

ATTACHMENT 9

CONSUMERS ENERGY  
BIG ROCKPOINT

DOCKET NUMBERS 50-155 AND 72-043

TRANSMITTAL OF SURVEY PACKAGES IN SUPPORT OF BIG ROCK POINT PHASED  
LICENSE TERMINATION

CLASS 1 AREA –FINAL STATUS SURVEY, 09C<sub>X41</sub>,  
EXCAVATED SOIL FROM SCREENHOUSE AREA

October 9, 2006

42 Pages

**Final Status Survey 09C<sub>x4</sub>1**

**Excavated Soil from Screenhouse Area  
Survey Unit 09  
Survey Date: 10-01-2004**

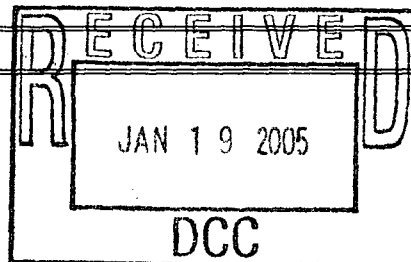
**SURVEY PACKAGE CLOSURE**

Final Status Survey Documentation is authorized for closure. All required reviews are completed and data analysis results meets the criteria established for unrestricted release as clean fill available for construction usage.

Signed: *[Signature]* Date: 11-16-04  
(ESSG Supervisor)

Signed: *[Signature]* Date: 12-09-04  
(ES Superintendent)

Signed: *[Signature]* Date: 12-9-04  
(RP & ES Manager)



**Final Status Survey Area Requirements**  
**Survey 09C<sub>x41</sub>**  
**Excavated Soil from Screenhouse Area**

**Survey Description**

Final Status Survey 09C<sub>x41</sub> encompasses a 1200 m<sup>2</sup> area composed of excavated soil originating from the area immediately west and south of the Screenhouse in Survey Unit 09. Based on Site Characterization (LTP, Appendix 2E) and supporting surveys conducted during the excavation process, the residual radioactivity in soil removed from this area is not expected to exceed fractional concentrations of the DCGL value.

The excavated soil for Final Status Survey (FSS) will be graded to a maximum depth of one (1) meter and surveyed as a Class 1 area in accordance with Special Case Surveys, Procedure RM-76, *Final Status Survey Design*, Section 2.4, and the requirements established in LTP 5.4.2.4 as revised. Sample locations will be established by random start, square grid pattern over the graded area. Each soil sample will be a full core homogenized composite that is representative of total soil thickness. Surface scanning will be conducted over 100% of the survey area.

**History**

The excavated soil for FSS originates from a minor area in Survey Unit 09. This location is a Class 1 area immediately west and south of the Screenhouse.

**Current Radiological Status**

The Historical Site Assessment did not indicate the potential for residual radioactivity in this area. Site characterization analyses and surveys conducted during soil excavation have not identified residual radioactivity above trace concentration levels.

**Quality Assurance/Quality Control**

As a minimum 5% of the sample population of this survey shall be selected for QA/QC verification in accordance with RM-79, *Final Status Survey Quality Control*. Both split samples and sample recounts will take place. In addition, a minimum of 5% of the survey area will receive a verification scan. QA/QC soil samples and verification scan locations will be selected using the RAND function in Microsoft 2000 software program.

**Additional Sample Analysis Requirements**

The area of soil excavation intersects the identified waterborne pathway for Tritium migration and shall require Tritium in soil analyses for a minimum of 10% of the sample population. Tritium soil samples will be sent to an independent laboratory for analysis.

## Post-Construction Expectations

Survey 09C<sub>x4</sub>1 will be performed in the following activity sequence:

1. Walkdown: Site Characterization personnel will perform a walkdown assessment to insure survey area preparations are complete and confirm that the following post-construction expectations have been satisfied:
  - Groundwater and Surface water control is adequate
  - All construction debris has been removed from the survey area
  - The current survey area status meets all applicable safety requirements
2. Survey Area Isolation and Control: Control measures will be established to ensure that any potential ongoing decommissioning activities in adjacent locations do not impact the current survey area status. Isolation and control measures include postings, barriers, access points, and the evaluation of ongoing work activities in adjacent areas.
3. Survey Design and Execution: Survey design and execution will follow the Data Quality Objectives for Survey 09C<sub>x4</sub>1 in accordance with the survey requirements established in RM-76, *Final Status Survey Design*, RM-77, *Final Status Survey Implementation*, and LTP, Chapter 5. Survey size will be based on the statistical requirements of the Sign Test for Class 1 areas with soil samples collected in random start, systematic data point locations. Surface scanning will be performed with 100% survey area coverage. This survey will be conducted in accordance with approved BRP procedures and follow the guidance of NUREG 1575.
4. Data Quality Assessment: Isolation and control of the survey area will be maintained until the survey Data Quality Assessment demonstrates that the regulatory requirements for unrestricted site release have been satisfied.

**DATA QUALITY OBJECTIVES**  
**Survey 09C<sub>x41</sub>**  
**Excavated Soil from Screenhouse Area**

1. STATE THE PROBLEM

*The Problem:*

To demonstrate that the level of residual radioactivity in the excavated soil area originating from Survey Unit 9 does not exceed the release criteria of 25 mrem/year Total Effective Dose Equivalent (TEDE) as specified in the License Termination Plan (LTP). This soil is to be prepared for Final Status Survey (FSS) by grading out to a depth of one (1) meter or less. The excavated soil for FSS is to be designated as a Class 1 survey area. It must be demonstrated that excavated soils in this survey area satisfy the criteria established for unrestricted release prior disposition as fill material for onsite usage.

*Stakeholders:*

The primary stakeholders interested in the answer to this problem are Consumers Energy Co., and the general public as represented by the Michigan Department of Environmental Quality (MDEQ), and the US Nuclear Regulatory Commission (USNRC).

*The Planning Team:*

The planning team consists of members of the BRP Environmental Services Survey Group (ESSG). The primary decision maker will be the Final Status Survey Supervisor. The Final Status Survey Supervisor will obtain input from the site Construction Group and Scheduling Group for issues relating to schedule and costs.

*Schedule:*

Approximately five (5) working days are projected to implement the Final Status Survey to collect and analyze field data.

*Resources:*

The primary resources needed to determine the answer to the problem are two (2) technicians to perform fieldwork, one (1) technician to prepare the samples and conduct laboratory analyses, and two (2) site characterization team members to prepare and review the design, generate maps, coordinate field activities and evaluate data.

2. IDENTIFY THE DECISION

Several decisions need to be defined to address the stated problem.

*Principal Study Question (1):*

Does the mean concentration of residual radioactivity in the survey unit exceed the release criteria stated above?

*Decision (1):*

Determine whether the mean concentration of residual radioactivity in the survey exceeds the release criteria stated in the problem.

*Actions (1):*

Alternative actions include failure of the survey unit, remediation, or no action required.

*Principal Study Question (2):*

Do any areas of elevated activity in the survey unit exceed the release criteria?

*The Decision (2):*

Determine if any areas of elevated activity in the survey unit exceed the release criteria.

*Actions (2):*

Alternative actions include confirmation and investigation, performing the elevated measurement comparison (EMC), remediation, or no action required.

*Principal Study Question (3):*

Is the potential dose from residual radioactivity in the survey unit ALARA as stated?

*The Decision (3):*

Determine if the potential dose from residual radioactivity in the survey unit is ALARA. ALARA requirements for soil remediation are defined in Chapter 4 of the LTP.

*Actions (3):*

Alternative actions include remediation or no action required.

### 3. IDENTIFY INPUTS TO THE DECISION

*Information Needed:*

Characterization measurements are required to define the radionuclides present and determine the extent and variability of residual radioactivity in the survey area for design and implementation of the FSS. Survey area classification, ALARA analysis, potential radionuclides of interest, and site-specific DCGL values are also required inputs to the decision process. The primary information required for evaluation is the analytical results of FSS measurements.

*Source of the Information:*

The soil sample data to be used for FSS development are the radionuclide-specific measurements of soil samples collected within the affected local coordinate grids during the characterization process. The soil samples obtained are both judgmentally and statistically selected as a result of multiple surveys across the area to be excavated. The ALARA analysis for potential soil remediation is provided in LTP, Section 4.4. Site-specific DCGL values and BRP radionuclides of interest are defined in LTP Section 5, Table 5-1 and Procedure RM-76, *Final Status Survey Design*.

The FSS will be conducted in accordance with applicable regulatory guidance as established in LTP Section 5 for Class 1 areas. Soil samples will be utilized for radionuclide-specific measurements in this evaluation.

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FSS Data Quality Objectives

09C.41

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#### 4. BOUNDARIES OF THE STUDY

*Boundaries of the Survey:*

The target population for this survey is the total thickness of prepared soil in the survey area of 1200 m<sup>2</sup>.

*Temporal Boundaries:*

Scanning and sampling in this survey unit will only be performed during daylight hours under dry weather conditions. Collection of data will take place when surface conditions are most favorable. Surface soils must be free of significant snow cover and standing water prior to surface scanning. Soils must be in a non-frozen state or fragmented for collection to satisfy BRP procedural sampling requirements. The anticipated start date for the survey is 10-01-04.

*Constraints:*

Cold weather or rainy conditions may effect the operation of electronic equipment. Adverse weather conditions that include accumulations of rain or snow may limit area access and delay survey efforts.

#### 5. DEVELOP A DECISION RULE

The following decision rules have been developed to define a logical process for choosing among alternative actions for the principal study questions associated with this survey area.

*Decision Rule (1):*

If all reported concentrations for residual radioactivity are less than the site-specific DCGL's and the unity rule has been satisfied for each sample, then the survey unit meets release criteria. No further action is required.

*Decision Rule (2):*

If the mean value of activity in the survey unit is greater than the DCGL, then the survey unit fails to meet the release criteria.<sup>1</sup> Remediate, resurvey, and evaluate the results relative to the decision rule.

*Decision Rule (3):*

If the mean activity in the survey unit is less than the DCGL and any individual sample measurement exceeds this value conduct the Sign Test and the elevated measurement comparison (EMC) per LTP, Chapter 5 and Procedure RM-76, *Final Status Survey Design*. If the EMC and the Sign Test have been satisfied then the survey unit meets the release criteria and no further action is required. If the EMC or the Sign Test has not been satisfied then remediate the area(s) of elevated activity, resurvey as appropriate, and evaluate the results relative to the decision rule.

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<sup>1</sup> When multiple radionuclides are present the mean activity value is determined as the average of the weighted sum. The DCGL of the weighted sum is 1.

*Decision Rule (4):*

If the potential dose from residual radioactivity in the survey unit is ALARA, then no further action is necessary. If the potential dose from residual radioactivity in the survey unit is not ALARA, then remediate and resurvey.

6. SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

*The Null Hypothesis:*

It is assumed that residual radioactivity in the survey unit exceeds the release criterion.

*Type I Error ( $\alpha$ ):*

The  $\alpha$  error is the maximum probability of rejecting the null hypotheses when it is true. The  $\alpha$  error is defined in the LTP at a value of 0.05 (5%) and cannot be changed to a less restrictive value unless prior approval is granted by the USNRC. The  $\alpha$  error value of 0.05 will be used for survey planning and data assessment for this survey area.

*Type II Error ( $\beta$ ):*

The  $\beta$  error is the probability of accepting the null hypothesis when it is false. A value of 0.05 (5%) will be used for survey planning and data assessment for this survey area.

*The Lower Bound of the Gray Region (LBGR):*

The LBGR is initially set at 0.5 for this survey unit. The LBGR may be adjusted during survey design to achieve an optimum relative shift between 1.0 and 3.0.

*Relative Shift ( $\Delta/\sigma$ ):*

The relative shift will be maintained within the range of 1.0 and 3.0 by adjusting the LBGR as appropriate.

7. OPTIMIZE DESIGN FOR OBTAINING DATA

Statistical Test

*Sign Test:*

Radionuclides of potential plant origin also present in soil as background activity resulting from fallout constitute only a small fraction of the DCGL. Therefore, the Sign Test will be used where applicable in the FSS evaluation to determine if the survey area meets the requirements for unrestricted release.

*Number of Samples Determined:*

The number of samples required for this survey will be determined based on the relative shift as defined by the requirements of the Sign Test (LTP, Chapter 5.) and Procedure RM-76, *Final Status Survey Design*. The LBGR is initially set at 0.5 and may be adjusted as necessary for optimizing the survey design to achieve a relative shift between 1.0 and 3.0. Sample point locations are to be determined using a random start, systematic grid spacing. For sample point locations where access is impractical or unsafe, alternate locations will be randomly selected to achieve the sample size requirement.

**Biased Sampling:**

Co-60 is the most limiting radionuclide for identification by surface scanning; biased surface and subsurface core samples will be collected in any location that exceeds the scan investigation level.

**Scan Coverage:**

Scanning for this survey area will provide 100% coverage.

**Number of Samples for Quality Control:**

A minimum of 5% of the sample population will be collected for quality evaluation. These samples may include sample splits, sample recounts, or 3<sup>rd</sup> party sample analysis. Quality analyses will be conducted as defined in LTP, Chapter 5 and Procedure RM-79, *Final Status Survey Quality Control*.

**Additional Sample Analysis Requirements:**

An additional quantity of soil shall be collected for Tritium Analysis in the same locations as samples selected for QAQC. A minimum of 10% of the sample population will be sampled. Tritium analyses will be performed by an independent laboratory. Data results will be provided in the FSS package.

**Investigation Levels:**

Investigation levels are defined in LTP, Chapter 5 and Procedure RM-76, *Final Status Survey Design*, by individual survey area classification; however, prior to regulatory approval of the LTP a more conservative approach for investigation will be established for this survey as shown below:

**Investigation Levels for Survey 09C<sub>x4</sub>1**

Classification	Scan Measurement	Soil Sample Analysis
Class 1	> DCGL	> DCGL <sub>w</sub>

The investigation levels for soil sample measurements are meant to include any individual radionuclide result greater than the site-specific DCGL or where the combined radionuclide values exceed the unity rule. Co-60 is the most limiting radionuclide for identification by surface scanning; further investigation will be initiated at any location that exceeds the Co-60 Scan<sub>DCGL</sub> of 1818 CPM above background as detailed in the survey design.

## SURVEY DESIGN

Survey 09C<sub>x4</sub>1  
Final Status Survey Design  
Excavated Soil from Screenhouse Area

### Survey Unit Description

Final Status Survey 09C<sub>x4</sub>1 is composed of excavated soil from the area west and south of the Screenhouse, originating in Survey Unit 09, Grids 139, 158, 177, and 178. It must be demonstrated that the soil in this prepared survey area meets the criterion established for unrestricted release prior to on site disposition as clean fill material.

The soil has been graded out to a maximum thickness of one (1) meter. Soil sample locations will be determined using a random start square grid pattern over the graded area. Each soil sample will be a homogenized composite representative of the total thickness of soil. Surface scanning will be conducted over 100% of the graded area.

### Soil Sample Design

#### Scoping Data

Sample measurements obtained to determine suitability for transport and FSS of the soil excavated identified only background or MDA levels of residual radioactivity. As a conservative measure, input values for survey design were estimated based on surveys conducted for characterization of this survey area (LTP Appendix 2-E).

Table 1  
Input Data for Survey Design (pCi/g)

Radionuclides	Cs-137	Co-60
$\sigma$	0.43	0.43
DCGL	11.93	3.21

#### Sample Requirements

The number of sample data points for this survey is based on the requirements of the Sign Test. The Unity Rule is used for the presence of multiple radionuclides. The Standard Deviation of the weighted sum is described by the following:

$$\sigma = \sqrt{\left(\frac{\sigma_{\text{CS137}}}{\text{DCGL}_{\text{CS137}}}\right)^2 + \left(\frac{\sigma_{\text{CO60}}}{\text{DCGL}_{\text{CO60}}}\right)^2}$$

$$\sigma = \sqrt{\left(\frac{0.43}{11.93}\right)^2 + \left(\frac{0.43}{3.21}\right)^2}$$

$$\sigma = 0.14$$

### Relative Shift

The DCGL for the weighted sum is 1.0. The relative shift is determined using an LBGR value set at 72% of the DCGL<sub>w</sub>.

$$\text{Relative Shift} = \frac{\text{DCGL} - \text{LBGR}}{\sigma}$$

$$\text{Relative Shift} = \frac{1 - 0.72}{0.14}$$

$$\text{Relative Shift} = 2.0$$

With  $\alpha$  and  $\beta$  error levels set at 0.05 and the relative shift of 2.0, the Sign Test requires 15 sample data points (Table 5.5 NUREG 1575). As a conservative measure 18 samples will be collected in this survey unit.

### Sample Locations

Sample locations are selected in a random-start systematic pattern with the southwest corner of the survey unit as origin (X=0, Y=0). Two random numbers between 0 and 1 are generated using the RAND function within Microsoft 2000 Excel software program (Table 2). The numbers are applied to the survey unit maximum X and Y dimensions to determine the random start location.

Table 2  
Random Numbers

Random #, X Axis	Random #, Y Axis
0.591229	0.467514

Survey Unit 09C<sub>x41</sub> Dimensions: X (E/W) = 150.0 meters  
Y (N/S) = 8.0 meters

Random Start Location: X = (0.591229)(150) = 88.7 meters  
With SW Corner Origin Y = (0.467514)(8) = 3.7 meters

### Sample Spacing

Samples are located in a square grid pattern with sample spacing determined by the following:

$$L = \sqrt{\frac{A}{n}}, \quad \text{where } A = \text{area of survey unit and} \\ n = \text{number of samples.}$$

$$L = \sqrt{\frac{1200}{18}} = 8.2 \text{ meters}$$

Sample point locations are identified in Attachment 1.

### **QA/QC Sampling**

A minimum of 5% of the sample population and 5% of the scan survey area are required to be selected for QA/QC verification in accordance with BRP Procedure RM-79, *Final Status Survey Quality Control*. As a conservative measure, three (3) soil samples and 10% of the scan survey area will be selected for QA/QC evaluation. Data point locations will be selected using the RAND function in the Microsoft 2000 Excel software program:

$\text{RAND}() \cdot (b-a) + a$  where  $a = 1$  and  $b = \text{total number of soil samples to be collected}$ .

Verification scan start point and track direction is determined using the above function. The first sample location selected will determine the start point of the verification scan, and the second sample location will determine the direction in which the scan will track. QA/QC location results are listed in Table 3:

Table 3  
Random Numbers Generated for QA/QC

QA/QC Soil Samples	Random Sample Number	Verification Scan	Random Sample Number
Split Sample:	11	Start Point:	8
Sample Recount:	18	Scan Towards :	16
Sample Recount:	12	Minimum Scan Area Requirement:	60 m <sup>2</sup>

### **Surface Scanning**

The coverage requirement for surface scanning in this Class 1 area is 100%. The Scan<sub>MDC</sub> has been established at fractional values of the DCGL<sub>W</sub> for typical background activity levels at Big Rock Point. Scan<sub>MDC</sub> values for varying backgrounds are provided in Attachment 3. The

investigation level for identification of potential areas of elevated activity in this survey area will be the Scan<sub>DCGL</sub> as defined by the following:

$$\text{Scan}_{\text{DCGL}} = \text{Detector Rating} \frac{\text{CPM}}{\text{uR/hr}} * \text{Exposure Model} \frac{\text{uR/hr}}{\text{pCi/g}} * \text{DCGL}_w$$

$$\text{Scan}_{\text{DCGL}} \text{ for Co-60} = 1818 \text{ cpm}$$

$$\text{Scan}_{\text{DCGL}} \text{ for Cs-137} = 3518 \text{ cpm}$$

Where:<sup>1</sup>

$$\text{Detector Rating} = \frac{1200 \text{ CPM}}{\text{uR/hr}} \text{ Cs-137 and } \frac{565 \text{ CPM}}{\text{uR/hr}} \text{ Co-60}$$

$$\text{Exposure Model} = \frac{1.229 \text{ uR/hr}}{5 \text{ pCi/g}} \text{ Cs-137 and } \frac{5.029 \text{ uR/hr}}{5 \text{ pCi/g}} \text{ Co-60}$$

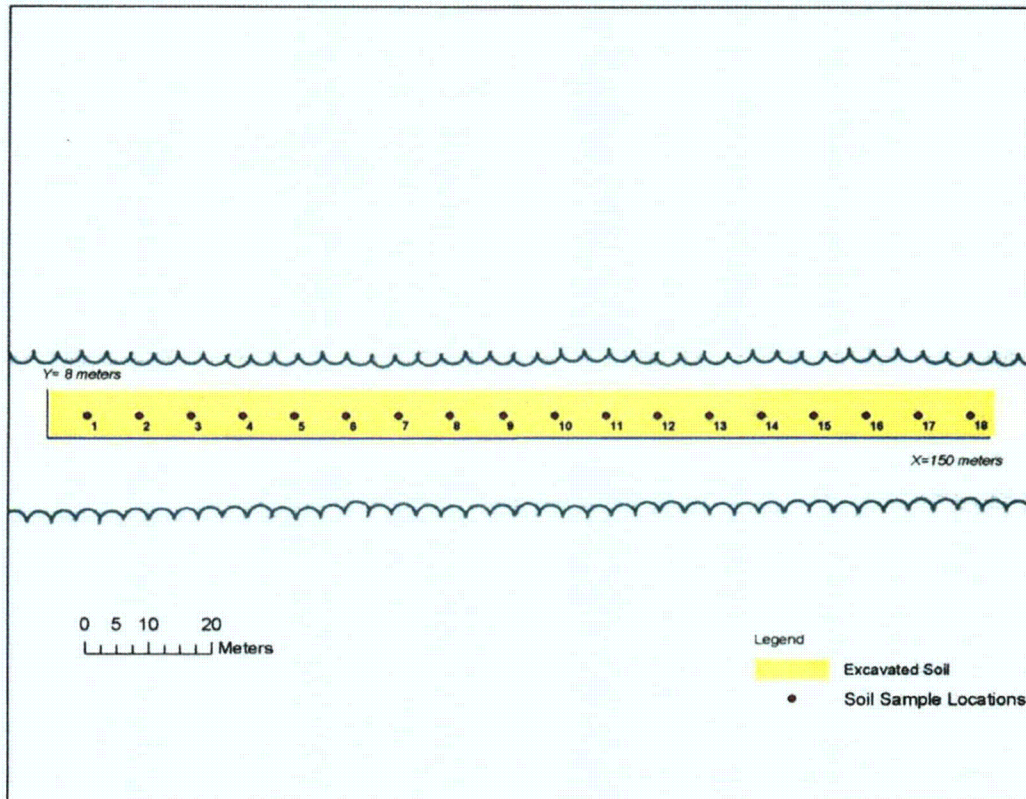
$$\text{DCGL}_w = 11.93 \text{ pCi/g Cs-137 and } 3.21 \text{ pCi/g Co-60}$$

The DCGL<sub>w</sub> for Co-60 is the most limiting value for scanning measurements performed to identify areas of potentially elevated activity. Scanning conducted for this Final Status Survey will assume all residual radioactivity to originate from Co-60 and the instrument response at the Co-60 DCGL<sub>w</sub> (1818 cpm) will be used as the scanning investigation level for Survey 09C<sub>x4</sub>1.

<sup>1</sup> These values established in EA-BRP-SC-0201, *Nal Scanning Sensitivity for Open Land Survey*.

## Attachment 1

Soil Sample Locations  
Final Status Survey 09C<sub>u</sub>1  
Excavated Soil from Screenhouse Area  
10-01-2004



Sample No.	X Coord.	Y Coord.
1	6.7	3.7
2	14.9	3.7
3	23.1	3.7
4	31.3	3.7
5	39.5	3.7
6	47.7	3.7
7	55.9	3.7
8	64.1	3.7
9	72.3	3.7

Sample No.	X Coord.	Y Coord.
10	80.5	3.7
11	88.7	3.7
12	96.9	3.7
13	105.1	3.7
14	113.3	3.7
15	121.5	3.7
16	129.7	3.7
17	137.9	3.7
18	146.1	3.7

Note: Coordinate location relative to SW Corner of survey unit where X=0 m. and Y=0 m.  
Random Start Location: X= 88.7 meters, Y= 3.7 meters. Sample spacing is 8.2 meters.

## Attachment 2

### Scan MDC In Varying Backgrounds

				CPM	MDER uR/hr		Scan MDC pCi/g	
Background	d'	i	s <sub>i</sub>	MDCR <sub>surveyor</sub>	Cs-137	Co-60	Cs-137	Co-60
2000	2.48	4	28.64	607.47	0.51	1.08	2.06	1.07
2500	2.48	4	32.02	679.18	0.57	1.20	2.30	1.20
3000	2.48	4	35.07	744.00	0.62	1.32	2.52	1.31
3500	2.48	4	37.88	803.61	0.67	1.42	2.72	1.41
4000	2.48	4	40.50	859.10	0.72	1.52	2.91	1.51
4500	2.48	4	42.95	911.21	0.76	1.61	3.09	1.60
5000	2.48	4	45.28	960.50	0.80	1.70	3.26	1.69
5500	2.48	4	47.49	1,007.38	0.84	1.78	3.42	1.77
6000	2.48	4	49.60	1,052.17	0.88	1.86	3.57	1.85
6500	2.48	4	51.63	1,095.14	0.91	1.94	3.71	1.93
7000	2.48	4	53.57	1,136.48	0.95	2.01	3.85	2.00
7500	2.48	4	55.45	1,176.37	0.98	2.08	3.99	2.07
8000	2.48	4	57.27	1,214.95	1.01	2.15	4.12	2.14
8500	2.48	4	59.04	1,252.34	1.04	2.22	4.25	2.20
9000	2.48	4	60.75	1,288.65	1.07	2.28	4.37	2.27
9500	2.48	4	62.41	1,323.96	1.10	2.34	4.49	2.33
10000	2.48	4	64.03	1,358.35	1.13	2.40	4.61	2.39
10500	2.48	4	65.61	1,391.90	1.16	2.46	4.72	2.45
11000	2.48	4	67.16	1,424.65	1.19	2.52	4.83	2.51
11500	2.48	4	68.67	1,456.67	1.21	2.58	4.94	2.56
12000	2.48	4	70.14	1,488.00	1.24	2.63	5.04	2.62
12500	2.48	4	71.59	1,518.68	1.27	2.69	5.15	2.67
13000	2.48	4	73.01	1,548.76	1.29	2.74	5.25	2.73
13500	2.48	4	74.40	1,578.26	1.32	2.79	5.35	2.78
14000	2.48	4	75.77	1,607.22	1.34	2.84	5.45	2.83
14500	2.48	4	77.11	1,635.67	1.36	2.89	5.55	2.88
15000	2.48	4	78.42	1,663.63	1.39	2.94	5.64	2.93
Modeled Exposure (uR/hr) @ 5 pCi/g								
	Cs-137	1.23E+00						
	Co-60	5.03E+00						

### Attachment 3

#### Area Factors for Open Land Survey Evaluation

Contaminated Area (m <sup>2</sup> )	Calculated Area Factors at Time of Peak Dose								
	H-3	Mn-54	Fe-55	Co-60	Sr-90	Cs-137	Eu-152	Eu-154	Eu-155
8094	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4047	1.00	1.01	1.00	1.01	1.00	1.02	1.02	1.01	1.02
2024	1.00	1.03	1.00	1.03	1.00	1.03	1.03	1.03	1.03
1012	1.35	1.04	1.00	1.04	1.00	1.04	1.05	1.04	1.04
506	2.91	1.09	1.98	1.08	1.98	1.13	1.07	1.07	1.06
253	6.05	1.14	3.95	1.13	3.94	1.20	1.11	1.11	1.09
126	12.4	1.20	7.93	1.20	7.87	1.29	1.17	1.16	1.14
63	24.9	1.30	15.8	1.30	15.6	1.41	1.27	1.26	1.23
32	49.2	1.49	31.2	1.49	30.5	1.62	1.44	1.45	1.39
16	98.9	1.78	62.0	1.78	59.9	1.93	1.72	1.73	1.63
8	198	2.38	123	2.38	117	2.58	2.30	2.31	2.14
4	397	3.61	243	3.62	230	3.91	3.49	3.52	3.19
2	794	5.68	473	5.75	452	6.14	5.48	5.55	4.90
1	1590	9.57	905	9.73	887	10.3	9.24	9.39	7.88

RM-76-5  
FINAL STATUS SURVEY APPROVAL  
AND AUTHORIZATION FOR IMPLEMENTATION

Survey Code FSS 09C<sub>x4</sub>1

Survey Area Description:

Approximately <sup>1200 fill</sup>~~1050~~ m<sup>2</sup> of excavated soil has been prepared for Special Case Final Status Survey in the Soil Verification Area and graded to a depth of one (1) meter. This soil originated from the excavation immediately west and south of the Screenhouse.

The survey area is authorized for Final Status Survey Implementation.

  
Designed by

9-29-04  
Date

  
Technical Review by

9-29-04  
Date

RM-77-1  
SURVEY IMPLEMENTATION CHECKLIST  
Page 1 of 3

<u>Step</u>		<u>Initial</u>	<u>Date</u>
(+)			
1.0	PREPARATION FOR SURVEY <u>09C-41</u>		
	Survey #		
1.1	Survey Area Status:		
<u>✓</u>	a. Final Status Survey Design has been approved for implementation (see RM-76-5, Final Status Survey Approval and Authorization for Supplementation).		
	1. Survey area walkdown complete		
	2. Survey area determined ready for FSS		
	3. Decommissioning activities that may impact the environmental status of the survey area have been completed.		
	4. Survey area environment is controlled by barriers and postings or other approved method to restrict access.	<u>ESSG</u>	<u>9-30-04</u>
<u>✓</u>	b. Survey area has been turned over to the Environmental Services Survey Group (ESSG) in acceptable condition for FSS.	<u>ESSG</u>	<u>9-30-04</u>
1.2	Field Preparation:		
<u>✓</u>	a. Survey unit boundaries delineated (Step 6.1.1)		
<u>✓</u>	b. Statistical soil samples predetermined in the survey design are located and marked within the survey unit. (Step 6.1.2)		
<u>✓</u>	c. Soil sample locations verified (Step 6.1.2.c)		
<u>✓</u>	d. Instruments and equipment have been collected and calibrated for data measurement and collection (Step 6.1.3)		
<u>✓</u>	e. Field documentation is prepared (Step 6.1.4)	<u>ESSG</u>	<u>10-1-04</u>

RM-77-1  
SURVEY IMPLEMENTATION CHECKLIST  
Page 2 of 3

		<u>Initial</u>	<u>Date</u>
2.0	DATA COLLECTION		
2.1	Soil Survey:		
<u>✓</u>	All soil samples collected and controlled (Step 6.2.1).	<u>MMH</u> ESSG	<u>10-1-04</u>
2.2	Surface Scan:		
<u>✓</u>	Surface Scan complete. Action response requirements have been conducted on any identified areas exceeding the investigation level (Step 6.3).	<u>MMH</u> ESSG	<u>9-30-04</u>
2.3	Judgmental Soil Samples:		
<u>N/A</u>	a. Judgmental soil samples have been collected and controlled (Step 6.2.3).		
<u>N/A</u>	b. Deep core profiles performed in areas identified to contain elevated residual activity (Step 6.2.3).	<u>MMH</u> ESSG	<u>10-1-04</u>
3.0	SAMPLE PREPARATION AND LABORATORY ANALYSIS		
3.1	Sample Preparation (Step 6.4.1):		
<u>✓</u>	a. Soil samples are homogenous		
<u>✓</u>	b. Soil samples are visibly dry prior to packing		
<u>✓</u>	c. Non-soil materials have been removed from sample		
<u>✓</u>	d. Soil samples have been transferred to one-liter Marinelli containers and are labeled and sealed.	<u>MMH</u> ESSG	<u>10-2-04</u>

RM-77-1  
SURVEY IMPLEMENTATION CHECKLIST  
Page 3 of 3

- |   | <u>Initial</u>     | <u>Date</u>     |
|---|--------------------|-----------------|
| 3.2 Laboratory Analysis:  |                    |                 |
| <u>✓</u> Isotopic analyses are complete. The spectroscopy report requires a signature of completion by the laboratory analyst and a signature of evaluation documenting that a second level review has been performed (Step 6.4.2). | <u>MDH</u><br>ESSG | <u>10-4-04</u>  |
| 3.3 Sample Control and Documentation:   |                    |                 |
| Chain of custody documentation exhibits control of soil samples (Step 6.4.3).   | <u>MDH</u><br>ESSG | <u>10-10-04</u> |

<u>W. Parish</u>	<u>11-01-04</u>
Reviewed by	Date

ATTACHMENT RM-59-1  
SAMPLING AND ANALYSIS REPORT

Date: 10-01-2004	Time: 10:55	Location: Powerline/SVA	Tech: mjk/jlr
<b><u>SURVEY IDENTIFICATION / DESCRIPTION</u></b>			
Survey 09C <sub>x4</sub> 1, Final Status Survey of excavated soil originating west and south of the Screenhouse.			
<b><u>SURVEY TYPE</u></b>			
Survey Type: <input type="checkbox"/> Characterization <input checked="" type="checkbox"/> Scan (Motive)			
<input type="checkbox"/> Remediation			
<input checked="" type="checkbox"/> Final <input type="checkbox"/> Scan (Static)			
<b><u>SURVEY DESIGN</u></b>			
Sample Collection: <input type="checkbox"/> Judgmental <input type="checkbox"/> Random <input checked="" type="checkbox"/> Systematic			
Scan Coverage: <u>100</u> %			
<b><u>ANALYSIS</u></b>			
Inst./Serial No. <u>Detector 6</u> DAILY CHECK: <input checked="" type="checkbox"/> SAT <input type="checkbox"/> UNSAT INIT: <u>MDH</u>			
Scan 186201/JB365			
Investigation Of Unidentified Peaks: <input type="checkbox"/> N/A <input checked="" type="checkbox"/> SAT <input type="checkbox"/> UNSAT INIT: <u>MDH</u>			
Minimum Detectable Activity (Section 5.3.3) <input checked="" type="checkbox"/> SAT <input type="checkbox"/> UNSAT INIT: <u>MDH</u>			
<b><u>COMMENTS</u></b>			
Sample Design: Random start with a square grid systematic pattern. Eighteen soil samples were collected all of which showed concentrations of radioactivity at a fraction of the DCGL <sub>w</sub> .			
100% mobile scan did not identify areas of activity above background.			
Technician Signature: <u>Jodie L. Reed</u>		Date: <u>10-02-04</u>	
Second Level Review: <u>Mark J. Hill</u>		Date: <u>10-5-04</u>	

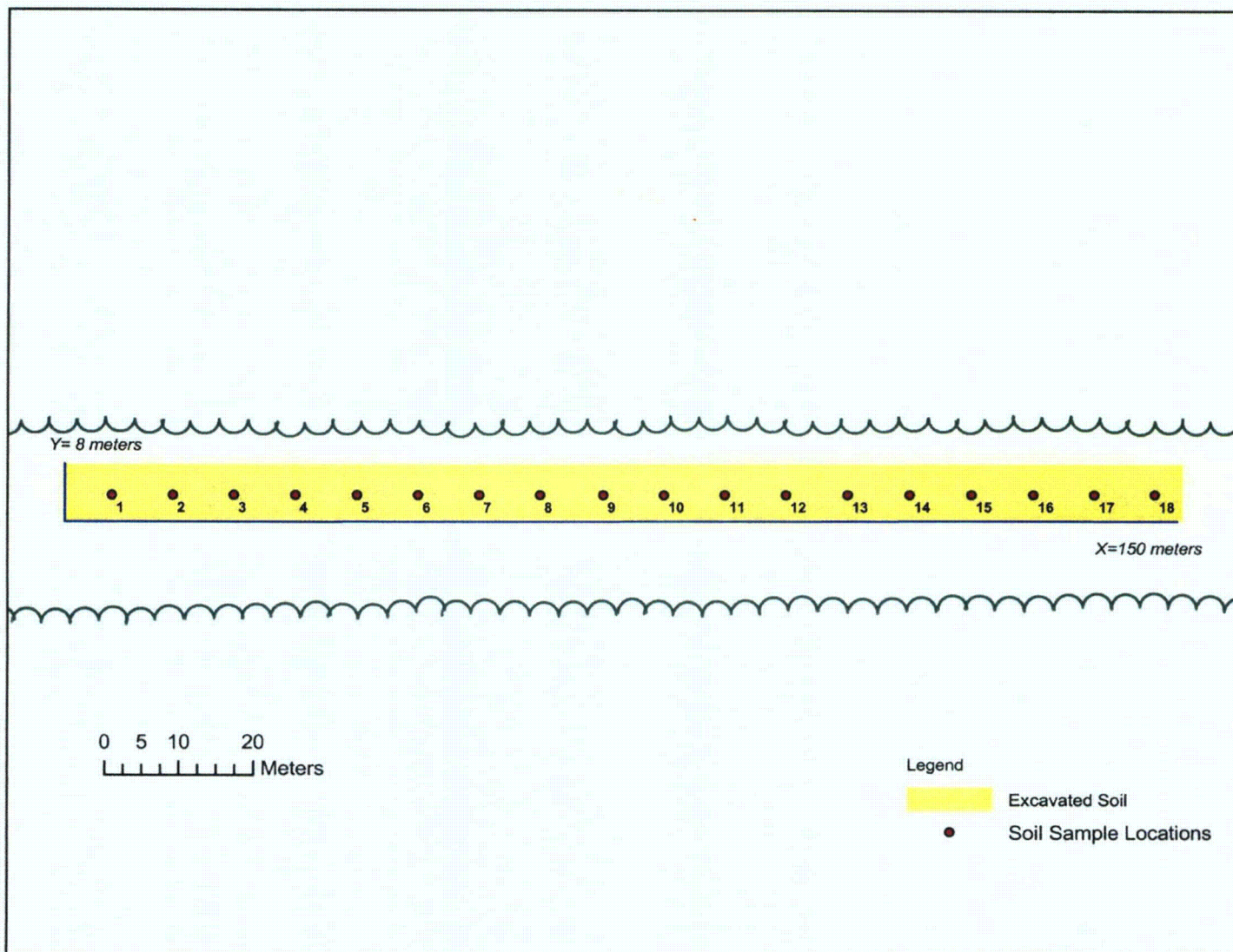
**Activity Summary**  
**Final Status Survey 09C<sub>x4</sub>1**  
**Excavated Soil from Screenhouse Area**  
**10-01-2004**

Sample No.	X Coord.*	Y Coord.*	Cs-137 (pCi/g)		Co-60 (pCi/g)	
			Activity	MDA	Activity	MDA
1	6.7	3.7	0.04		nd	0.07
2	14.9	3.7	0.06		nd	0.06
3	23.1	3.7	0.04		nd	0.05
4	31.3	3.7	nd	0.06	nd	0.05
5	39.5	3.7	nd	0.05	nd	0.05
6	47.7	3.7	nd	0.04	nd	0.05
7	55.9	3.7	nd	0.05	nd	0.06
8	64.1	3.7	nd	0.04	nd	0.07
9	72.3	3.7	nd	0.04	nd	0.06
10	80.5	3.7	nd	0.03	nd	0.07
11	88.7	3.7	nd	0.05	nd	0.05
12	96.9	3.7	nd	0.04	nd	0.05
13	105.1	3.7	nd	0.05	nd	0.08
14	113.3	3.7	nd	0.04	nd	0.06
15	121.5	3.7	nd	0.05	nd	0.05
16	129.7	3.7	nd	0.05	nd	0.06
17	137.9	3.7	nd	0.06	nd	0.05
18	146.1	3.7	nd	0.05	nd	0.05

\*Coordinate location relative to SW Corner of survey unit where X=0 m. and Y=0 m.

Note: nd indicates activity not detected above MDA values.

Soil Sample Locations  
Final Status Survey 09C<sub>x4</sub>1  
Excavated Soil from Screenhouse Area  
10-01-2004

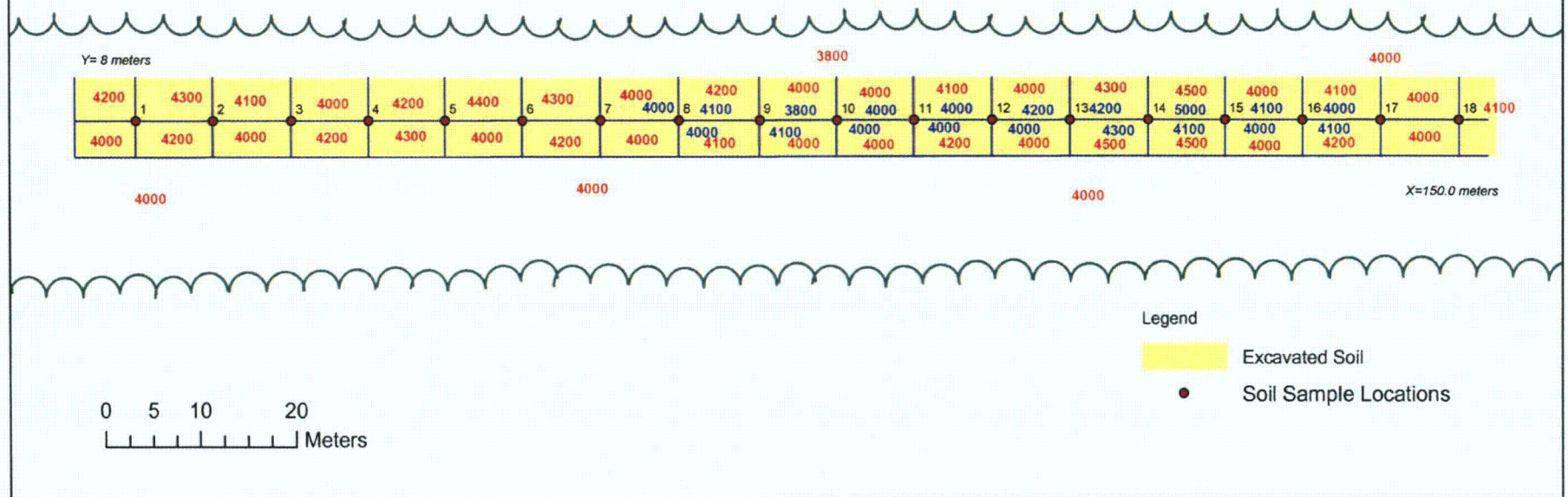


Sample No.	X Coord.	Y Coord.
1	6.7	3.7
2	14.9	3.7
3	23.1	3.7
4	31.3	3.7
5	39.5	3.7
6	47.7	3.7
7	55.9	3.7
8	64.1	3.7
9	72.3	3.7

Sample No.	X Coord.	Y Coord.
10	80.5	3.7
11	88.7	3.7
12	96.9	3.7
13	105.1	3.7
14	113.3	3.7
15	121.5	3.7
16	129.7	3.7
17	137.9	3.7
18	146.1	3.7

Note: Coordinate location relative to SW Corner of survey unit where X=0 m. and Y=0 m.  
Random Start Location: X= 88.7 meters, Y= 3.7 meters. Sample spacing is 8.2 meters.

Final Status Survey 09C<sub>xx</sub>1  
Excavated Soil from Screenhouse Area  
Mobile Scan Survey  
10-01-2004



Primary Scan : 100 %

Technician Signature: [Signature] Date: 9/10/04  
Time: 17:50

QC Verification Scan: 10+ %

Technician Signature: [Signature] Date: 10/1/04  
Time: 12:45

Numbers in **Red** indicate Average General Area Activity (cpm)  
Identified During Mobile Scan  
Numbers in **Blue** indicate Average General Area Activity (cpm)  
Identified During QC Verification Scan

RM-72-1  
CHAIN-OF-CUSTODY RECORD

*Survey 29Cxy1*

Sample Number	Sampling Location	Date	Time	Final Disposition of Sample
1	<del>(6.7)</del> (3.7)	10-1-04	1055	90C
2	(14.8)(3.7)	10-1-04	1057	90D
3	<del>MV</del> (23.1)(3.7)	10-1-04	1100	90D
4	(31.3)(3.7)	10-1-04	1103	90D
5	(39.5)(3.7)	10-1-04	1106	90D
6	(47.9)(3.7)	10-1-04	1108	90D
7	(55.9)(3.7)	10-1-04	1110	90E
8	(64.1)(3.7)	10-1-04	1113	90E
9	(72.3)(3.7)	10-1-04	1115	90E
10	(80.5)(3.7)	10-1-04	1117	90E
11	(89.7)(3.7)	10-1-04	1119	90E
11 split	<del>MV</del> ( <del>105.9</del> )( <del>3.7</del> )( <del>93.1</del> )( <del>3.7</del> )	10-1-04	1119	90F
12	<del>MV</del> ( <del>105.9</del> )(3.7)	10-1-04	1121	90F
13	<del>MV</del> ( <del>133.3</del> )(3.7)	10-1-04	1315	90F
14	(113.3)(3.7)	10-1-04	1317	90F
15	(121.5)(3.7)	10-1-04	1320	90F
16	(124.7)(3.7)	10-1-04	1322	90G
17	(137.4)(3.7)	10-1-04	1325	90G
18	( <del>146.1</del> )(3.7)	10-1-04	1328	90G

(Samples may be analyzed and stored, shipped for offsite evaluation or analyzed and disposed of.)

1. Relinquished by: <i>W. H. Reed</i>	Date 10/01/04	Time 1500	Received in good condition by: <i>Jodie L. Reed</i>
2. Relinquished by: <i>Jodie L. Reed</i>	Date 10/01/04	Time 1550	Received in good condition by: over (locked)
3. Relinquished by: <i>Jodie L. Reed</i>	Date 10/02/04	Time 1030	Received in good condition by: Chem. Lab Locker (locked)
4. Relinquished by: <i>W. H. Reed</i>	Date 10/04/04	Time 1600	Received in good condition by: Permanent Storage

RM-78-3  
DATA ASSESSMENT REPORT  
Page 1 of 8

FINAL STATUS SURVEY: 09C<sub>x41</sub>

1.0 DATA VERIFICATION

1.1 Data Acceptance

x Review the Implementation Checklist (RM-77-1) to verify that survey isolation and control measures were executed prior to FSS and are being maintained.

x Review RM-77, Final Status Survey Implementation, to verify that methods, techniques, and survey activities required for FSS have been applied in accordance with the appropriate procedures.

1.2 Field QC Records:

n/a Review all assessments, Condition Reports and audits to ensure that identified issues have been resolved.

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

x Verify scan instrumentation was in calibration and the QC source checks were performed prior to and after surveys.

x Verify daily QC source checks for Canberra gamma spectroscopy detector properly logged prior to soil sample analysis.

1.3 Review Verification:

x Verify that the Data Quality Objectives are complete.

x Verify that the survey design has been technically reviewed.

RM-78-3  
DATA ASSESSMENT REPORT  
Page 2 of 8

- x   Verify that gamma spectroscopy results have received a technical review.
- x   Verify the Sample and Analysis Report (RM-59-1) is completed and reviewed.

Data Verification Completed: Yes No

Comments \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

  
Assessor

11/11/04  
Date

RM-78-3  
DATA ASSESSMENT REPORT  
Page 3 of 8

2.0 DATA VALIDATION

2.1 Documentation Review:

Perform documentation review for quality control purposes and validate the data collected is complete and appropriate for use as defined by the survey design. Documentation includes:

  x   Field measurement records  
  x   Chain-of-custody  
  x   Quality Control (QC) measurement records  
  x   Current qualification of survey personnel  
 n/a  Corrective Action Reports  
  x   Data inputs (laboratory spectroscopy)  
  x   Sample preparation techniques

2.2 Detection Limit Review:

  x   Scan MDCs are below established site DCGLs.  
  x   Forced-count values are assigned as necessary when activity is not detected in a sample.  
  x   Minimum Detectable Concentration (MDC) values of gamma spectroscopy are below established DCGLs.

2.3 Quality Control (QC) Data Review:

  x   Quality Control (QC) data results have received required reviews and are complete and consistent.  
  x   Results of judgmental samples have been reviewed and evaluated.  
  x   Review to ensure that the analytical results of judgmental samples do not impact the evaluation for unrestricted release of the survey area.

RM-78-3  
DATA ASSESSMENT REPORT  
Page 4 of 8

2.4 Qualification of Data:

Statistical radionuclide-specific measurements for completeness. Evaluate the survey for determination of data usability and confirm that sufficient qualified data are present for the decision process.

a. Total number of statistical samples planned for the survey: 18

b. Total number of statistical samples determined as valid: 18

c. Calculate % Completeness:  $\frac{b}{a} \times 120 = \underline{120\%}$

x Qualified data are  $\geq 100\%$  completeness and are sufficient to support the Sign Test requirement for determination of unrestricted release.

Data Validation Completed: Yes No

Comments: Refer to RM-78-3 Attachment 1 for verification of analysis results, 2.4.a, 2.4.b,  
and 2.4.c.  
Refer to the Additional Sampling Requirements section for Tritium in Soil data  
results.

  
Assessor

11-1-04  
Date

RM-78-3  
DATA ASSESSMENT REPORT  
Page 5 of 8

3.0 DATA QUALITY ASSESSMENT

3.1 Review the DQOs and Survey Design:

- x   Confirm that all inputs to the decision have been reviewed and are complete.
- x   Verify that boundaries or constraints identified in the survey area have not affected the quality of the data.
- x   Review the Statement of Hypothesis and confirm that it remains relevant.
- x   Confirm that Type I and Type II error limits are consistent with DQOs.
- x   Confirm that the survey design is consistent with DQOs and that the appropriate number of data points were obtained.

3.2 Preliminary Review:

3.2.1 Preliminary Evaluation:

- x   Quality Assessment (QA) reports consistent with procedure RM-79, Final Status Survey Quality Control.
- x   Survey is of sufficient intensity to satisfy classification requirement.
- x   Potential trends of radioactivity levels in the survey area do not impact a decision for unrestricted release.

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RM-78-3  
DATA ASSESSMENT REPORT  
Page 6 of 8

3.2.2 Calculate Basic Statistical Quantities:\*

- |    |                                 |                    |
|----|---------------------------------|--------------------|
| a. | Number of qualified data points | <u>18</u>          |
| b. | Calculation of the Mean         | <u>0.003 (SOR)</u> |
| c. | Calculation of the Median       | <u>0.004 (SOR)</u> |
| d. | Calculation Standard Deviation  | <u>0.004 (SOR)</u> |

*\*Note: Statistical Quantities are calculated on RM-78-3, Attachment 1.*

n/a Attach graphic representation of the data if any radionuclide-specific measurements exceed 50% of the DCGL.

x Sample QA/QC measurements consistent with FSS data.

3.3 Statistical Evaluation:

**NOTE:** If all measurement data are less than the  $DCGL_w$ , statistical testing is not required and the survey unit meets the regulatory requirement for unrestricted release.

x All survey measurements are below the  $DCGL_w$ .

3.3.1 Verify Assumptions of the Statistical Test

n/a Review the posting plot to verify that the if data exhibits spatial independence. Spatial trends must be investigated and resolved prior to further assessment.

n/a Review to verify dispersion symmetry. The appearance of skewed data must be investigated for cause and documented prior to further assessment.

RM-78-3  
DATA ASSESSMENT REPORT  
Page 7 of 8

n/a Review the dataset standard deviation and range for data variance. Questionable data must be investigated for cause and documented prior to further assessment.

n/a Compare the prospective power curve with the retrospective power curve. Verify that the data exhibits adequate power and confirm that the sample size is sufficient to satisfy the DQOs.

3.4 Draw Conclusions from the Data:

3.4.1 Investigation Levels and Response Actions

x Determine if data results have exceeded any investigation level. Document findings.

3.4.2 Evaluation for Unrestricted Release

Select applicable conclusion:

x Survey area acceptance criteria met and survey area satisfies the requirements for unrestricted release:

x All concentrations are less than the  $DCGL_w$ . The Null Hypothesis is rejected.

n/a The mean concentration of the survey area is below the  $DCGL_w$  but individual measurements in the survey unit exceed the  $DCGL_w$ . The Sign Test and EMC evaluation are successful and the Null Hypothesis is rejected.

RM-78-3  
DATA ASSESSMENT REPORT

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n/a Survey area acceptance criteria not met and survey area fails to satisfy the requirements for unrestricted release:

n/a The mean concentration in the survey area exceeds the DCGL<sub>w</sub> and the null hypothesis is confirmed.

n/a The mean concentration of the survey area is below the DCGL<sub>w</sub> but individual measurements in the Unit exceed the DCGL<sub>w</sub>. The Sign Test and EMC evaluation are unsuccessful and the null hypothesis is confirmed.

Data Quality Assessment Completed: Yes No

Comments \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

  
\_\_\_\_\_  
Assessor

11/1/04  
\_\_\_\_\_  
Date

Reviews:

  
\_\_\_\_\_  
Technical Review

11/01/04  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
ES Superintendent

12/2/04  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
RP&ES Manager

12-9-04  
\_\_\_\_\_  
Date

**RM 78-3, Attachment 1:**  
**Analysis of Data Results**  
**Final Status Survey 09C<sub>x3</sub>1**  
**Excavated Soil from Screenhouse Area**  
**09-23-2004**

Sample Number	Cs-137 (pCi/g)	Co-60 (pCi/g)	Weighted Sum	*Weighted Sum <DCGL <sub>w</sub> ?	DCGL-W. Sum	Sign
1	0.0354	0.0122	0.007	yes	0.993	+1
2	0.0617	-0.0036	0.004	yes	0.996	+1
3	0.0381	-0.0267	-0.005	yes	0.995	+1
4	0.0292	-0.0180	-0.003	yes	0.997	+1
5	0.0142	-0.0097	-0.002	yes	0.998	+1
6	0.0024	0.0119	0.004	yes	0.996	+1
7	0.0174	0.0179	0.007	yes	0.993	+1
8	-0.0051	0.0209	0.006	yes	0.994	+1
9	0.0022	0.0108	0.004	yes	0.996	+1
10	-0.0047	0.0247	0.007	yes	0.993	+1
11	0.0350	0.0016	0.003	yes	0.997	+1
12	-0.0024	-0.0142	-0.005	yes	0.995	+1
13	0.0088	0.0191	0.007	yes	0.993	+1
14	0.00005	0.0086	0.003	yes	0.997	+1
15	0.0229	-0.0149	-0.003	yes	0.997	+1
16	0.0069	0.0195	0.007	yes	0.993	+1
17	0.0174	0.0202	0.008	yes	0.992	+1
18	0.0145	0.0057	0.003	yes	0.997	+1

St. Deviation (SOR): 0.004  
Mean (SOR): 0.003  
Median (SOR): 0.004

Number of Positive Differences (S+): n/a

Critical Value, *k*, Table I.3 of *Marssim*: n/a

S+ > than *k*? : n/a

Survey Unit Pass or Fail: *\*Pass*

**Note:** Forced-Count values are used for samples with activity levels below the MDA.

\* If all measurement data are less than the DCGL<sub>w</sub>, then the Sign Test is not required.

000000 0.0000 0.0000

000000 0.0000 0.0000

RM-79-1  
FSS QUALITY CONTROL EVALUATION RESULTS

FSS Package # 09C<sub>x41</sub> QC Package # 09C<sub>x41</sub>

QC Measurement Type	Acceptance Criteria Met*?	Reference
<u>x</u> 1. Replicate Scan	<u>Yes</u> / No	Step 5.1.3
2. Sample Recounts		Step 5.1.4.1
<u>x</u> a. In-house	<u>Yes</u> / No	
b. Third party	Yes / No	
3. Split Samples		Step 5.1.4.2
<u>x</u> c. In-house	<u>Yes</u> / No	
d. Third party	Yes / No	

**\*NOTE:** If Acceptance Criteria is not met, completion of Attachment RM-79-2, FSS Quality Control Investigation Results, is required.

Comments:

1. Replicate Verification Scan Information is documented in the Implementation Section of this report, FSS Mobile Scan Map.

2a. In-House Sample Recount Worksheet is attached.

3c. Split Sample Verification Worksheet is attached.

Reviews:

  
Evaluator

11-01-04  
Date

  
Technical Review

11/1/04  
Date

# **QA Verification** **Split Sample Analysis**

Date: 10/1/2004

QA: 09C<sub>x4</sub>2 Excavated Soil From Screenhouse Area

Type: Split Sample

Lab: In House

Table 1

Acceptance Criteria	
Resolution	Ratio
<4	N/A
4-7	0.5-2.0
8-15	0.6-1.66
16-50	0.75-1.33
51-200	0.8-1.25
>200	0.85-1.18



			A	B	C	D	E	F	G	
Sample	Radionuclide	BRP Result Below MDA	BRP Results (pCi/g)	BRP % Error (Sigma)	BRP Resolution	Acceptance Ratio (Table 1)	Split Results Below MDA	Split Results (pCi/g)	Comparison Ratio F/A	Results in Agreement Compare G with D)
11	Co-60	<	0.0497	n/a	n/a	n/a	<	0.0696	1.40	YES
11	Cs-137	<	0.0512	n/a	n/a	n/a	<	0.0516	1.01	YES

$$\text{Resolution C} = \frac{A}{(A)(B/100)}$$

< Indicates results less than the MDA.

# **QA Verification Sample Recount Analysis**

Date: 10/1/2004

QA: FSS 09C<sub>x4</sub>1 Excavated Soil From Screenhouse Area

Type: Sample Recount

Lab: In- House

Table 1

Acceptance Criteria	
Resolution	Ratio
<4	N/A
4-7	0.5-2.0
8-15	0.6-1.66
16-50	0.75-1.33
51-200	0.8-1.25
>200	0.85-1.18



			A	B	C	D	E	F	G	
Sample	Radionuclide	BRP Result Below MDA	BRP Results (pCi/g)	BRP % Error (Sigma)	BRP Resolution	Acceptance Ratio (Table 1)	Recount Result Below MDA	Recount Results (pCi/g)	Comparison Ratio F/A	Results in Agreement Compare G with D)
12	Co-60	<	0.0452	n/a	n/a	n/a	<	0.0555	1.23	YES
12	Cs-137	<	0.0433	n/a	n/a	n/a	<	0.0358	0.83	YES
18	Co-60	<	0.0463	n/a	n/a	n/a	<	0.0436	0.94	YES
18	Cs-137	<	0.0495	n/a	n/a	n/a	<	0.0533	1.08	YES

$$\text{Resolution } C = \frac{A}{(A)(B/100)}$$

< Indicates results less than the MDA.

**Tritium in Soil  
Analysis of Data Results  
Final Status Survey 09C<sub>x4</sub>1  
Screenhouse Excavation Area  
10-01-2004**

<b>Sample Number</b>	<b>Tritium in Soil (pCi/g)</b>
11	0.04
12	0.06
18	0.24

**Mean: 0.11  
Median: 0.06  
St. Dev: 0.11**

Note: DCGL for Tritium is 327 pCi/g.  
Sample data results are a fraction of the DCGL.

# GENERAL ENGINEERING LABORATORIES, LLC

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## 10 CFR Part 50/61 Certificate of Analysis

GEL Sample ID: 123759006  
Client Sample ID: #11 FSS 09CX41  
Matrix: Soil  
Amount of Sample Received:

Client: Big Rock Nuclear Facility  
Collect Date: October 01, 2004  
Receive Date: October 18, 2004  
Report Date: November 01, 2004

Analyte	Aliquot ( )	Run Date	Activity <sup>2</sup>	Uncertainty	MDA <sup>1</sup>	RL	Units	Qualifier
H-3		10/27/04	5.40E+02	2.27E+02	3.55E+02	5.00E+02	pCi/L	3
Moisture		10/29/04	6.29E+00				percent	

Note(s): 1. Calculated MDAs are a-posteriori values.

2. Activity concentration net +/- 2 sigma overall on reference date.

3. Results are statistically positive at the 99.9% confidence level (activity is greater than three times the uncertainty)

U Indicates the target analyte was analyzed for but not detected above the detection limit.

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## 10 CFR Part 50/61 Certificate of Analysis

GEL Sample ID: 123759007  
Client Sample ID: #12 FSS 09CX41  
Matrix: Soil  
Amount of Sample Received:

Client: Big Rock Nuclear Facility  
Collect Date: October 01, 2004  
Receive Date: October 18, 2004  
Report Date: November 01, 2004

Analyte	Aliquot	Run Date	Activity <sup>2</sup>	Uncertainty	MDA <sup>1</sup>	RL	Units	Qualifier
	0							
H-3		10/27/04	1.05E+03	2.64E+02	3.82E+02	5.00E+02	pCi/L	3
Moisture		10/29/04	6.22E+00				percent	

Note(s): 1. Calculated MDAs are a-posteriori values.

2. Activity concentration net +/- 2 sigma overall on reference date.

3. Results are statistically positive at the 99.9% confidence level (activity is greater than three times the uncertainty)

U Indicates the target analyte was analyzed for but not detected above the detection limit.

# GENERAL ENGINEERING LABORATORIES, LLC

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## 10 CFR Part 50/61 Certificate of Analysis

GEL Sample ID: 123759012  
Client Sample ID: #18 FSS 09CX41  
Matrix: Soil  
Amount of Sample Received:

Client: Big Rock Nuclear Facility  
Collect Date: October 01, 2004  
Receive Date: October 18, 2004  
Report Date: November 01, 2004

Analyte	Aliquot ( )	Run Date	Activity <sup>2</sup>	Uncertainty	MDA <sup>1</sup>	RL	Units	Qualifier
H-3		10/27/04	3.73E+03	4.19E+02	4.87E+02	5.00E+02	pCi/L	3
Moisture		10/29/04	6.99E+00				percent	

Note(s): 1. Calculated MDAs are a-posteriori values.

2. Activity concentration net +/- 2 sigma overall on reference date.

3. Results are statistically positive at the 99.9% confidence level (activity is greater than three times the uncertainty)

U Indicates the target analyte was analyzed for but not detected above the detection limit.

Filename : H3VAC.WAT

File type : Excel

Version # : 13

Batch : 375116

Analyst : JLB1

Date : 10/22/2004

BKG Count time : 30 min

# TRITIUM WATER/SOIL

Using the Vacuum Distillation Rig

Procedure Code : LSC\_VH3S

Parmname : Tritium

Batch Counted on : LSCBLUE

Sample ID	Sample Dup	Run Date
1200725333	123759001	10/27/2004 9:34
1200725334	123759001	10/27/2004 10:05
1200725335		10/27/2004 10:37

BRP SAMPLE ID	Sample ID	Sample Volume mL	Position#	Count Time min	Raw CPM	Net Sample CPM	Counting Efficiency %	Bkg CPM	Time Counted
	123759001	10.0000	10-2	30	28.47	21.30	26.75	7.17	10/27/2004 2:39
	123759002	10.0000	10-3	30	7.10	-0.07	27.20	7.17	10/27/2004 3:11
	123759003	10.0000	10-4	30	7.60	0.43	28.01	7.17	10/27/2004 3:43
	123759004	10.0000	10-5	30	14.20	7.03	28.29	7.17	10/27/2004 4:15
	123759005	10.0000	10-6	30	14.77	7.60	24.53	7.17	10/27/2004 4:47
11 090x4	123759006	10.0000	10-7	30	10.77	3.60	30.06	7.17	10/27/2004 5:18
12 090x4	123759007	10.0000	10-8	30	13.70	6.53	27.91	7.17	10/27/2004 5:50
	123759008	10.0000	10-9	30	27.50	20.33	29.35	7.17	10/27/2004 6:22
	123759009	10.0000	10-10	30	7.53	0.36	28.45	7.17	10/27/2004 6:54
	123759010	10.0000	10-11	30	7.93	0.76	26.55	7.17	10/27/2004 7:26
	123759011	10.0000	10-12	30	25.33	18.16	23.13	7.17	10/27/2004 7:58
13 090x4	123759012	10.0000	53-1	30	25.30	18.13	21.91	7.17	10/27/2004 8:30
	1200725332	10.0000	53-2	30	7.33	0.16	29.01	7.17	10/27/2004 9:02
	1200725333	10.0000	53-3	30	31.23	24.06	27.54	7.17	10/27/2004 9:34
	1200725334	10.0000	53-4	30	109.50	102.33	22.66	7.17	10/27/2004 10:05
	1200725335	10.0000	53-5	30	43.40	36.23	23.00	7.17	10/27/2004 10:37

Sample Type	Standard ID	NC	NC units	Recovery/RPD
DUP				9%
MS	0134-H	1.17	pCi/G	105%
LCS	0134-H	7.98	pCi/G	89%

BRP SAMPLE ID	Tritium MDA pCi/G	Tritium RESULT pCi/G	Tritium ERROR pCi/G	MDA Met?	Error Met?
	0.0292	0.26	0.0263	Yes	Yes
	0.0199	0.00	0.0113	Yes	Yes
	0.0188	0.00	0.0109	Yes	Yes
	0.0229	0.07	0.0160	Yes	Yes
	0.0255	0.08	0.0180	Yes	Yes
#11 09C x41	0.0269	0.04	0.0172	Yes	Yes
#12 09C x41	0.0230	0.06	0.0159	Yes	Yes
	0.0222	0.19	0.0198	Yes	Yes
	0.0138	0.00	0.0080	Yes	Yes
	0.0195	0.01	0.0115	Yes	Yes
	0.0323	0.25	0.0279	Yes	Yes
#18 09C x41	0.0319	0.24	0.0274	Yes	Yes
	0.3678	0.02	0.2116	Yes	Yes
	0.0283	0.29	0.0265	Yes	Yes
	0.0344	1.49	0.0562	Yes	Yes
	0.4639	7.10	0.4984	Yes	Yes