan Marsh

2.0 PERFORMING THE TEST

2.1 CHARACTERIZATION OF RSS NaI CRYSTAL AND HPGe CRYSTAL

2.1.1 RSS NaI Crystal Characterization

Before any field measurements are made with the RSS NaI crystal, the RSS crystal must first be characterized. In characterization, the RSS crystal angular response to a U_3O_8 standard will be determined. The U_3O_8 standard will be placed in increments of 10 degree angles, from 0-180 degrees from the center of the crystal, at 1 meter and 2 meter distances. From this, an efficiency curve (efficiency is equal th counts per second divided by disintegrations per second) will be constructed. The efficiency curve will display the conversion factor on the y-axis and the energy (keV) on the x-axis. Energies used will be from approximately 60 to 1300 keV which represents the gamma emissions from the U-238 daughter Pa-234 (16 hour half life). Angular measurements a 1.0 meters and 2.0 meters will be used to determine the RSS Field of view which is expected to be the same as the RTRAK (approximately 1.2 meters).

Characterization will be conducted in accordance with Procedure EQT-22 Characterization of Gamma Sensitive Detectors, Rev 0. The characterization will differ from the procedure in two ways:

a) The source will be placed at angles from 0-180 degrees, instead of 0-90 degrees as specified in the procedure.

b) The source will be U_3O_8 instead of the americium-241, cesium-137, europium-152, and cobalt-60 sources as specified in the procedure

2.1.2 HPGe Crystal Characterization

Before any field measurements are made with the HPGe crystal, the HPGe crystal must first be re-characterized. The current characterization of the HPGe crystal was in 10 degree increments from 0-90 degrees. For the purposes of this test the HPGe crystal will be re-characterized in 10 degree increments from 0-180 degrees. From this the HPGe crystal angular response to the americium-241, cesium-137, europium-152, and cobalt-60 will be determined.

Characterization will be conducted in accordance with Procedure EQT-22 Characterization of Gamma Sensitive Detectors, Rev 0. The characterization will differ from the procedure in one way: the sources will be placed at angles from 0-180 degrees instead of 0-90 degrees as specified in the procedure.

2.2 CALIBRATION OF THE RSS

Calibration of the RSS will take place at the selected test areas identified in Section 1.2 Scope and Table 2.1. The areas selected will be visually verified to ensure that they have not been remediated or disturbed. The areas selected represent "background", "low contamination", "medium contamination" and "high contamination" activity levels.

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RSS measurements collected from these 10 selected areas will be compared to the HPGe system measurements at the 31 cm and 1.0 meter height using 4 isotopes: potassium-40, radium-226, thorium-232, and total uranium. Equations derived from the comparisons will be used to generate calibration curves.

TABLE 2-1
RADIATION SCANNING SYSTEM (RSS) CALIBRATION AREAS

HPGe Comp Study Area Name	Area Description	RSS Study Area Name	Easting	Northing
Area 3	Drum Bailing Area	RSS-A3-1	1350511.83	481664.93
		RSS-A3-2	1350515.96	481683.41
		RSS-A3-3	1350515.54	481724.59
		RSS-A3-4	1350515.67	481778.35
		RSS-A3-5	1350515.72	481802.19
Area 9	SR128 and South Entrance Road	RSS-A9-1	1350550.20	476872.35
Area 11	USID Sample Point and Field Quality Control Point 15	RSS-A11-1	1351675.86	480391.41
Area 13	Northwest Center Side of South Field	RSS-A13-1	1347804.00	478011.00
Area 15	South Center Side of South Field	RSS-A15-1	1347958.00	477818.50
Area 16	South Field	RSS-A16-1	1348028.00	477982.00

CONTROLLED

2.2.1 Static RSS and HPGe Measurement Locations

Areas in which measurements for both the static RSS and HPGe readings are identified on Figure 2-1 and Table 2-1. There are 6 distinct areas identified (Areas 3, 9, 11, 13, 15, and 16) however, within several of the areas, multiple reading locations will be staked and surveyed. A total of 10 locations will be measured with the HPGe and RSS.

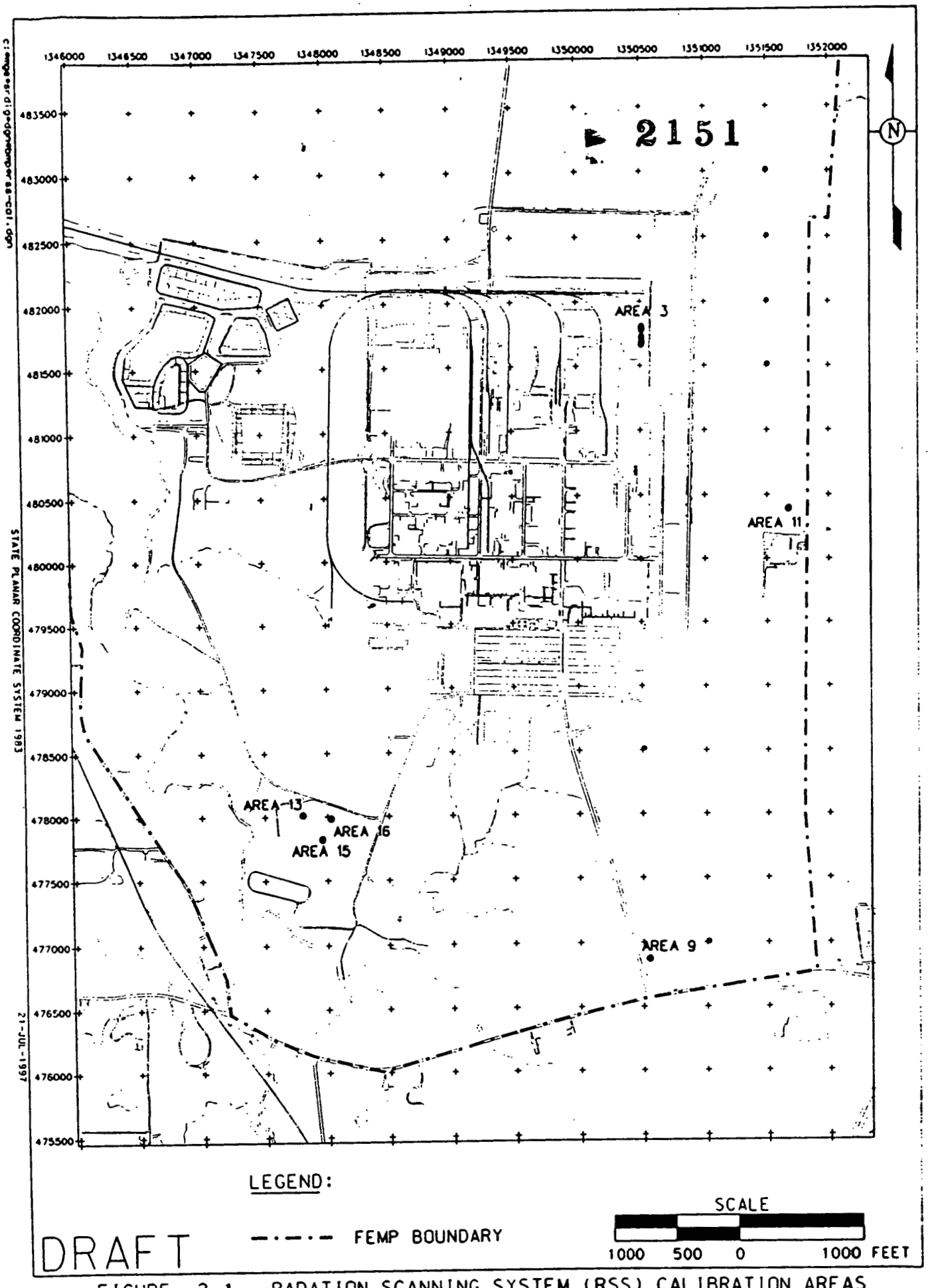

FIGURE 2-1. RADATION SCANNING SYSTEM (RSS) CALIBRATION AREAS

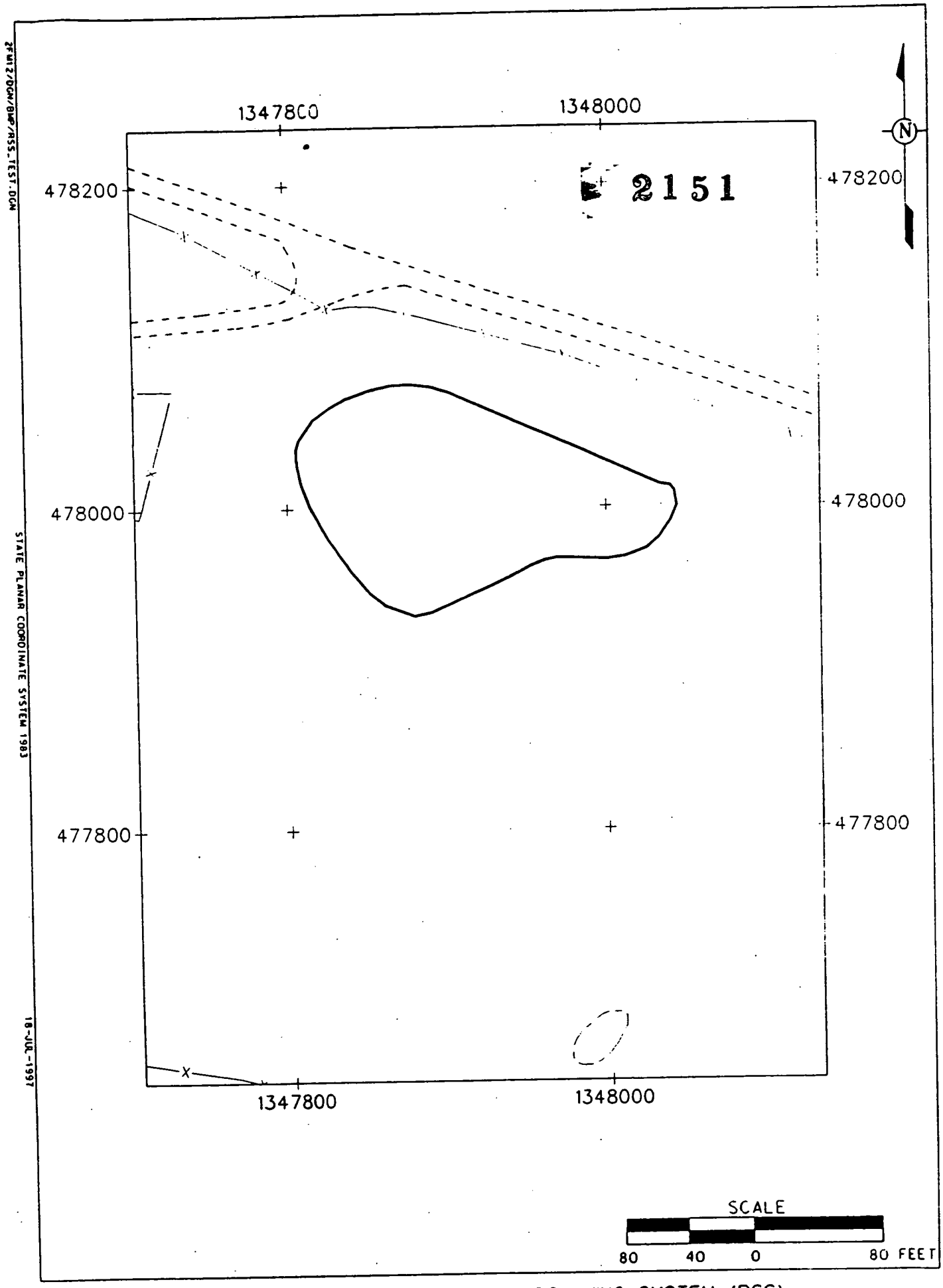

FIGURE 2-2. MOBILE RADIATION SCANNING SYSTEM (RSS)
VERIFICATION OF CALIBRATION TRACK - SOUTH FIELD AREA

2.2.2 Static RSS Measurements Collection

RSS measurements will be collected at each predesignated location for comparison with the HPGe measurements. For all RSS measurements, the detector height will be at 31 cm. Two measurements (one reading and one duplicate reading) will be collected at each location for an acquisition time of 5 minutes each.

2.2.3 HPGe Measurements Collection

HPGe measurements will be collected at each pre-designated location for comparison with the static RSS measurements. Measurements will be taken at both the 31 cm and 1 meter HPGe detector heights. One measurement will be collected at each detector height at each location for an acquisition time of 15 minutes each. A 15 minute acquisition time is required since this is the standard operational acquisition time used in the HPGe Comparability Study. One duplicate reading at the 31 cm height will be collected in each RSS study area.

2.2.4 RSS Calibration

The RSS and HPGe data will be handled to generate calibration equations as described in Section 3 of the RTRAK Applicability Study.

2.3 VERIFY CALIBRATION OF THE RSS

Calibration of the RSS to the RTRAK will be verified by a comparison of mobil RSS readings in the South Field with RTRAK measurements collected over the same area at any earlier time. The RTRAK results were reported on in the RTRAK Applicability Study. The parameters compared will be the means, standard deviations and the % standard deviations (% of the mean for uranium-238, thorium-232, and radium-226). If the results are comparable, within an acceptable range of variation, the calibration will have been successful. The RSS can then be used in place of the RTRAK for areas that are inaccessible to a tractor-mounted NaI detector.

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2.3.1 Mobil RSS Measurement Collection

Verifying the calibration will be performed by operating the RSS in the mobil mode in RTRAK Test Area 2 in the South Field identified in Variance 50.03.49-2. The test area is a circular track (Figure 2-2), marked with flagging, over which the RSS measurements will be recorded.

To perform the calibration verification, the RSS will be operated at the following parameters:

a) 1 mph walking speed - walking speed will be determined by mounting the Global Positioning System (GPS) to the RSS.
b) 4 second acquisition time
c) 31 cm detector height
d) 10 circular trips around the test area

2.4 SUPPORTING INFORMATION

Environmental conditions will be noted during the conducting of this test. Parameters to be measured are: air temperature, humidity, soil moisture, soil density, soil type, and specific weather conditions. If the test is to be conducted in the same pre-designated test location over several days, the parameters identified must be repeated each day, or more frequently if environmental conditions change or are expected to change.

If additional test areas, in addition to those identified in this PSP are identified as being needed, a full set of physical samples, RTRAK, HPGe, RSS measurements, and environmental conditions will be collected.

2.4.1 Temperature Measurements

Air temperature will be recorded on the Field Activity Log (FAL) at the beginning of each set of RSS/HPGe readings. It is to be obtained by calling the Communications Center. The Communications Center temperature reading is updated every minute by the site meteological tower. If temperature readings are not available from the Communications Center, the temperature can be obtained by calling Ed Ray at telephone 648-4230.

2.4.2 Humidity Measurements

Humidity measurements will be recorded on the FAL at the beginning of each set of RSS/HPGe readings. Measurements will be obtained by using the Wet Bulb gauge as per the Psycro-dyne® Model 3312-40 Instruction Manual.

2.4.3 Surface Moisture-Density Gauge Measurements

Surface moisture-density gauge measurements will be taken using the Troxler tool to determine soil moisture content and soil density at each set of RSS/HPGe readings. Measurements will be taken in-situ and adjacent to each RSS/HPGe readings location. Measurements will be taken in both the direct transmission mode and in the backscatter mode.

Technicians will calibrate and operate the Troxler tool according to Procedure EQT-32, Troxler 3440 Series Surface Moisture/Density Gauge - Calibration, Operation and Maintenance. If ground conditions are unsuitable for Troxler readings, a moisture core will be collected and submitted to the on-site laboratory for moisture analysis.

2.4.4 Surveying

Static RSS/HPGe locations will be surveyed and staked using either the Global Positioning System (GPS) or the Geodimeter survey instrumentation prior to collecting RSS and HPGe measurements. Mobil RSS locations will be measured by means of a GPS mounted in the RSS. All survey work will be conducted in accordance with procedure EQT-05, Geodimeter 4000 Surveying System-Operation, Maintenance, and Calibration.

2.4.5 Numbering System

Location numbering will utilize the following system: RSS (Radiation Scanning System), followed by the area number (example A3) followed by the location number, followed by the measurement number. For example:

RSS measurement, Area 3, location 1, measurement 4 would be: RSS-A3-1-4

A duplicate of this reading would be: RSS-A3-1-4D

A gamma moisture core at this location would be: RSS-A3-1-4G

If physical samples are to be collected they will follow the same numbering system. If RTRAK runs are performed they will have the location information in the electronic file or in the Field Activity Log (FAL).

2.4.6 Additional Test Areas

Additional test areas are defined as areas not previously tested in the HPGe Comparability Study or the RTRAK Applicability Study.

Additional areas may be identified for testing if they contain activity levels of radium-226, thorium-232, total uranium or potassium-40 needed to supplement this test. If testing is performed in these areas, a full set of data consisting of readings from the RSS, HPGe, and RTRAK systems as well as physical samples will be collected, as applicable.

2.4.6.1 Physical Samples

If an additional area is identified, a sample grid will be identified, in accordance with the parameters identified in the Area 1, Phase I Remedial Action Work Plan Comparability Study, Part B. From the grid, 0-6" physical samples will be collected and analyzed for total uranium, using the Bromo PADAPP method, at ASL B. One duplicate physical sample will be collected per 20 physical samples, with at least one collected for each test area requiring physical samples. Additional analytes may be sampled for as per the direction of the Project Manager.

2.4.6.2 RTRAK Runs

If an additional area is identified, a RTRAK run area will be established, in accordance with the parameters identified in the RTRAK Applicability Study. The RTRAK run will be set up in a straight line (not a circle or a loop) and will be run over the specified area for 10 round trips (20 passes), at 1 mph for a 4 second acquisition time.

2.5 Quality Assurance Readings

One duplicate HPGe reading will be collected for each RSS study area.

One duplicate RSS static reading will be collected for each RSS study area.

No duplicate RSS mobil reading is necessary since the instrument will traverse the South Field circle test area 10 times (duplicate built in to the test).

If an RTRAK run is necessary, no duplicate RTRAK runs will be necessary since multiple runs will be built into the test.

If physical samples are collected, laboratory analysis will be performed using the methodology and QC specified for Analytical Support Level (ASL) B in the Sitewide CERCLA Quality Assurance Document (SCQ). Field QC requirements will be satisfied by collecting a duplicate sample for every 20 physical samples collected. At least one duplicate will be collected at each test area requiring physical samples.

3.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

3.1 PROJECT REQUIREMENTS FOR INDEPENDENT AND SELF ASSESSMENTS

Project management has ultimate responsibility for the quality of the work processes and the results of the sampling activities covered by this PSP. The FEMP QA organization will conduct independent assessments of the work process and operations to assure the quality of performance. Assessment will encompass technical and procedural requirements of this PSP and the SCQ. Independent assessment will be performed by conducting surveillances. As a minimum, one surveillance will be conducted during implementation of this PSP, consisting of monitoring/observing on-going project activity and work areas to verify conformance to specified requirements. Surveillances will be planned and documented according to Section 12.3 of the SCQ.

3.2 FIELD CHANGES TO THE FIELD IMPLEMENTATION PLAN

If field conditions require changes or variances, written approval must be obtained from the Project Lead and QA before the changes may be implemented (electronic mail is acceptable). Changes to the PSP will be noted in the applicable field activity logs and on a Variance Request/Field Change Notice Form (VR/FCN). QA must receive the completed VR/FCN, which includes the signatures of the Project Sampling Lead, Project Lead, and the QA Representative, within 7 working days of the granting of the verbal approval.

3.3 APPLICABLE PROCEDURES AND REFERENCES

3.3.1 Applicable Procedures

Work performed under this PSP will be conducted in accordance with the following procedures:

ADM-02, Field Project Prerequisites
EQT-22, Characterization of Gamma Sensitive Detectors
EQT-23 Operation of ADAM Series Analyzers with Gamma Sensitive Detectors
EQT-30, Operation of the Radiation Tracking Vehicle Sodium Iodide Detection System

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EQT-32, Troxler 3440 Series Surface Moisture/Density Gauge-Calibration, Operation, and Maintenance
SMPL-01 Solids Sampling
SMPL-21 Collection of Field Quality Control Samples
ADM-02 Field Project Prerequisites

3.3.2 Applicable References

Work performed under this PSP supplements and complements the data collected under earlier PSPs and variances listed below. The data has been presented in several summary documents also listed below:

Area 1, Phase I Remedial Action Work Plan Comparability Study, Part B PSP, Project Number 50.03.40.
PSP for Determination of the Optimal RTRAK Detector Speed and Acquisition Time, Project Number 50.03.49
RTRAK Applicability Study, Rev.0, July 1997
Characterization Comparability Study, July 1997
Variances: 50.03.49-2 (To establish Run Area 2 for RTRAK test in South Field)
50.03.49-3 (To establish Run Area 3 for RTRAK test in Drum Bailing Area)
50.03.40.03-2 (To establish Quality Control Point 15 for Gamma HPGe calibration)
50.03.40.03-3 (To conduct Radium study for HPGe-Set up Test Areas 12-17, South Field)

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4.0 EQUIPMENT DECONTAMINATION

All insitu detection equipment will be subject to all site decontamination requirements as it passes from a controlled to a non-controlled radiological area. If a scope change is implemented through a variance requiring physical samples to be collected then the decontamination of equipment that comes into contact with the sample will be conducted in accordance with procedure SMPL-01, Solids Sampling.

5.0 HEALTH AND SAFETY

Technicians will conform to precautionary surveys performed by personnel representing the Utility Engineer, Industrial Hygiene, and Radiological Control as applicable. Concurrence with applicable safety permits (indicated by the signature of each technician assigned to this project) is expected by technicians in the performance of their assigned duties.

A project specific health and safety matrix will not be required for this activity. Compliance with the applicable Environmental Monitoring Procedures and all applicable FDF Permits will suffice. Safety and health requirements have been built into these procedures and any additional requirements will be established on the permits. A safety briefing will be conducted prior to the initiation of field activities by the Health and Safety Contact.

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6.0 DISPOSITION OF WASTE

The generation of waste is not anticipated for planned field activities. If a scope modification is made through proper variance requirements, all generated contact and decontamination waste will be placed into properly labeled bags and disposed of it according to appropriate FEMP waste management policies. Waste materials determined to be free of contamination will be disposed of in an on-site uncontrolled access dumpster. Excess soil generated during any sampling process will be returned to the surface point of origin.

7.0 DATA MANAGEMENT

A data management process will be implemented so information collected during the investigation will be properly managed following completion of the field activities. As specified in Section 5.1 of the SCQ, daily activities will be recorded on the Field Activity Log, with sufficient detail to be able to reconstruct a particular situation without reliance on memory. Sample Collection Logs will be completed according to Procedure ADM-02, Field Prerequisites.

Electronically recorded data from the Geodimeter, GPS, HPGe, and NaI systems (as applicable) will be downloaded to disks on a daily basis or as the project requires. Technicians will review the data for completeness and accuracy and then download it onto the Local Area Network (LAN). Once on the LAN, the Data Management Contact within the Soils Certification and Excavation Project will perform an evaluation of the data. Once complete, the data will be sent to the loader where it will be loaded onto the Oracle system and an error log will be generated. The data will then be made available to users through both the Graphical Information System (GIS) and Microsoft (MS) Access Software. Technicians will retain all downloaded data on disk for future reference and archive.

Field documentation, such as the Field Activity Log, Gamma Spectrometry Field Worksheet, Geodimeter Survey Files, Nuclear Field Density/Moisture Worksheet, and the Sample Collection Log will undergo an internal QA/QC review by the technicians. Copies will then be generated and will be delivered to the Data Management Contact who will perform an evaluation of the data and create the appropriate links between the electronically-recorded data and the paper-generated data. From this point, the paper-generated data will be sent to data entry personnel for input into the Oracle System. Field logs may be completed in the field and maintained in loose-leaf form.

APPENDIX A

DATA QUALITY OBJECTIVE

SL-045

Control Number _____

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Fernald Environmental Management Project

Data Quality Objectives

Title: Radiation Scanning System Study

Number: SL-045

Revision: 0

Final Draft: July 21, 1997

Contact Name: Joan White

Approval: _____ Date: 7/21/97
William D. Kelley
DQO Coordinator

Approval: _____ Date: 7/21/97
Chris Sutton
Project Lead

Rev. #	0						
Draft Date:	7/21/97						

DATA QUALITY OBJECTIVES
Radiation Scanning System Study

1.0 Statement of Problem

The Radiation Scanning System (RSS) is a more compact version of the Radiation Tracking (RTRAK) system. Both use identical sodium iodide (NaI) crystals. This study proposes to test the RSS in the same way that the RTRAK was originally tested to see if it will give comparable results to the RTRAK. To do this three things need to be accomplished. The angular response of the RSS sodium iodide (NaI) crystal to gamma rays must be characterized. It must be determined if the RSS can be calibrated versus the High Purity Germanium (HPGe) system.The calibration of the RSS must be verified by comparing measurements collected by the RSS NaI and the RTRAK, at a location chosen from the RTRAK Applicability Study.

2.0 Identify the Decision

Document the RSS crystal angular response to a U_3O_8 standard placed at predetermined angles from 0-180 degrees from the center of the crystal at 1 meter and 2 meters distances. From this an efficiency curve will be constructed for both the 1 and 2 meter distances.

Calibration of the RSS measurements in the STATIC MODE versus the HPGe measurements at the 31 cm and 1.0 meter height using a minimum of 4 isotopes: potassium-40, radium-226, thorium-232, and total uranium (total uranium represented by uranium-238 determined from the protactinium-234 daughter).

Verify calibration between the RTRAK and the RSS using the same type NaI crystal in the MOBILE MODE, the same type of computer hardware and software, under the same environmental conditions, in the same test area. Calibration verification will be determined by compariing the RSS measurements to RTRAK measurements in the South Field, reported in the RTRAK Applicability Study (conducted earlier) to determine whether the RSS measurements are within an acceptable range of variation. The parameters compared will be the means, standard deviations and the % standard deviations (% of the mean for uranium-238, thorium-232, and radium-226). The RSS will be operated at 1 mph walking speed with a 4 second acquisition time, at a detector height of 31 cm for 10 round trip runs (20 run lengths). Walking speed will be determined by mounting the Global Positioning System (GPS) to the RSS.

3.0 Inputs That Affect the Decision

Homogeneous activity concentrations are assumed WITHIN a test area (one specific test area may be chosen specifically for its heterogeneity).

Heterogeneous activity concentrations are known to exist BETWEEN the different test areas.

RSS duplicate measurements will indicate the precision of the instrument.

Consistent environmental conditions (temperature, precipitation) during the test.

HPGe energy calibration peaks, photopeak resolution and net peak areas are within acceptable tolerance (per procedure EQT-23).

Standards used will be National Institute of Standards Technology (NIST), or equivalent, approved standards (U_3O_8 for the RSS; Americium-241, Cesium-137 and Cobalt-60 for the HPGe).

4.0 The Boundaries of the Situation

4.1 Scale of Decision Making

Testing will render the RSS applicable for use in soil characterization for applications where the RTRAK has been determined acceptable, as described in the RTRAK Applicability Study, Rev.1, July 1997. The small RSS size will render the tool accessible to areas inaccessible to the larger tractor mounted RTRAK.

4.2 RSS Calibration Location

Calibration of the RSS will take place at selected areas tested under previous studies. Some of the selected areas may be chosen from the Area 1, Phase I Remedial Action Work Plan Comparability Study, Part B Project Specific Plan 50.03.40 and Variances 50.03.40-2, 50.03.40-3 and 50.03.40-5, and some may be chosen from the Project Specific Plan (PSP) For Determination of the Optimal RTRAK Detector Speed and Acquisition Time 50.03.49 and Variances 50.03.49-1 through 50.03.49-3. The areas selected will be visually verified to ensure that they have not been remediated or disturbed. The areas selected will represent "background", "low contamination", "medium contamination" and "high contamination" and "very high" contamination.

4.3 Calibration Verification Location

For verifying calibration, the RSS will be operated in the mobile mode at a test run location in the South Field (as identified in Variance 50.03.49-2 to the PSP for Determination of the Optimal RTRAK Detector Speed and Acquisition Time). The test run area will cross (tie) the run to the static RSS test location. The South Field test area is circular profile. The

RSS will be walked around the circle 10 times. The measurements taken will be subdivided into segments, and the measurements within each segment will be used to calculate the means, the standard deviation, and the % standard deviation. These values will then be compared to the RTRAK segment data collected at an earlier date and documented in the RTRAK Applicability Study.

4.4 Additional Test Areas

Additional areas may be identified for testing if they contain activity levels of radium-226, thorium-232, total uranium or potassium-40 needed to supplement this test. If testing is performed in these areas, a full set of data consisting of readings from the RSS, HPGe, and RTRAK systems as well as physical samples will be collected, as applicable.

4.5 Parameters of Interest

The parameters of interest will be the primary radiological constituents of concern at the FEMP: radium-226, thorium-232 and total uranium (measured isotopically), and potassium-40. These parameters were selected because they are known to be observable in the soil on site, and because the analysis of the Constituents of Concern (COCs) is important to all sampling and remediation efforts on impacted soil at the FEMP.

5.0 Decision Rule

Establish efficiency curves for the RSS NaI crystal efficiency as compared to the known test standards.

Use the HPGe as a standard to calibrate the RSS prior to data collection to ensure consistency in calibration and measurement results between the RSS and the RTRAK.

Use the RSS in areas inaccessible to the RTRAK under similar environmental and field conditions, with the expectation of obtaining equivalent readings.

6.0 Limits on Decision Errors

Decision Error 1: This is a false positive error. If the RSS gives a false high reading, this could lead to soils erroneously being identified as exceeding WAC, or being erroneously identified as being a hot spot, when in fact it meets WAC or is not a hot spot. This could result in incurring needless increased off-site soil disposal costs.

Decision Error 2: This is a false negative error. If the RSS gives a false low reading, this could lead to soils erroneously being identified as meeting WAC, or being erroneously identified as not being a hot spot, when in fact it exceeds WAC or is a hot spot. This could lead to soil being placed in the OSDF cell when it should have been sent off-site for disposal. This would be a violation of OSDF WAC and certification criteria.

In this case, a false negative is the greatest concern. The false positive could result in a non-compliance issue by depositing above WAC material in the OSDF and in inadequately identifying hot spots requiring remediation before certification.

7.0 Design for Obtaining Quality Data

7.1 HPGe and RSS Crystal Characterization

A full 180 degree angle characterization of the crystals is needed to test for symmetry in both of the crystals. The crystals will be characterized in accordance with Procedure EQT-22, with the exception that the characterization will be conducted at a full 180 degrees (procedure specifies 90 degrees).

7.2 RSS Operation in the Static Mode

RSS measurements will be collected in the static mode at each pre-designated location to calibrate the static RSS measurements to the static HPGe measurements. For all RSS measurements, the detector height will be kept stationary at 31 cm. Two measurements (one reading and one duplicate reading) will be collected at each location for an acquisition time of 5 minutes each.

7.3 HPGe Operation

HPGe measurements will be collected at each pre-designated location for comparison with the static RSS measurements. Measurements will be taken at both the 31 cm and 1 meter HPGe detector heights. Two measurements (one reading and one duplicate) will be collected at each detector height at each location for an acquisition time of 15 minutes each. A 15 minute acquisition time is requested since this is the standard operational acquisition time used in the HPGe Comparability Study.

7.4 RSS Operation in the Mobile Mode

Measurements in the mobile mode will be collected for one set of operating conditions: 1 mph for 4 seconds acquisition time, at a detector height of 1 foot. The mobile RSS run will cross the stationary RSS and HPGe locations so the data collected by the static RSS and static HPGe readings can be tied to the mobile run. The South Field test area circle will be traversed 10 times with the RSS.

7.5 Environmental Conditions

Environmental conditions will be noted during the conducting of this test. Parameters to be measured are: soil temperature, air temperature, humidity, soil moisture, soil density, and soil type. If the test is to be conducted in the same pre-designated test location over several days, the parameters identified must be repeated each day, or more frequently if environmental conditions change.

A full set of the environmental parameters must be collected for each pre-designated test location to be identified in the PSP.

7.6 Physical Samples

Physical samples will not be conducted in this test, unless a new test area is designated (not tested for the HPGe Comparability Study or the RTRAK Applicability Study). A new test area may be identified to measure the HPGe, RSS and RTRAK results for activity level near the WAC level of 1080 ppm total uranium. The area would be designated as a "high contamination" area, and a sample grid identified. If a new location is designated, a 0-6" physical sample will be collected and analyzed for total uranium, using the Bromo PADAPP method, at ASL B. One duplicate physical sample will be collected per 20 physical samples, with at least one collected for each test area requiring physical samples.

7.7 RTRAK Run

RTRAK runs will not be conducted in this test, unless a new test area is designated (not tested in the Comparability Study). A new test area may be identified to measure the HPGe, RSS and RTRAK results for contamination near the WAC level of 1080 ppm. total uranium. The areas would be designated as a "high contamination" area, and a sample grid identified. If a new location is designated the HPGe and RSS data will be collected as described above, and the RTRAK will be run over the area 10 round trips (20 passes) along a straight line path, at 1 mph for 4 seconds acquisition time.

7.8 QC Considerations

One duplicate HPGe reading will be collected for each test area. One duplicate RSS static reading will be collected for each test area.

RSS instrument will traverse the South Field circle test area 10 times (duplicate built in to the test).

If an RTRAK run is necessary, no duplicate RTRAK runs will be necessary since the multiple runs are built into the test.

If physical samples are collected, laboratory analysis will be performed using the methodology and QC specified for Analytical Support Level (ASL) B in the Sitewide CERCLA Quality Assurance Document (SCQ). Field QC requirements will be satisfied by collecting a duplicate sample for every 20 physical samples collected. At least one duplicate will be collected at each test area requiring physical samples.

7.9 Independent Assessment

Self -assessment and independent assessments of work processes and operations shall be undertaken to assure quality of performance. Self-assessments shall encompass technical and procedural requirements. Such self-assessments may be conducted at any point in the test.

Independent assessments shall be performed by the Fernald Environmental Management Project (FEMP) Quality Assurance (QA) organization by conducting surveillance. Surveillance shall be planned and documented in accordance with Section 12.3 of the SCQ.

7.10 Applicable Procedures

EQT-22, Characterization of Gamma Sensitive Detectors
EQT-23 Operation of ADAM Series Analyzers with Gamma Sensitive Detectors
EQT-30, Operation of the Radiation Tracking Vehicle Sodium Iodide Detection System
EQT-32, Troxler 3440 Series Surface Moisture/Density Gauge-Calibration, Operation, and Maintenance
SMPL-01 Solid Sampling
SMPL-21 Collection of Field Quality Control Samples
ADM-02 Field Project Prerequisites

7.11 References

Area 1, Phase I Remedial Action Work Plan Comparability Study, Part B PSP, Project Number 50.03.40.
PSP for Determination of the Optimal RTRAK Detector Speed and Acquisition Time, Project Number 50.03.49
RTRAK Applicability Study, Rev.1, July 1997
Characterization Comparability Study, July 1997 Variances
50.03.49-1 (To allow for additional RTRAK runs to occur to supplement study)
50.03.49-2 (To establish Run Area 2 for RTRAK test in South Field)
50.03.49-3 (To establish Run Area 3 for RTRAK test in Drum Bailing Area)
50.03.49-4 (To establish numbering system for mobile RTRAK, static RTRAK, HPGe and moisture cores in Run Area 3. Supports Variance 50.03.49-4)
50.03.49-5 (To modify identifier for moisture cores for RTRAK Run Area 3 from "M" to "G")
50.03.40.03-2 (To establish a control point for Gamma HPGe calibration)
50.03.40.03-3 (To conduct Radium study for HPGe-Set up Test Areas 12-17, South Field)
50.03.40.03-4 (To move a duplicate location)
50.03.40.03-5 (To establish Test Areas 18 and 19, Sludge Drying Beds)

Data Quality Objectives
Radiation Scanning System Study

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1A. Task/Description: Certification Sampling Analysis

1.B. Project Phase: (Put an X in the appropriate selection.)

RI ☐ FS ☐ RD ☐ RA ☒ R/A ☐ OTHER ☐

1.C. DQO No.: SL-045 DQO Reference No.: _____

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2. Media Characterization: (Put an X in the appropriate selection.)

Air ☐ Biological ☐ Groundwater ☐ Sediment ☐ Soil ☒

Waste ☐ Wastewater ☐ Surface water ☐ Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization
A ☐ B ☐ C ☐ D ☐ E ☐

Risk Assessment
A ☐ B ☐ C ☐ D ☐ E ☐

Evaluation of Alternatives
A ☐ B ☐ C ☐ D ☐ E ☐

Engineering Design
A ☐ B ☐ C ☐ D ☐ E ☐

Monitoring during remediation activities
A ☐ B ☐ C ☐ D ☐ E ☐

Other *
A ☒ B ☒ C ☐ D ☐ E ☐
*Method development

4.A. Drivers: Area 1 Phase 1 Area Remedial Action Work Plan (RAWP), Applicable or Relevant and Appropriate Requirements (ARARs) and Operable Unit 5 Record of Decision (ROD)

4.B. Objective: Determine whether in-situ measurements recorded with the Radiation Scanning System (RSS) are comparable with RTRAK measurements.

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5. Site Information (Description):

The OU2 and OU5 RODs have identified areas at the FEMP that require soil remediation activities. The RODs specify that the soils in these areas will be demonstrated to be below the FRLs. Certification and WAC disposition of soils will be necessary for areas of the site with soils that have been remediated to demonstrate that the residual soils do not contain contamination exceeding these levels at a specified confidence level and that excavated soild are disposed of appropriately. Use of in-situ testing would provide significant time and cost savings, if the resulting data is of sufficient quality and repeatability.

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1.	pH	☐	2.	Uranium	☐	3.	BTX ☐
	Temperature	☒ *		Full Radiological	☒ **		TPH ☐
	Specific Conductance	☐		Metals	☐		Oil/Grease ☐
	Dissolved Oxygen	☐		Cyanide	☐		
	Technetium-99	☐		Silica	☐		

4.	Cations	☐	5.	VOA	☐	6. Other (specify)***
	Anions	☐		BNA	☐	
	TOC	☐		Pesticides	☐	
	TCLP	☐		PCB	☐	
	CEC	☐				
	COD	☐				

* Soil and ambient air temperature at individual sample locations.
** Full rad if new study areas are added, otherwise suite limited as given in DQO.
*** Soil density and percent moisture.

6.B. Equipment Selection and SCQ Reference:

Equipment Selection	Refer to SCQ Section
ASL A RSS, RTRAK, Densitometer, HPGe	SCQ Section: App B, Table 1
ASL B Per SCQ	SCQ Section:
ASL C	SCQ Section:
ASL D	SCQ Section:
ASL E	SCQ Section:

7.A. Sampling Methods: (Put an X in the appropriate selection.)

Biased ☐ Composite ☐ Environmental ☐ Grab ☒ Grid ☒

Intrusive ☒ Non-Intrusive ☐ Phased ☐ Source ☐

DQO Number: SL-045

7.B. Sample Work Plan Reference: Project Specific Plan for the associated construction area Remedial Action Work Plan

Background samples: RTRAK Applicability Study

7.C. Sample Collection Reference:

Sample Collection Reference: Associated PSP(s), SMPL-01

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8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

8.A. Field Quality Control Samples:

Trip Blanks	☐	Container Blanks	☐
Field Blanks	☐	Duplicate Samples	☐
Equipment Rinsate Samples	☐	Split Samples	☐
Preservative Blanks	☐	Performance Evaluation Samples	☐
Other (specify)			

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8.B. Laboratory Quality Control Samples:

- Method Blank ☐
- Matrix Spike ☐
- Tracer Spike ☐
- Matrix Duplicate/Replicate ☐
- Surrogate Spikes ☐

Other (specify) _____

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

A minimum of one duplicate HPGe measurement and one duplicate RSS measurement will be recorded for each test area. If additional test areas are defined, one duplicate physical sample and one duplicate RTRAK sample will also be collected.