20701-

2152

# PROJECT SPECIFIC PLAN FOR DETERMINATION OF THE OPTIMAL RTRAK DETECTOR SPEED AND ACQUISITION TIME

Project Number: 50.03.49

Revision: 0

Date: March 26, 1997

INFORMATION ONLY

Prepared by: Fluor Daniel Fernald

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

Under Contract DE-AC05-92OR21972

**ORIGINAL**

2152

PROJECT SPECIFIC PLAN FOR DETERMINATION OF THE

OPTIMAL RTRAK DETECTOR SPEED AND ACQUISITION TIME

Approval:

3/27/97

Project Lead Date

3/27/97

Project Coordinator Date

3/27/97

Project Quality Assurance Date

| VARIANCE / FIELD CHANGE NOTICE | V/F50.03.49-1 |
|---|---|
| WBS NO.: 50.03.49 | Page 1 of 2 |
| PROJECT TITLE: Determination of the Optimal RTRAK Detector Speed and Acquisition Time | Date: 4/4/97 |

VARIANCE / FIELD CHANGE NOTICE (Include justification):

Field Change Notice:

This variance is in response to a review of data that revealed that coverage of the study area by the RTRAK at 0.5 mph, 2 sec acquisition time was not sufficient to provide adequate data for the project purposes. Consequently, it is necessary to repeat the measurement for this combination of parameters.

2152

Justification:

An evaluation of the data and the field procedure indicated that one of the factors leading to the insufficient coverage was the difficulty in following the proposed spiral path at a speed of 0.5 mi/hr. To mitigate this problem, the proposed path will be changed from a spiral to a series straight-line paths across the study area, with the RTRAK changing direction at the completion of each pass. Using this approach it will be easier for the operator to stay on course and get more complete coverage of the study area. The path configuration will have no effect on the data because they are collected as discrete data points associated with a set of location coordinates provided through a GPS system.

The new data will be collected on different days and under different weather conditions than the data collected previously. It will be necessary to repeat a portion of the Troxler moisture measurements to verify that soil moisture contents are comparable for the two measurement periods. The moisture content and soil density will be measured, by Troxler readings, at 33% of the original locations. Locations will be selected on the basis of a review of the existing data and will include the high and low extremes. If the moisture contents are found to differ by more than 20% at identical locations, the moisture content will be re-measured at all 36 current locations.

INFORMATION ONLY

The following specific changes to the PSP are requested:

1. Section 2.2, paragraph 2.

   Change the first sentence to read: "The RTRAK measurement strategy will consist of moving the RTRAK in a manner that will provide maximum coverage of the study area".

   Add a sentence: "The specific configuration to be used will be determined in the field by the Project Coordinator on the basis of an assessment of field conditions and RTRAK operating limitations."

1. Section 2.2, third paragraph. Add the following sentence to the end of the paragraph: "If HPGe and RTRAK data are collected on different days, at least 33% of the Troxler moisture/soil density measurements must be repeated in conjunction with RTRAK measurement areas. If an evaluation of the moisture data indicated a difference of greater than 20% between two measurements at identical locations, the measurements must be repeated at all locations."

1. Section 2.2, sixth paragraph. Add the following sentence to the end of the paragraph: "If a review of the data indicate that they are insufficient for the needs of this project, measurements may be repeated at the discretion of the Project Lead".

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REQUESTED BY: Joan White JHW Date: 4/1/97 JHW

# VARIANCE / FIELD CHANGE NOTICE

V/F50.03.49-2

WBS NO.: 50.03.49

Page 1 of 2

PROJECT TITLE: Determination of the Optimal RTRAK Detector Speed & Acquisition Time

Date: 5/6/97

**VARIANCE / FIELD CHANGE NOTICE (Include justification):**

Field Change Notice:

2152

This variance establishes a RTRAK Baseline Study Run Area in the FEMP Area known as the South Field. The activity supplements the work performed under Variance 50.03.40.03-3 (dated 4/28/97) to the Comparability Study, Part B. Rev. 0. Variance 50.03.40.03-3 established test Areas 12-17 for comparison of HPGE, and physical sample data for Radium-226. This variance ties RTRAK runs for Radium-226 analysis to the HPGE and physical sample locations for Radium-226 analysis established in Areas 13 and Area 16.

RTRAK runs will occur in a straight line track from coordinates 478017.42, 1347754.42 in the NW, to coordinates 477975.58, 1348077.59 in the SW, for a run length of 225.87 feet. The RTRAK run area will intesect Location 1 (sample point and HPGE point) in Area 13 at coordinates 478011.00, 1347804.00, and Location 1 (sample point and HPGE point) in Area 16 at coordinates 477975.58, 13480077.59.

Minimum of twenty runs will be conducted at each of the following speeds and acquisition times:
2.0 mph, 2 sec
0.5 mph, 8 sec
1.0 mph, 4 sec.

Since the RTRAK runs are being conducted on different days and different moisuture conditions than the HPGE and physical samples referenced above, Troxler moisture/density readings will be re-collected at Area 13, Location 1, and Area 16 Location 1 for each day in which the RTRAK run is conducted.(Attached figure includes coordinates)

INFORMATION ONLY

Soil and air temperature and humidity readings will also be recorded at the beginning of each day in which the RTRAK run is conducted.

Justification:

This variance is needed to set up a RTRAK Baseline Study Run Area in the South Field for Radium-226 to tie to the HPGE and physical sample data collected for Radium-226 in Variance 50.03.40.03-3. This variance will support the comparability of RTRAK, HPGe, and physical sample results for Radium-226.

REQUESTED BY: Joan White Date: 5/6/97

| X IF REQD | VARIANCE/FCN APPROVAL | DATE | X IF REQD | VARIANCE/FCN APPROVAL | DATE |
|---|---|---|---|---|---|
| X | QUALITY ASSURANCE | 5-6-97 | X | PROJECT MANAGER | 05/06/97 |
| | DATA QUALITY MANAGEMENT | | X | FIELD MANAGER | |
| | ANALYTICAL CUSTOMER SUPPORT | | | OTHER | |
| | OTHER | 5/6/97 | | OTHER | 5/6/97 |

VARIANCE/FCN APPROVED [X ]YES [ ]NO

REVISION REQUIRED: [ ]YES [x]NO

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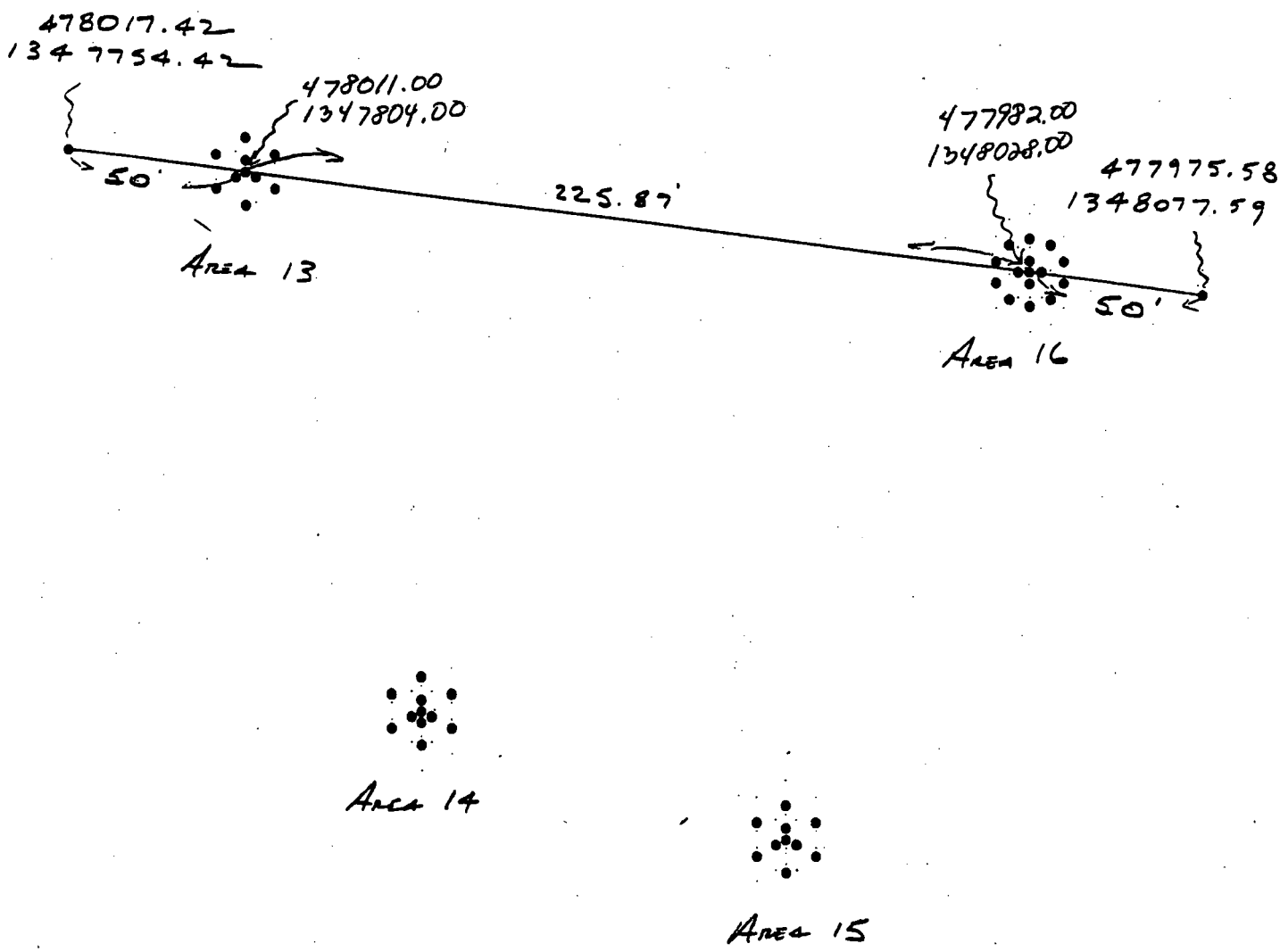
| PROJECT MANAGER: | DOCUMENT CONTROL: Michelle Tudor | OTHER: |
| QUALITY ASSURANCE: | OTHER: | OTHER: |
| FIELD MANAGER: | OTHER: | OTHER: |

2152

RTRAK BASELINE RUN
IN THE SOUTHFIELD

1:50



| VARIANCE / FIELD CHANGE NOTICE | V/F 50.03.49-3 |
|---|---|
| WBS NO.: 50.03.49 | Page 1 of 4 |
| PROJECT TITLE: Determination of Optimal RTRAK Speed & Acquisition Time | Date: 5/27/97 |

VARIANCE / FIELD CHANGE NOTICE (Include justification):

**Justification:**

2152

This variance establishes RTRAK Baseline Study Run Area #3 in the Drum Bailing Area in the NE portion of the Former Processing Plant (Figure 1). The area corresponds to a former physical sample location in the Drum Bailing Area with demonstrated concentration of total uranium at approximately 647 mg/kg. This RTRAK data will provide information for instrument response at levels of total uranium approaching the On Site Disposal Facility (OSDF) Waste Acceptance Criteria (WAC) of 1030 ppm Total Uranium.

Note: RTRAK Baseline Study Run Area #1 was originally defined as the area North of the Incinerator. The work scope was defined in PSP 50.03.49 and modified in Variance 50.03.49-1. RTRAK Baseline Study Run Area #2 was set up in the South Field under Variance 50.03.49-2.

**Field Change Notice:**

RTRAK Run Area #3 will be set up as one straight line track in the Drum Bailing Area located in the North Eastern portion of Former Production Area on the FEMP site. Along this track mobil RTRAK, Static RTRAK, HPGe readings, moisture and environmental data will be collected.

In Run 3, the RTRAK will run from the south at a coordinate value of N 481628.39, E 1350515.37 to the north a coordinate value of N 481835.87, E 1350520.07, for a total distance of 207.53 feet. The run is adjacent to a former sample point at coordinates N 481688.72, E 1350547.8. The sample point was tested during the USID Study (Uranium Soils Integrated Demonstration Study) for a total uranium concentration of approximately 647 mg/kg.

INFORMATION ONLY

In detail the following work will be performed:

1- Surveying

Surveying of the RTRAK Run Area limits and the Static RTRAK/HPGe locations will be conducted using standard surveying techniques. The RTRAK Run Area limits and the RTRAK Static/HPGe locations will be marked with a survey flag and coordinates recorded in the Sitewide Environmental Database, as applicable.

2-Environmental conditions

Environmental conditions will be collected for the RTRAK Run. For example: for the mobile RTRAK runs, environmental conditions will be recorded at the beginning of the 1 mph 8 sec run, at the beginning of the1 mph 4 sec run, etc. For the Static RTRAK/HPGe readings, environmental conditions will be recorded at the beginning of each reading. Environmental conditions to be collected are:

a- Air temperature (Site Communication Center temperature reading is acceptable)
b- Soil temperature (acquired by placing a thermometer in the ground)
c- Humidity readings (either taken in the field or reported by the Site Communications Center)

CONTINUED ON FOLLOWING PAGE:

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3- Mobile RTRAK readings

At the RTRAK Run Area a minimum of twenty runs will be conducted at each of the following speeds and acquisition times:

a- speed of ½ mph at 8 second acquisition time
b- speed of 1 mph at 4 second acquisition time
c- speed of 2 mph at 2 second acquisition time

E 2152

If the mobile RTRAK runs occur over several days, care will be taken to ensure the Static RTRAK, HPGE, moisture, and environmental data is recorded for each day in which mobil RTRAK runs occur.

4-Static RTRAK readings

Static RTRAK readings will be collected at the designated location within each RTRAK Run Area (See Figure 2). The Static RTRAK readings (as well as HPGe readings, moisture readings, and environmental conditions) will be collected at two locations in the track approximately 1/3 of the way in from the east end and approximately 1/3 of the way in from the west end. For Run Area #3 the locations are N 481697.55, E 1350516.94 and N 481766.71, E 1350518.5. The Static RTRAK measurements will be performed at acquisition time intervals of 2 seconds and 8 seconds for a total of 300 seconds each. Static readings will be collected TWICE at each location for each acquisition time for a total of 4 reads acquired.

5-HPGe readings

HPGe readings will be collected at the same designated static RTRAK reading locations (discussed above) within the RTRAK Run Area, for a total of 2 designated locations (see Figure 2). At each location TWO readings will be taken at the 1 meter height for 15 minute acquisition times. In addition one location will be chosen at random as a duplicate, and one additional 1 meter 15 minute read collected.

6-Moisture readings

A Troxler Moisture reading of the soil will be taken at the Static RTRAK/HPGe reading locations in the RTRAK Run Area. If the Mobil RTRAK or Static RTRAK readings are taken on a different day than the HPGe/Troxler Moisture readings, the Troxler Moisture readings will be repeated. Troxler moisture readings must be taken within 8 hours of the Mobil RTRAK/Static RTRAK/ HPGe readings. If moisture conditions are expected to change or have changed, Troxler readings will be taken more frequently.

Moisture cores will only be taken if Troxler readings are unable to be conducted. Moisture cores, if taken, will be collected in accordance with procedure SMPL-01. A moisture core will be collected for each day work is performed in the field or more frequently if environmental conditions are expected to change or have changed.

7-Soil samples

Soil sample collection is not an aspect of this activity.

8- Field Activity Logs (FALs)

(FALs) will reference this variance number 50.03.49-3

Requested by: Joan White 5/27/97

| X IF RED | VARIANCE/FAN APPROVAL | DATE | X IF RED | VARIANCE/FAN APPROVAL | DATE |
|---|---|---|---|---|---|
| X | QUALITY ASSURANCE | 5/27/97 | X | PROJECT MANAGER | 5/21/97 |
| | DATA QUALITY MANAGEMENT | | X | FIELD MANAGER | 05/27/97 |
| | ANALYTICAL CUSTOMER SUPPORT | | X | Field Manager Real Time Monitoring | 5/27/97 |
| | OTHER | | | OTHER | |

VARIANCE/FAN APPROVED [X ]YES [ ]NO

REVISION REQUIRED: [ ]YES [x]NO 000007

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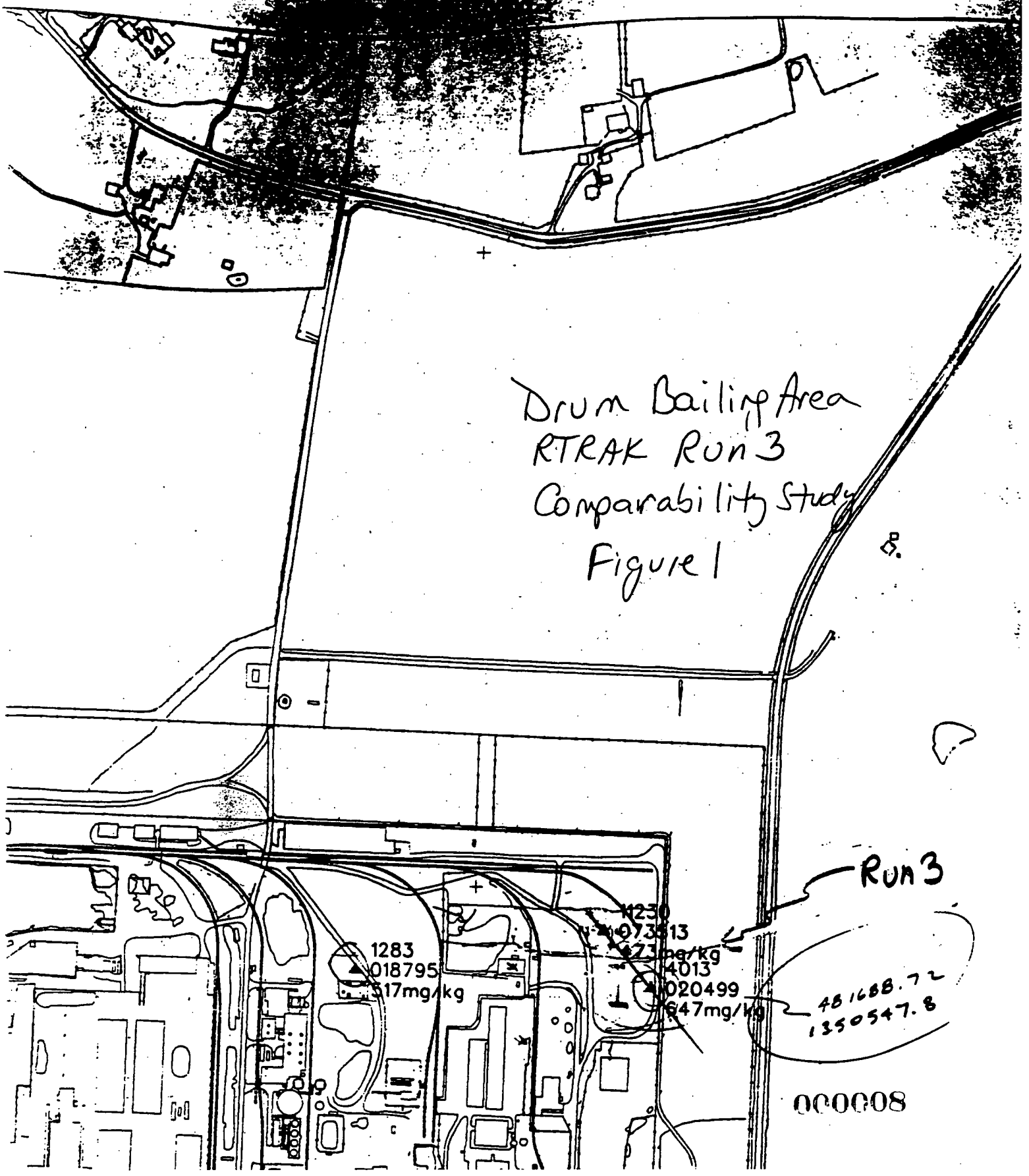
| QUALITY ASSURANCE: | OTHER: | OTHER: |
| FIELD MANAGER: | OTHER: | OTHER: |

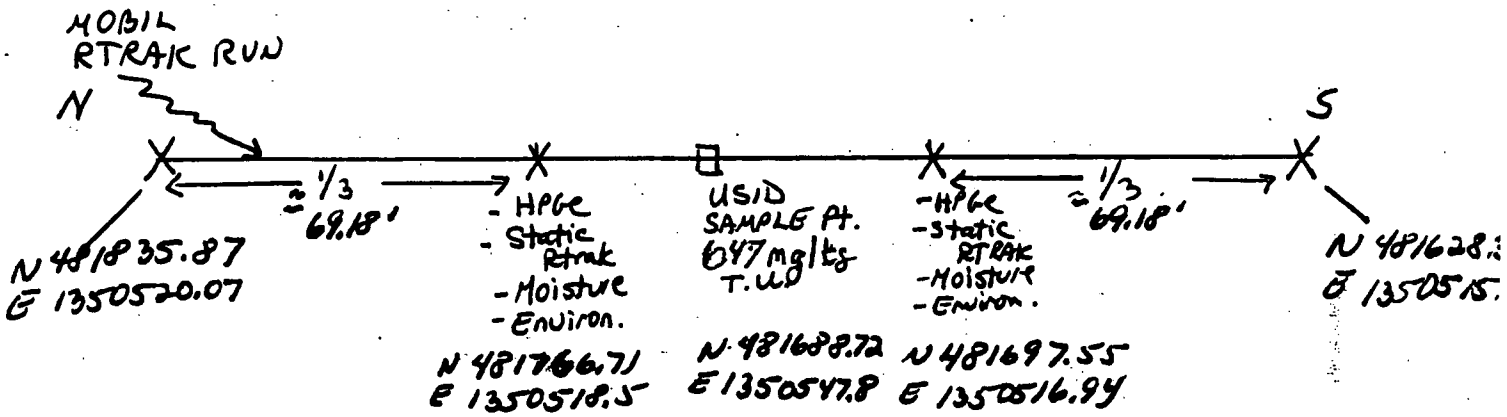

Drum Bailing Area
RTRAK Run 3
Comparability Study
Figure 1
Run 3
1283
018795
517mg/kg
1230
073613
473mg/kg
4013
020499
647mg/kg
481688.72
1350547.8

# Drum Bailing Area 2152

# RTRAK Study Run Area 3

## Figure 2

### Mobil RTRAK RUN 3



# VARIANCE / FIELD CHANGE NOTICE

V/F 50.03.49-4

WBS NO.: 50.03.49

Page 1 of 1

PROJECT TITLE: Determination of Optimal RTRAK Speed & Acquisition Time

Date: 5/28/97

VARIANCE / FIELD CHANGE NOTICE (Include justification):

2152

**Justification:**
This variance establishes the numbering system for the Mobil RTRAK, Static RTRAK, HPGe, and moisture data collected in RTRAK Baseline Study Run Area #3 in the Drum Bailing Area in the NE portion of the Site. Since the data is likely to be acquired over a several day period, it is necessary to establish the numbering system to provide consistency in the data set. (The Mobile RTRAK data will be filed in the system customarily used in the program). This variance supplements Variance 50.03.49-3 dated 5/27/97.

**Field Change Notice:**

1-Mobile RTRAK.
Mobile RTRAK computer file numbers will have inserted in the E-Cal the designator "RBS3" to designate the area as the RTRAK Baseline Study Area 3.

2-Static RTRAK Reading Computer File Numbers
Static RTRAK computer file numbers will be used which reflect the scope of work and the area in which the work is being performed. The number will contain "RBS" (RTRAK Baseline Study), followed by a "3" (representing Run Area 3), followed by the "Location number" (1 or 2) , and the "file number" (1 through as needed). A duplicate will be suffixed by "D". For example, reading number 2 at location 1 would be RBS3-1-2. A duplicate of this reading would be RBS3-1-2-D

3-HPGe Reading Computer File Numbers
HPGe computer file numbers will follow the same system as identified above in item 1 with the addition of a "G" for Gamma. For example, reading number 2 at location 1 would be RBS3-1-2G. A duplicate of this reading would be RBS3-1-2G-D.

INFORMATION ONLY

4-Moisture Cores
Moisture core numbers will use the same system identified above in item 1, with the addition of a "M" for moisture. For example, reading number 2 at location 1 would be RBS3-1-2M. There are no duplicates for moisture cores.

5- Field Activity Logs (FALs)
Field Activity Logs (FALs) will reference this Variance number 50.03.49-3 as well as Variance number 50.03.49-2 under which the work is being performed.

Requested by: Joan White 5/28/97

| X IF RED | VARIANCE/FAN APPROVAL | DATE | X IF RED | VARIANCE/FAN APPROVAL | DATE |
|---|---|---|---|---|---|
| X | QUALITY ASSURANCE | 5/29/97 | X | PROJECT MANAGER | 05/28/97 |
| | DATA QUALITY MANAGEMENT | | X | FIELD MANAGER | |
| | ANALYTICAL CUSTOMER SUPPORT | | X | Field Manager Real Time Monitoring | 5/28/97 |
| | OTHER | | | OTHER | 5/27/97 |

VARIANCE/FAN APPROVED [X ]YES [ ]NO

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| FIELD MANAGER: | OTHER: | OTHER: |

| VARIANCE / FIELD CHANGE NOTICE | V/F 50.03.49-5 |
|---|---|
| WBS NO.: 50.03.49 | Page 1 of 1 |
| PROJECT TITLE: Determination of Optimal RTRAK Speed & Acquisition Time | Date: 6/5/97 |

VARIANCE / FIELD CHANGE NOTICE (Include justification):

2152

Justification:
This variance modifies the numbering system for the moisture data collected for the RTRAK Baseline Study Run Area #3, Drum Bailing Area, as identified in variance 50.03.49-3 dated 5/27/97. The suffix "M" identified in the variance was already used as a designator for Metals analysis.

Field Change Notice:
Moisture Cores
Moisture core numbers will be identified in the same manner as Gamma measurements. They are tied in the Environmental Database by the suffix "G" to their corresponding Gamma reading with the same number and suffix "G". Therefore, moisture core number 2 at location 1 would be RBS3-1-2G. There are no duplicates for moisture cores.

Field Activity Logs (FALs)
Field Activity Logs (FALs) will reference this Variance number 50.03.49-4 as well as Variance number 50.03.49-3 and Variance number 50.03.49-2 under which the work is being performed.

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Requested by: Joan White 6/5/97

| X IF RED | VARIANCE/FAN APPROVAL | DATE | X IF RED | VARIANCE/FAN APPROVAL | DATE |
|---|---|---|---|---|---|
| X | QUALITY ASSURANCE | 6-5-97 | X | PROJECT MANAGER | 6/5/97 |
| | DATA QUALITY MANAGEMENT | | X | FIELD MANAGER | |
| | ANALYTICAL CUSTOMER SUPPORT | | X | Field Manager Real Time Monitoring | 6/5/97 |
| | OTHER | | | OTHER | 6/5/97 |

VARIANCE/FAN APPROVED [X ]YES [ ]NO

REVISION REQUIRED: [ ]YES [x]NO

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| FIELD MANAGER: | OTHER: | OTHER: |

| VARIANCE / FIELD CHANGE NOTICE 20701 | VF/ 50.03.49-6 |
|---|---|
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| PROJECT TITLE: Determination of Optimal RTRAK Speed and Acquisition | Date: 10/9/98 |

**VARIANCE / FIELD CHANGE NOTICE (Include justification):**

2152

**Justification:**

When excavation of all visible fly ash on the IFP is completed (performed under PSP for Excavation Characterization for Inactive Flyash Pile and SP5, 20.03.13.06 ECDC #20300-PSP-0004 Rev.1), the data will be evaluated to determine:

a- if a correlation can be made between RTRAK/RSS total gamma activity and HPGe total uranium ppm at low concentrations of total uranium (for example at 10 ppm).

b- the number of RTRAK/RSS measurements needing to be aggregated to make a viable pre-certification map at 10 ppm total uranium considering the requirements of precision and MDCs in the RTRAK Applicability Study.

If no correlation can be determined between RTRAK/RSS total gamma activity and HPGe total uranium ppm measurements (items a&b above), then a full 90.6% coverage scan (no overlap) of the surface may be conducted with the HPGe system.

**Field Change Notice:**

1 - RTRAK IFP Final Scan Mapping and Data Evaluation:
The moisture corrected RTRAK data will be mapped to display the total gamma activity (counts per second) over the area. The total gamma activity map will be generated using Single Point Measurement field of view (9m2). Interpretation of total activity will be assisted by maps of total uranium, K-40, thorium-232, and radium-226 (mapped in 1, 2 or 3 point running averages based on the MDCs of the RTRAK for the specific radio nuclide as determined in the RTRAK Applicability Study.

3 - HPGe Measurements at RTRAK Locations:
Based upon the above maps, total activity will be subdivided into ranges (ex.3 to 5 ranges depending on the range of total activity in the RTRAK scan). Two HPGe measurements will be taken in each of the gamma activity ranges. The HPGe measurements will be collected using a 15 minute read at a 1 meter detector height representing a 12 meter diameter field of view. One duplicate HPGe measurement will be taken for each 20 HPGe measurements collected.

INFORMATION ONLY

The RTRAK/RSS locations chosen for HPGe measurement will be:

a- determined based on geographic criteria. For example, the two locations within each gamma activity range should be as far apart in distance as possible to ensure local soil type is not affecting the results (clay soils may naturally have a higher gamma count than sand soils).

b- determined such that all, or most, RTRAK/RSS measurements within the HPGe field of view fall into the same concentration range (one of the ranges mentioned above).

If no clear correlation between gamma total activity and HPGe total uranium ppm measurement is established, the project lead can designate up to an additional two HPGe measurements in each gamma activity range.

Continued on following page.....

REQUESTED BY: Joan White DATE: 10/9/98

ORIGINAL

Continued from preceding page.



4 - HPGe Measurements - Surface Scan:

If no correlation between total activity and HPGe total uranium ppm measurement can be determined, then a full 90.6% coverage scan (no overlap) of the surface may be conducted with the HPGe system. The decision to conduct the full HPGe scan will be made by the project lead. Measurements will be collected using a 15 minute read at a 1 meter detector height representing a 12 meter diameter field of view. One duplicate HPGe measurement will be taken for every 20 HPGe measurements collected.

5 - Moisture Measurements:

a - For RTRAK/RSS measurements, one moisture measurement will be collected per acre. If visible varying moisture conditions are present in the acre, more than one measurement will be collected and the results averaged for a measurement that is representative of the area.

b - For HPGe measurements at RTRAK/RSS locations, one moisture measurement will be collected at each HPGe location.

c - If HPGes are used to make a 90.6% scan of the surface, one moisture measurement will be collected at each HPGe location.

| X IF REQD | VARIANCE/FAN APPROVAL | DATE | X IF REQD | VARIANCE/FAN APPROVAL | DATE |
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| X | QUALITY ASSURANCE | 10-9-98 | X | PROJECT MANAGER | 10/9/98 |
| | DATA QUALITY MANAGEMENT | | X | Real-time Program Mgr | 10/9/98 |
| | ANALYTICAL CUSTOMER SUPPORT | | X | Characterization Lead | 10/9/98 |
| | OTHER | | | OTHER | 10/9/98 |

VARIANCE/FCN APPROVED [X ]YES [ ]NO

REVISION REQUIRED: [ ]YES [x]NO

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| QUALITY ASSURANCE: | OTHER: | OTHER: |
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# 1.0 INTRODUCTION

## 1.1 PURPOSE

The use of mobile scanning and detection devices such as the Radiation Tracking System (RTRAK) to determine the radiological characteristics of surface media has the potential to optimize time and resources during soil characterization. Previous tests have shown that sodium-iodide detection devices such as the RTRAK are capable of characterizing radiological contamination in soil (Rautman et al. 1994). If the RTRAK is to be used for waste acceptance criteria (WAC) attainment and certification readiness sampling, it is desirable to take measurements as quickly as possible while still obtaining the desired resolution. Therefore, it is necessary to determine the optimal speed and acquisition time configuration which still allows for sufficient resolution to meet the measurement requirements to determine the gamma discernable constituents of concern (COCs) at the Fernald Environmental Management Project (FEMP). This information will help provide the basis for a decision to determine the applicability of RTRAK technology for WAC attainment and certification readiness during soil remediation at the FEMP. Objectives of this study are discussed more explicitly in DQO SL-030.

## 1.2 SCOPE

This Project Specific Plan (PSP) will present the methods of obtaining the necessary data on which to help assess the future use and role of the RTRAK during soil remediation at the FEMP.

The decision on how to use the RTRAK in soil remediation will be partially based upon data collected during this study as well as historical data. Data collection will occur at the locations specified in this PSP. The parameters analyzed are limited to the primary radiological COCs at the FEMP.

## 1.3 KEY PROJECT PERSONNEL

The members of the Soil Characterization and Excavation Project (SCEP) listed in Table 1-1 below are key project personnel for this PSP.

**TABLE 1-1 KEY PROJECT PERSONNEL**

| TITLE | PRIMARY | ALTERNATE |
|---|---|---|
| Project Lead | Chris Sutton | Dave Yesso |
| Project Coordinator | Dale Seiller | Jim Schwing |
| Project Engineer | Jim Schwing | Dale Seiller |
| Technical Expert | Dave Yesso | Tom Cox |
| Quality Assurance Contact | Reinhard Friske | Steve Reutcke |
| Data Management Contact | Jeff Maple | Susan Marsh |
| Health & Safety Contact | Dale Seiller | Kevin Tschaenn |

## 2.0 DATA COLLECTION

2152

Data collection will take place in two parts. Part I, static field of view determination, will lead to a determination of the nominal field of view dimensions of the RTRAK NaI detector. Part II assesses the physical operation parameters of the detector.

### 2.1 PART I - STATIC FIELD OF VIEW DETERMINATION

The spatial resolution determination will be performed with the detector system in a static condition. The measurements for this determination will be performed at building 52A using a Cesium-137 source. The Cs-137 source utilized is a NIST traceable standard assayed at 0.936 uCi on 1 AUG 1996 S/N 405-60-14. Building 52A will be scanned with a micro-r-meter to ensure no interfering radiations fields are present in the background.

The detector crystal has dimensions of 4x4x16 inches. Measurements will be taken radially at a 31 cm offset from the detector centerline in four directions: 0°, 90°, 180°, and 270°. Conventions for measurements will be in degrees, with 0° indicating the front of the vehicle. In each direction, measurements will be taken by moving the point source to four different offset distances from the detector centerline: 31 cm representing 100% of the effective peak area for the 661.6 keV region of interest, and at distances determined form 75%, 50%, and 25% of the effective peak area measured at 31 cm. The distances determined at the 75%, 50%, and 25% EPA are to be determined. A total of 16 measurements will be taken, in the x and y axes. The 0 degree (100%) measurement will be repeated at the start of each angular set of data. Each measurement will utilize the same acquisition time, which will be determined during the 31 cm measurement based on a minimum of 10,000 counts in the reference peak region.

### 2.2 PART II - ASSESSMENT OF PHYSICAL OPERATING PARAMETERS

The detector speed and acquisition time measurements will consist of multiple dynamic runs in an area north of the incinerator (see attached map). The identified testing area measures approximately 1 acre and was selected based on soil characterization data from previous testing and demonstrations. The area is well characterized and the primary gamma discernable radiological COCs are known to be present. Concentrations of U-238, Th-232, Ra-226, and K-40 will serve as the parameters to be analyzed. The approximate concentration range of U-238 is 30-100 pCi/gm within this area. To determine the optimal configuration, three combinations of vehicle speeds and detector acquisition times will be used as follows:

- 2 mph at 2 second acquisition time;
- 0.5 mph at 2 second acquisition time;
- 0.5 mph at 8 second acquisition time.

RTRAK measurement strategy will consist of moving in a clockwise spiral going from the perimeter of the mapped area toward the center of the spiral. Vehicle speed and detector acquisition time will be adjusted prior to each run.

Thirty-six High Purity Germanium (HPGe) measurements at a height of 1 meter will be performed using a triangular grid layout to characterize 100% of the 1 acre as shown schematically on the attached map. The coordinates of each measurement point will be established and located. Soil moisture and density measurements will be performed in conjunction with each HPGe measurement to physically assess the soil conditions.

Static measurements using the RTRAK NaI system will be performed at selected locations on the grid representing two relative high and two relative low contamination concentration values. These locations will be determined upon review of the RTRAK and HPGe measurement results. The measurements will be performed at acquisition time intervals of 2 and 8 seconds for a total of 300 seconds each.

A single track sample profile will be selected based on the RTRAK and HPGe measurement results. This track will be measured using the RTRAK system applying a repeated pass method for twenty iterations using each combination of acquisition time and vehicle speed as described above in the dynamic test for a total of twenty passes. This will allow assessment of the total uncertainty associated with each combination of RTRAK speed and data acquisition time. The track location will be determined based upon review of moving RTRAK measurements.

A general description of the soil type and topography of the gridded measurement area will be recorded. Also, a description of the soil type will be observed and noted at each of the 36 HPGe measurement locations. Soil sample collection is not an aspect of this activity. Atmospheric temperature will be recorded during all measurements using both RTRAK and HPGe detection systems.

## 3.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

### 3.1 PROJECT REQUIREMENTS FOR SELF-ASSESSMENTS, SURVEILLANCES

An independent assessment may be performed by the FEMP QA organization by conducting a surveillance. One or more surveillances may be conducted, consisting of monitoring/observing on-going project activity and work areas to verify conformance to specified requirements. Surveillances shall be planned and documented in accordance with Section 12.3 of the SCQ.

### 3.2 FIELD CHANGES TO THE FIELD IMPLEMENTATION PLAN

Prior to the implementation of changes, the Project Coordinator and Project Engineer shall be informed of the proposed changes. Once the Project Coordinator has obtained written approval from the Project Lead and QA Representative for changes to the PSP, the changes may be implemented. Changes to the PSP shall be noted in the applicable project logbook and on a Variance Request Form. QA must receive the completed Variance Request Form, which includes the signatures of the Project Coordinator, Project Lead, and the Quality Assurance Representative, within 10 days of granting the verbal approval.

### 3.3 APPLICABLE PROCEDURES AND STANDARD METHODS

Measurements and data collection under this PSP shall follow the requirements outlined within the following procedures and standard methods:

EQT-30, Operation of Radiation Tracking Vehicle Sodium Iodide Detection System

EQT-23 Operation of ADCAM Series Analyzers with Gamma Sensitive Detectors
EQT-22 Characterization of Gamma Sensitive Detectors
ASTM D 2922-91: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

## 4.0 EQUIPMENT DECONTAMINATION

Testing as defined in this task will not occur in a designated Controlled Area of contamination. Equipment decontamination procedures will be followed should contamination be identified.

## 5.0 HEALTH AND SAFETY

Participating project and support personnel shall conform to precautionary surveys performed by the personnel representing the Utility Engineer, Industrial Hygiene, and Radiological Control. Concurrence to applicable safety permits (indicated by the signature of each participant assigned to this project) is expected by all project personnel in the performance do their assigned duties.

The Project Engineer will ensure that project personnel have read the Project-Specific Health Plan and Safety Matrix (PSHSM) identified as CON-MTX-1039, dated May 1996, and reviewed the applicable surveys and permits that protect worker safety and health. Project personnel who do not sign these documents shall not participate in the execution of measurement activities related to the completion of assigned project responsibilities. Copies of applicable safety permits/surveys issued for worker safety and health shall are available for review, and at the completion of the project, the completed forms shall be submitted for incorporation into the project record files.

## 6.0 DISPOSITION OF WASTES

No wastes will be generated as a result of measurement activities.

## 7.0 DATA MANAGEMENT

Electronic data from the RTRAK will be collected on computer disk and submitted for transfer to the sitewide environmental database (SED). Data files will be processed for uranium-238, thorium-232, Potassium-40, and radium-226 for mapping on Geographical Information System (GIS). Data will then be assessed and interpreted by the project lead. Data collected will be treated as Analytical Support Level E data as defined by the DQO.

## 8.0 REFERENCES

Rautman, C.A., M.V. Cromer, G.C. Newman and D.A. Beiso. 1994. Fernald Field Characterization Demonstration Program Data Report. Sandia National Laboratories, Albuquerque, N.M.
EQT-30, Operation of Radiation Tracking Vehicle Sodium Iodide Detection System
EQT-23 Operation of ADCAM Series Analyzers with Gamma Sensitive Detectors
EQT-22 Characterization of Gamma Sensitive Detectors
ASTM D 2922-91: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

# APPENDIX A

# DATA QUALITY OBJECTIVES

# SL-030

2152

Control Number _____

# Fernald Environmental Management Project

## Data Quality Objectives

**Title:** Determination of the Optimal Detector Speed for the Mobile Sodium Iodide (NaI) Detector (RTRAK)

**Number:** SL-030

**Revision:** 1

**Effective Date:** 3/26/97

**Contact Name:** Chris Sutton

**Approval:** _____ **Date:** 3/26/97

William D. Kelley
DQO Coordinator

**Approval:** _____ **Date:** 3/27/97

Chris Sutton
Project Lead

| Rev. # | 0 | 1 | | | | | |
|---|---|---|---|---|---|---|---|
| Effective Date: | 3/21/97 | 3/26/97 | | | | | |

DATA QUALITY OBJECTIVES
Determination of the Optimal Detector Speed for the Mobile NaI Detector (RTRAK)

Members of Data Quality Objectives (DQO) Scoping Team
The members of the DQO team include a project lead, a field lead, a statistician, a lead radiological chemist, a sampling supervisor, a non-destructive assay supervisor, a data management lead, a gamma spectroscopy expert, and a representative from the DOE Environmental Measurements Lab.

Conceptual Model of the Site
Soil is considered contaminated if the concentration of an area-specific constituent(s) of concern (ASCOCs) in a Certification unit (CU) exceeds the final remediation levels (FRLs) (See the Area 1 Phase 1 (A1P1) Remedial Action Work Plan, Draft, Rev. date 11/96). The primary source of contamination in peripheral or boundary areas is airborne deposition from the former production area of the FEMP. The extent of soil contamination was estimated and published in the Operable Unit 5 Feasibility Study (FS). Maps outlining contaminated soil boundaries were in the Operable Unit 5 Remedial Investigation(RI) report, and further modified by spatial analysis of maps reflecting the most current soil characterization data. A sequential remediation plan has been presented which subdivides the FEMP into seven construction areas. The certification sampling and analysis program supports a sequential process for site remediation by documenting that each of these seven construction areas, or phase areas, within the construction areas have met their area specific Waste Acceptance Criteria (WAC) for eligibility of disposal into an On Site Disposal Facility (OSDF) and/or Final Remediation Levels (FRLs) established in the Operable Unit 5 Record Of Decision (OU5 ROD).

## 1.0 Statement of Problem

A step in defining the most appropriate application of the RTRAK system is determination of the optimum system operating parameters and the system response characteristics. The goal is to sample an area as quickly as possible while still obtaining the necessary precision and spatial resolution. To establish these parameters it is necessary to determine the optimal combination of travel speed and acquisition time that will detect the gamma discernable constituents of concern (COCs) at the Fernald Environmental Management Project (FEMP).

## 2.0 Identify the Decision

The results of this study must be evaluated for two decisions:

1. What combination of acquisition time and travel speed will provide optimal results such that the necessary precision and spatial resolution are achieved.

2. The overall system precision must be estimated.

## 3.0 Inputs That Affect the Decision

A study area must be defined that contains a wide range of activity concentrations. This area will be described in the PSP.

System response at various combinations of travel speed and acquisition time must be determined.

The precision of the measurements and the system's spatial resolution must be measured.

Static measurements using calibration sources will be made prior to data collection to determine the field of view of the RTRAK system.

A study area must be selected that allows repeated measurements for estimating system precision.

Soil density and soil moisture content must be measured at representative locations throughout the study area and on any days during which data are collected.

A geological description of the HPGe measurement locations and atmospheric conditions must be noted for the data collection period.

## 4.0 The Boundaries of the Situation

### Scale of Decision Making

Testing will be applicable to use of the RTRAK in similar conditions of precipitation and in similar areas of topography and analyte concentrations. The media to be measured will be soil and all associated organic material within the defined test area

### Location of Test

To determine the effects of detector speed and acquisition time on results, sampling will take place in an area north of the incinerator in the eastern sector of the FEMP. The study area will be defined in more detail in the PSP.

Parameters of Interest

The parameters of interest will be primary radiological constituents of concern at the FEMP (radium-226, thorium-232 and total uranium [which is measured isotopically]), cesium-137,, and potassium-40. These parameters have been selected because they are known to be observable in the soil on site, and because the analysis of the COCs is important for all sampling and remediation efforts on impacted soil at the FEMP.

## 5.0 Decision Rule

System precision will be estimated on the basis of the repeat measurements of the single track sample profile.

The optimal operating characteristics will be those that provide the highest travel speed that can achieve the required precision and spatial resolution.

## 6.0 Limits on Decision Errors

### 6.1 Types of Decision Errors and Consequences

#### 6.1.1 Definition

System Precision

Decision Error 1: This is a false positive error. This would occur if it is concluded that the RTRAK system has performance characteristics adequate for a proposed purpose when in fact it is not adequate. This could lead to incorrect decisions which might result in increased costs for remediation or disposal or an increased risk to the public.

Decision Error 2: This is a false negative error. This could occur if a decision is made to not use the RTRAK for purposes for which it is appropriate, possibly resulting in heavier reliance on physical sampling and analysis which is more costly and time consuming than the RTRAK system. This could lead to increased costs and delays in remediation activities.

The potential for these errors will be controlled by ensuring that systems are performing adequately, prior to use. This will be done by conducting all activities in accordance with existing FEMP procedure and the PSP. Oversight of the project by the project management team and quality assurance personnel will help ensure strict adherence to the PSP and procedure requirements.

The RTRAK optimization will be considered to be successful when selected operating

parameters provide precision and spatial resolution that satisfy the needs for the overall FEMP remediation.

## 7.0 Optimizing Design for Useable Data

### 7.1 Static Field of View Determination

#### 7.1.1 Sample Collection

The field of view determination will be performed with the mobile detector system in a static condition. while assessing the system's field of view. The measurements for this determination will be performed at building 52A using a cesium-137 source. A series of measurements will be taken at varying distances and angles from the detector axis. The details of these measurements will be described in more detail in the PSP.

#### 7.1.2 QC Considerations

The RTRAK will be subjected to daily performance checks before sampling in accordance with EQT-30, Operation of Radiation Tracking Vehicle Sodium Iodide Detection System.

Duplicate measurements will be conducted at a minimum of one distance for each of the four angle measurements.

### 7.2 Assessment of Physical Operating Parameters

#### 7.2.1 Sample Collection

After the field of view determination has been performed, the detector speed and acquisition time sampling will consist of multiple dynamic runs in the area north of the incinerator. This area contains approximately 1.0 acres of land in the vicinity of test points 4 and 6 from the Comparability study. Due to the known contamination, the primary gamma discernable radiological COCs will serve as the parameters analyzed. To determine the optimal configuration, three combinations of vehicle speeds and detector acquisition times will be run.

Static measurements using the RTRAK NaI system will be performed at selected locations on the grid representing two relative high and two relative low contamination concentration values. These locations will be determined upon review of the RTRAK and HPGe measurement results. The measurements will be performed at acquisition time intervals of 2 and 8 seconds for a total of 300 seconds each.

In conjunction with these measurements, measurements will also be made of soil moisture. If RTRAK measurements are conducted on the same day that HPGe measurements of the same area are made, it is not necessary to repeat soil moisture measurement. However, if the data are collected on different days or if there is a change in weather conditions or appreciable drying of the soil has occurred between measurements, moisture measurements must be repeated. The moisture levels are being measured so that the results can be corrected to a dry weight basis and will be consistent with laboratory data for radionuclides in soil.

Ambient temperature will be recorded for all measurement. In addition, a geological description of the study area will be recorded.

7.2.2 QC Considerations

Comparisons of the three runs, along with evaluations of past data and the HPGe results will provide information for the characterization of the data reliability.

7.3 Precision Measurements

7.3.1 Sample Collection

To acquire data that can be used to estimate the total uncertainty of the RTRAK system, a series of measurements will be conducted on a portion of the study area. A single track sample profile will be selected from the RTRAK and HPGe measurement results. This track will be measured, using the RTRAK system, for twenty replicates for each combination of acquisition time and vehicle speed as described above in the dynamic test. The data will be evaluated to determine a manner of presentation that provides a reasonable representation of the precision of the data.

Ambient temperature, and soil moisture, and a soil description will be recorded for the period of these tests.

7.3.2 QC Considerations

Evaluation of the replicates will be used to determine precision.

All work will be performed in accordance with the PSP and the SCQ.

7.4 HPGe Measurements

7.4.1 Sample Collection

Measurements of 100% of the area covered by the RTRAK will performed using the

HPGe system. The measurements will be performed in accordance with EQT-23, Operation of ADCAM Series Analyzers with Gamma Sensitive Detectors.

In conjunction with these measurements, measurements will also be made of soil density in conjunction with ASTM D2922-91, moisture and ambient temperature.

7.4.2 QC Considerations

Daily performance checks will be conducted in accordance with EQT-23, Operation of ADCAM Series Analyzers with Gamma Sensitive Detectors.

One measurement will be conducted in duplicate to provide an indication of precision.

7.5 Independent Assessment

Independent assessments of work processes and operations shall be undertaken to assure quality of performance.

Independent assessment shall be performed by the FEMP QA organization by conducting surveillances. Surveillances shall be planned and documented in accordance with Section 12.3 of the SCQ.

7.6 Applicable Procedures

Sample collection under the PSP shall follow the requirements outlined within the following procedures:

EQT-22, Characterization of Gamma Sensitive Detectors
EQT-30, Operation of Radiation Tracking Vehicle Sodium Iodide Detection System
EQT-23, Operation of ADCAM Series Analyzers with Gamma Sensitive Detectors
ASTM D 2922-91, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

**Data Quality Objectives**
**Determination of the Optimal Detector Speed for the Mobile Sodium Iodide (NaI) Detector (RTRAK)**

1A Task/Description: Certification Sampling Analysis

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

RI ☐ FS ☐ RD ☒ RA ☐ $R_vA$ ☐ OTHER ☐

1.C. DQO No.: SL-030 DQO Reference No.: SL-023, SL-028

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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 ☐

---

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

4.B. Objective: Confirmation that excavation activities have remediated the site to below the Final Remediation Level (FRL) for area-specific constituents of concern.

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5. Site Information (Description):

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 ☐
   Temperature ☐
   Specific Conductance ☐
   Dissolved Oxygen ☐
   Technetium-99 ☐

2. Uranium ☒*
   Full Radiological ☒**
   Metals ☐
   Cyanide ☐
   Silica ☐

3. BTX ☐
   TPH ☐
   Oil/Grease ☐

4. Cations ☐
   Anions ☐
   TOC ☐
   TCLP ☐
   CEC ☐
   COD ☐

5. VOA ☐
   BNA ☐
   Pesticides ☐
   PCB ☐

6. Other (specify) ☒
   (Percent Moisture
   Soil density)

* Total Uranium calculated from sum of uranium isotopes

** See Attached List.

6.B. Equipment Selection and SCQ Reference:

| Equipment Selection | | Refer to SCQ Section |
|---|---|---|
| ASL A | _____ | SCQ Section: _____ |
| ASL B | _____ | SCQ Section: _____ |
| ASL C | _____ | SCQ Section: _____ |
| ASL D | _____ | SCQ Section: _____ |
| ASL E | RTRAK, HPGE Systems | 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-030

7.B. Sample Work Plan Reference: Project Specific Plan for-Determination Optimal Detection Speed and Acquisition Time(Project 50.03.49)

Background samples: OU5 RI

7.C. Sample Collection Reference:

Sample Collection Reference: EQT22, EQT23, EQT30

---

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 | X |
| Equipment Rinsate Samples | ☐ | Split Samples | X *** |
| Preservative Blanks | ☐ | Performance Evaluation Samples | ☐ |

Other (specify)

*** Split samples will be collected where required.

8.B. Laboratory Quality Control Samples:

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

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.

**TABLE 1**
**SUMMARY OF CONSTITUENTS OF CONCERN**

| Analytical Suites | Area 1, Phase I Contaminants of Concern | FRL |
|---|---|---|
| Primary COCs | | |
| Gamma discernable radiological | Total uranium | 82 mg/kg ** |
| | Cesium-137 | 1.4 pCi/g |
| | Radium-226 | 1.7 pCi/g |
| | Thorium-232 | 1.5 pCi/g |
| | Potassium-40 | N/A*** |

** Total uranium is obtained from the sum of isotopic uranium results

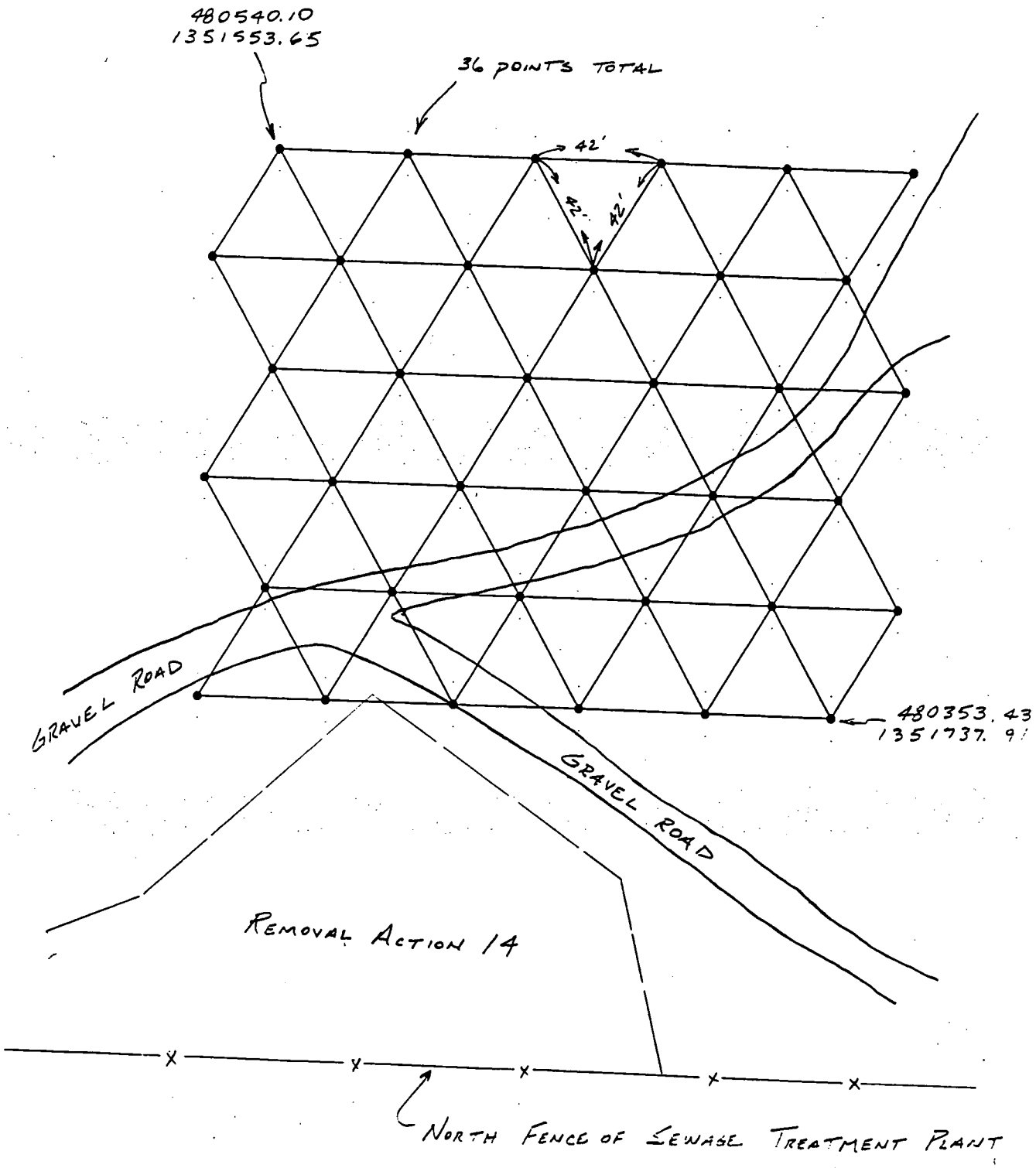
*** There is no FRL for potassium. It is being measured as a useful quality control parameter for assessing system performance.

# APPENDIX B

# TEST AREA MAP AND POINT COORDINATES

RTRAK & HPGe
TEST AREA
(APPROX. ONE Ac)

1:50



PROJECT:
DESCRIPTION:
FILE: F:\PC2\GRID.CGO
UNITS: U.S. SURVEY FOOT

Wednesday, March 26,1997
9:26 AM
PAGE 2

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| TYPE | POINT | NORTHING | EASTING | ELEV. | DESCRIPTION |
|---|---|---|---|---|---|
| LIST | 1 | 480538.7800 | 1351532.6100 | 595.04 | AA6 |
| LIST | 2 | 480534.1500 | 1351712.5500 | 598.20 | AA9 |
| LIST | 3 | 480418.8200 | 1351529.5200 | 593.97 | W6 |
| LIST | 4 | 480352.6600 | 1351767.8900 | 598.00 | U10 |
| LIST | 5 | 480532.6068 | 1351772.5252 | | AA10 |
| LIST | 6 | 480358.8332 | 1351527.9748 | | U6 |
| LIST | 7 | 480357.7529 | 1351569.9609 | | |
| LIST | 8 | 480356.6725 | 1351611.9470 | | |
| LIST | 9 | 480355.5922 | 1351653.9331 | | |
| LIST | 10 | 480354.5119 | 1351695.9192 | | |
| LIST | 11 | 480353.4315 | 1351737.9053 | | |
| LIST | 12 | 480394.6541 | 1351549.9035 | | |
| LIST | 13 | 480393.5737 | 1351591.8896 | | |
| LIST | 14 | 480392.4934 | 1351633.8757 | | |
| LIST | 15 | 480391.4131 | 1351675.8618 | | |
| LIST | 16 | 480390.3327 | 1351717.8479 | | |
| LIST | 17 | 480389.2524 | 1351759.8340 | | |
| LIST | 18 | 480430.4749 | 1351571.8321 | | |
| LIST | 19 | 480429.3946 | 1351613.8182 | | |
| LIST | 20 | 480428.3143 | 1351655.8043 | | |
| LIST | 21 | 480427.2339 | 1351697.7904 | | |
| LIST | 22 | 480426.1536 | 1351739.7765 | | |
| LIST | 23 | 480467.3761 | 1351551.7747 | | |
| LIST | 24 | 480503.1970 | 1351573.7033 | | |
| LIST | 25 | 480539.0179 | 1351595.6320 | | |
| LIST | 26 | 480466.2958 | 1351593.7608 | | |
| LIST | 27 | 480465.2155 | 1351635.7469 | | |
| LIST | 28 | 480464.1351 | 1351677.7330 | | |
| LIST | 29 | 480463.0548 | 1351719.7191 | | |
| LIST | 30 | 480461.9745 | 1351761.7052 | | |
| LIST | 31 | 480502.1167 | 1351615.6894 | | |
| LIST | 32 | 480501.0363 | 1351657.6755 | | |
| LIST | 33 | 480499.9560 | 1351699.6616 | | |
| LIST | 34 | 480498.8757 | 1351741.6477 | | |
| LIST | 35 | 480504.2773 | 1351531.7172 | | |
| LIST | 36 | 480431.5553 | 1351529.8460 | | |
| LIST | 37 | 480537.9375 | 1351637.6181 | | |
| LIST | 38 | 480536.8572 | 1351679.6042 | | |
| LIST | 39 | 480535.7769 | 1351721.5903 | | |
| LIST | 40 | 480534.6965 | 1351763.5764 | | |
| LIST | 41 | 480540.0982 | 1351553.6459 | | |