

ATTACHMENT 4

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

CLASS 1 AREA - FINAL STATUS SURVEY, 02C_{X1}1,
EXCAVATED SOIL FROM RETENTION POND CONSTRUCTION

October 9, 2006

37 Pages

Final Status Survey 02C_{x1}1

**Excavated Soil from Retention Pond Construction
Survey Unit 02
Survey Date: 05-27-2004**

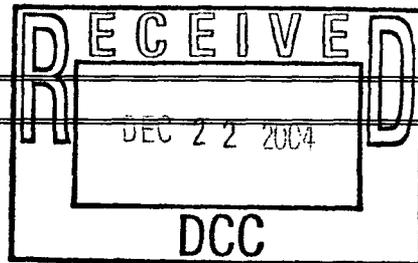
SURVEY PACKAGE CLOSURE

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: 8-19-04
(ESSG Supervisor)

Signed: *[Signature]* Date: 8-20-04
(ES Superintendent)

Signed: *[Signature]* Date: 10-13-04
(RP & ES Manager)



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**Final Status Survey Area Requirements
for Survey 02C_{x1}1
Excavated Soil from Retention Pond Construction**

Survey Description

Final Status Survey 02C_{x1}1 is composed of excavated soil originating from Survey Unit 02, Grids 205-208, 224-227, 243-246, 262-265, and 300-303. Based on the Site Characterization (LTP, Chapter 2) 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

Survey Unit 2 is located near the southwest boundary of the Protected Area adjacent to the transport route used to move spent resin and filter material from the Protected Area to the Radwaste Building. The specific area affected by the excavation is underneath the former location of the Maintenance Complex. The potential for subsurface contamination exists in this area due to subsurface stormwater drains, piping, and conduit. Previous characterization of subsurface areas in contact with stormdrains and piping has identified trace amounts of residual contamination.

Current Radiological Status

Residual radioactivity in the soil removed from this area has not been identified above fractional values of the DCGL in any survey effort conducted to date. Input for this evaluation includes the following survey data:

- Survey 02A₅1, Characterization of Retention Pond Excavation dated 4-30-04.
- Survey 02A₄1, Characterization of Stack Stormdrain Re-route dated 4-22-04.
- Survey 02A₃1, Characterization of Maintenance Building Septic Tank Removal dated 4-14-04.
- Survey 02A₂1, Characterization of Soil Underneath Former Maintenance Building dated 10-24-03.
- Survey 02A_{Deepcore1}1, Deep Core Boring performed by Radian International, dated 07-26-99.
- Survey 02A₁1, Primary Characterization of Survey Unit 2 dated 7-13-99 and 7-28-99.

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FSS Survey Area Requirements

02C_{x1}1

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Quality Assurance/Quality Control

As a minimum, 5% of the sample population shall be selected for QA/QC verification in accordance with BRP Procedure 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 Excel software program.

Post-Construction Expectations

Survey 02C_{x1}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:
 - Excavated soil graded to a thickness not exceeding one (1) meter,
 - All visible demolition debris has been removed from the survey area, and
 - The current survey area status meets all applicable safety requirements.
2. Survey Area Isolation and Control: Control measures will be established to ensure that 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 02C_{x1}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. Each soil sample will be a full core, homogenized composite representative of total soil thickness. ~~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. Once released for unrestricted use, this soil will be stockpiled in the Soil Verification Area (SVA) for future use.

DATA QUALITY OBJECTIVES

Survey 02C_{x1}1 Excavated Soil from Retention Pond Construction

1. STATE THE PROBLEM

The Problem:

To demonstrate that the level of residual radioactivity in the excavated soil from Local Coordinate Grids 205-208, 224-227, 243-246, 262-265, and 300-303 in Survey Unit 02 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 the prepared survey area meets the criteria established for unrestricted release prior to disposition as clean fill available for construction 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 were 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 BRP 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. Full core soil samples will be utilized for radionuclide-specific measurements in this evaluation.

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. The physical boundary of the survey includes all prepared soil in a defined survey area of 150 m².

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 05-25-04.

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.¹ 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 BRP 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.

¹ 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:

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 (α):

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

Type II Error (β):

The β 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 (Δ/σ):

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.). 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 3rd party sample analysis. Quality analyses will be conducted as defined in LTP, Chapter 5 and Procedure RM-79 *Final Status Survey Quality Control*.

Investigation Levels:

Investigation levels are defined in LTP, Chapter 5 and BRP 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 02C_{x1}1

Classification	Scan Measurement	Soil Sample Analysis
Class 1	> DCGL	> DCGL _w

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_{DCGL} of 1818 CPM above background as detailed in the survey design.

SURVEY DESIGN

Survey 02C_{x1}1
Final Status Survey Design
Excavated Soils from Retention Pond Construction

Survey Unit Description

Final Status Survey 02C_{x1}1 is composed of excavated soil originating Survey Unit 02, Grids 205-208, 224-227, 243-246, 262-265, and 300-303. The location from which the excavated soil originated is designated as a Class 1 Area. It must be demonstrated that the prepared survey area meets the criteria established for unrestricted release prior to disposition as clean fill.

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

Input for survey design was developed from ten (10) data points collected in the immediate area of excavation during the characterization phase of Survey Unit 02. Scoping data are detailed in Attachment 1. DCGL values for identified radionuclides are presented in Table 1 below:

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

Radionuclides	Cs-137	Co-60
σ	1.38	0.03
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:

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

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$$\sigma = \sqrt{\left(\frac{1.38}{11.93}\right)^2 + \left(\frac{0.03}{3.21}\right)^2}$$

$$\sigma = 0.12$$

Relative Shift

The DCGL for the weighted sum is 1.0. The relative shift is determined using an LBGR value set at 76% of the DCGL_w.

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

$$\text{Relative Shift} = \frac{1 - 0.76}{0.12}$$

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

With α and β error levels set at 0.05 and a maximum relative shift of 2.0, the Sign Test requires 15 sample data points (Table 5.5 NUREG 1575). As a conservative measure, a minimum of 18 soil 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 X and Y dimensions to determine the random start location.

Table 2

Random Numbers

Random #, X Axis	Random #, Y Axis
0.238372	0.606852

Survey Unit 02C_{x1}1 Dimensions: X (E/W) = 15 meters
Y (N/S) = 10 meters

Random Start Location: X = (0.238372)(15) = 3.6 meters
Y = (0.606852)(10) = 6.1 meters

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FSS Design

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Sample Spacing

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

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

$$n = \text{number of samples.}$$

$$L = \sqrt{\frac{150}{18}} = 2.9 \text{ meters}$$

With sample spacing established at 2.9 meters, 19 data point locations are available for survey as identified in Attachment 2.

QA/QC Sampling

As a minimum, 5% of the sample population and 5% of the survey area shall 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. Soil samples will be selected using the RAND function in the Microsoft 2000 Excel software program:

RAND()*(b-a)+a where a = 1 and b = total number of soil samples to be collected.

Verification scan start point and track direction will be 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.

Table 3
Random Numbers for QA/QC

QA/QC Soil Samples	Random Sample Number	Verification Scan	Random Sample Number
Split Sample:	6	Start Point:	15
Sample Recount:	16	Scan Towards :	3
Sample Recount:	14	Minimum Scan Area Requirement:	7.5 m ²

Surface Scanning

The coverage requirement for surface scanning in this Class 1 area is 100%. The Scan_{MDC} has been established at fractional values of the DCGL_W for typical background activity levels at Big Rock Point. Scan_{MDC} 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_{DCGL} as defined by the following:

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

Scan_{DCGL} for Co-60 = 1818 cpm

Scan_{DCGL} for Cs-137 = 3518 cpm

Where:¹

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

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

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

The DCGL_w 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_w (1818) will be used as the scanning investigation level for Survey 02C_{x1}1.

¹ These values established in EA-BRP-SC-0201, *Scanning Sensitivity for Open Land Survey*.

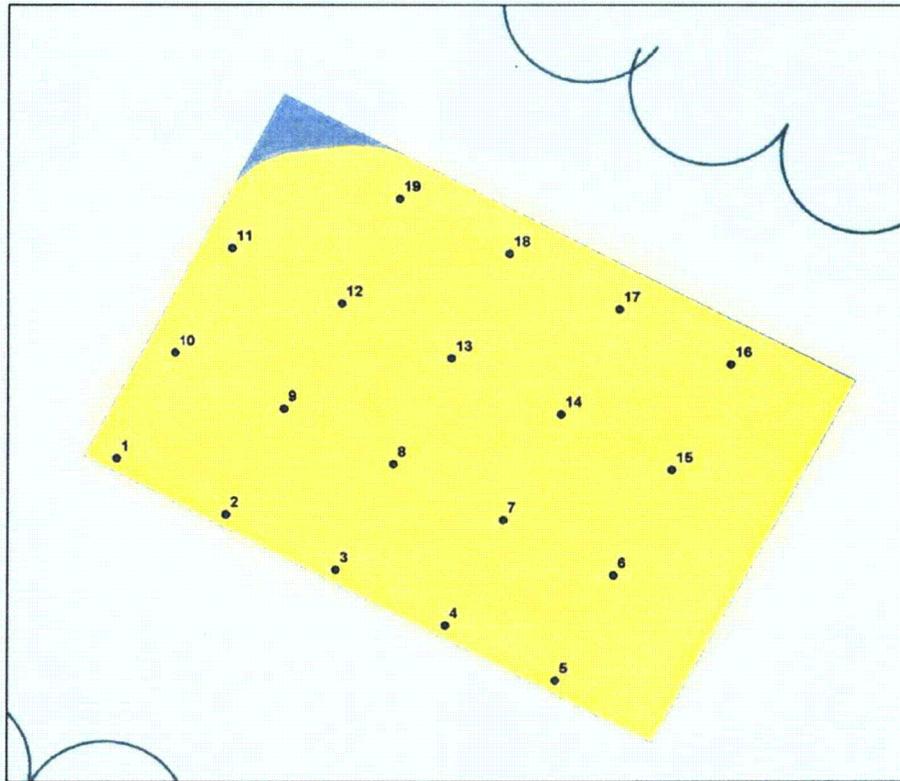
Attachment 1
Scoping Data
Survey Unit 02C_{x1}1
Excavated Soil from Retention Pond Construction

Sample	Grid	X	Y	ZTop	ZBottom	Cs-137 (pCi/g) Activity	Co-60 (pCi/g) Activity
1	224	9.9	3.9	0	-0.15	2.69	0.12
2	225	6.6	3.9	0	-0.15	3.94	0.11
3	225	8	3.1	0	-0.15	0.02	0.05
4	226	2.5	0.5	0	-0.15	0.05	0.04
5	226	3.9	3.8	0	-0.15	0.65	0.05
6	227	5.1	3.8	0	-0.15	0.28	0.05
7	263	7.9	1.4	0	-0.15	0.05	0.05
8	264	2.3	3.3	0	-0.15	0.05	0.04
9	301	8.9	5.6	0	-0.15	0.09	0.06
10	302	0.3	7.5	0	-0.15	0.060	0.06

Mean: 0.79 0.06
Median: 0.08 0.05
St. Dev.: 1.38 0.03

Note: MDA values were used for statistical purposes as data results in samples where activity was not detected.

Attachment 2
Soil Sample Locations, FSS 02C_{x1}1
Excavated Soil from Retention Pond Construction
05-25-2004



Scale: 0 1.5 3 6 Meters

Soil Sample Locations

Sample No.	X Coord.	Y Coord.	Sample No.	X Coord.	Y Coord.
1	0.7	0.3	10	0.7	3.2
2	3.6	0.3	11	0.7	6.1
3	6.5	0.3	12*	3.6	6.1
4	9.4	0.3	13	6.5	6.1
5	12.3	0.3	14	9.4	6.1
6	12.3	3.2	15	12.3	6.1
7	9.4	3.2	16	12.3	9.0
8	6.5	3.2	17	9.4	9.0
9	3.6	3.2	18	6.5	9.0
			19	3.6	9.0

Legend

- Treeline
- Soil Sample Locations
- Survey Boundaries
- Excavated Soil

Note: Coordinates for sample locations are w/r/t the southwest corner of the survey unit where X=0, Y=0.
 *Sample No 12 is the Random Start Location
 Square Grid Pattern Spacing from Random Start is 2.9 meters.

Attachment 3

Scan MDC In Varying Backgrounds

Background	d'	l	s _i	CPM	MDER uR/hr		Scan MDC pCi/g	
				MDCR _{surveyor}	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 4

Area Factors for Open Land Survey Evaluation

Contaminated Area (m ²)	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

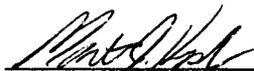
RM-76-5
FINAL STATUS SURVEY APPROVAL
AND AUTHORIZATION FOR IMPLEMENTATION

Survey Code FSS 02C_{x1}1

Survey Area Description:

Approximately 150 m³ of excavated soil Originating from Grids 205-208, 224-227,
243-246, 262-265, and 300-303, Survey Unit 02 has been placed in the Soil
Verification Area and graded to a depth of 1 meter. The excavated soil
originated in a Class 1 Area. Soil has been excavated from this area for the
construction of a stormwater retention pond. The expectation for this survey
area is that it meets the criteria established for unrestricted release prior to
disposition as clean fill available for construction use.

The survey area is authorized for Final Status Survey Implementation.


Designed by

5-19-04
Date


Technical Review by

5-25-04
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>02 C₀₁</u> Survey #		
1.1	Survey Area Status:		
✓	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>MSK</u> ESSG	<u>5/25/04</u>
✓	b. Survey area has been turned over to the Environmental Services Survey Group (ESSG) in acceptable condition for FSS.	<u>MSK</u> ESSG	<u>5/14/04</u>
1.2	Field Preparation:		
✓	a. Survey unit boundaries delineated (Step 6.1.1)		
✓	b. Statistical soil samples predetermined in the survey design are located and marked within the survey unit. (Step 6.1.2)		
✓	c. Soil sample locations verified (Step 6.1.2.c)		
✓	d. Instruments and equipment have been collected and calibrated for data measurement and collection (Step 6.1.3)		
✓	e. Field documentation is prepared (Step 6.1.4)	<u>MSK</u> ESSG	<u>5/21/04</u>

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

		<u>Initial</u>	<u>Date</u>
2.0	DATA COLLECTION		
2.1	Soil Survey:		
<input checked="" type="checkbox"/>	All soil samples collected and controlled (Step 6.2.1).	 ESSG	5/27/04
2.2	Surface Scan:		
<input checked="" type="checkbox"/>	Surface Scan complete. Action response requirements have been conducted on any identified areas exceeding the investigation level (Step 6.3).	 ESSG	06/01/04
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>N/A</u> ESSG	<u>N/A</u>
<hr/>			
3.0	SAMPLE PREPARATION AND LABORATORY ANALYSIS		
3.1	Sample Preparation (Step 6.4.1):		
<input checked="" type="checkbox"/>	a. Soil samples are homogenous		
<input checked="" type="checkbox"/>	b. Soil samples are visibly dry prior to packing		
<input checked="" type="checkbox"/>	c. Non-soil materials have been removed from sample		
<input checked="" type="checkbox"/>	d. Soil samples have been transferred to one-liter Marinelli containers and are labeled and sealed.	 ESSG	6/1/04

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**ATTACHMENT RM-59-1
 SAMPLING AND ANALYSIS REPORT**

DATE: 05-27-2004	TIME: 08:50	LOCATION: Powerline	TECH: MJK/DWP
SURVEY IDENTIFICATION / DESCRIPTION			
Survey 02C _{x1} 2, Final Status Survey of Excavated Soil from Retention Pond Construction in Survey Unit 02, West of the Turbine Building.			
SURVEY TYPE			
SURVEY TYPE:	<input type="checkbox"/> Scoping <input checked="" type="checkbox"/> Final <input type="checkbox"/> Bulk Materials	<input type="checkbox"/> Characterization <input checked="" type="checkbox"/> Scan (Motive)	<input type="checkbox"/> Remediation <input type="checkbox"/> Scan (Static)
SURVEY DESIGN			
SURVEY DESIGN:	<input type="checkbox"/> Judgmental <input checked="" type="checkbox"/> Scan	<input checked="" type="checkbox"/> Statistical (100 %)	<input type="checkbox"/> Remediation
ANALYSIS			
INST./SERIAL NO:	Detector 6 Scan 23501/186201	DAILY CHECK: <input checked="" type="checkbox"/> SAT	<input type="checkbox"/> UNSAT INIT: _____
INVESTIGATION OF UNIDENTIFIED PEAKS:	N/A	<input checked="" type="checkbox"/> SAT	<input type="checkbox"/> UNSAT INIT: _____
Minimum Detectable Activity / MDC (3.0.g, 4.2.b, 4.2.i)		<input checked="" type="checkbox"/> SAT	<input type="checkbox"/> UNSAT INIT: _____
COMMENTS			
Final Status Survey of Excavated Soil from the Retention Pond Construction involved 100% mobile scan with a NaI Detector and soil samples. Sample Design: Random start with a square grid systematic pattern. 18 soil samples were collected all of which showed concentrations of radioactivity at a fraction of the DCGL _w . 100% mobile scan identified 0 areas of activity above background.			
<i>did not identify WAP 7/21/04</i>			
TECHNICIAN SIGNATURE:	<i>[Signature]</i>	DATE: 06-02-04	
SECOND LEVEL REVIEW SIGNATURE:	<i>[Signature]</i>	DATE: <i>[Signature]</i> 7/21/04	

Activity Summary
Final Status Survey 02C_{x11}
Excavated Soil
from Retention Pond Construction

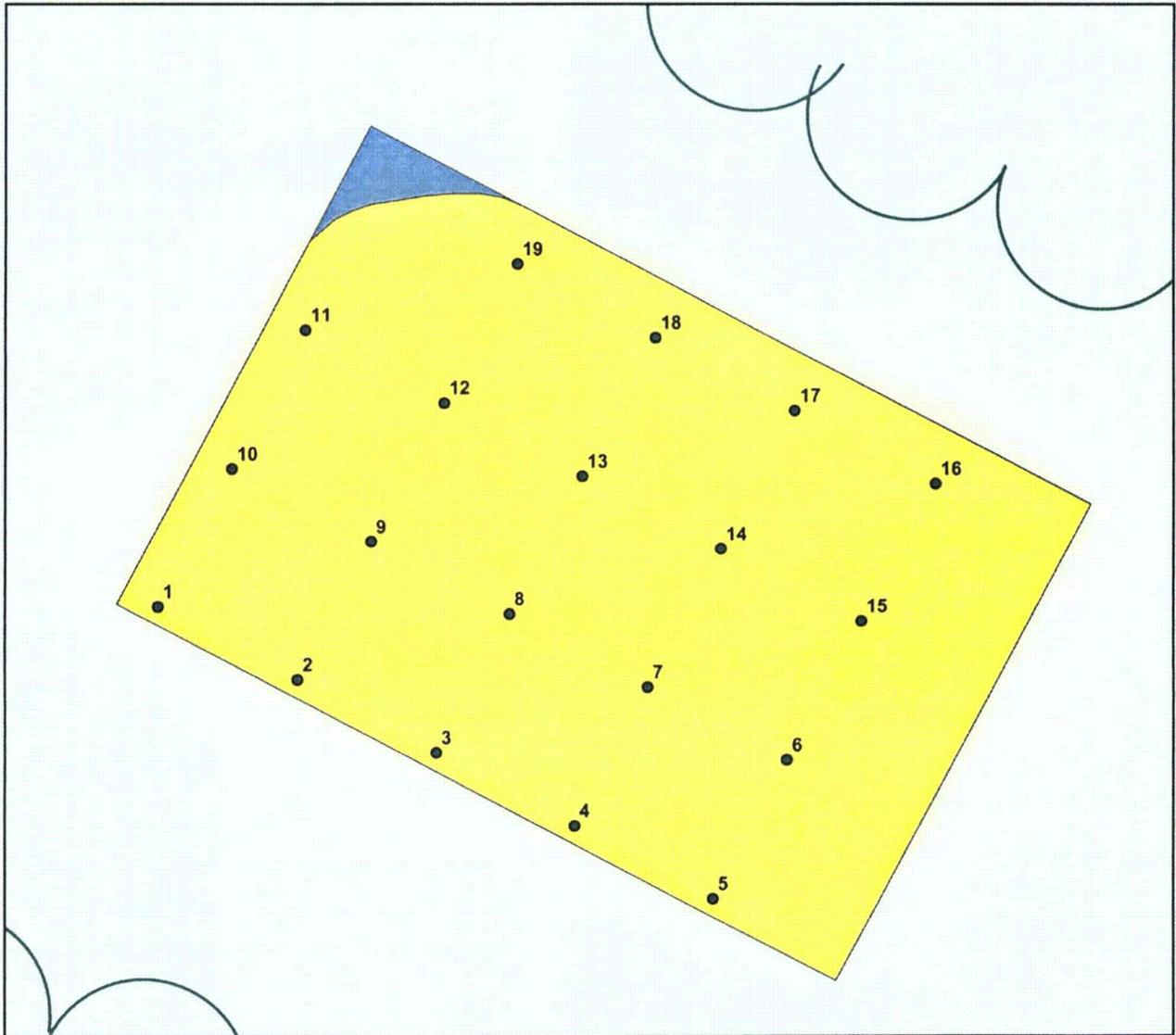
Sample No.	*Coordinate (x,y)	Cs-137 (pCi/g)		Co-60 (pCi/g)	
		Activity	MDA	Activity	MDA
1	(0.7)(0.3)	0.04		nd	0.04
2	(3.6)(0.3)	0.07		nd	0.05
3	(6.5)(0.3)	0.06		nd	0.06
4	(9.4)(0.3)	0.04		nd	0.04
5	(12.3)(0.3)	0.10		nd	0.06
6	(12.3)(3.2)	0.05		nd	0.06
7	(9.4)(3.2)	0.05		nd	0.05
8	(6.5)(3.2)	0.05		nd	0.05
9	(3.6)(3.2)	0.04		nd	0.06
10	(0.7)(3.2)	0.06		nd	0.03
11	(0.7)(6.1)	0.05		nd	0.05
12**	(3.6)(6.1)	0.08		nd	0.05
13	(6.5)(6.1)	0.04		nd	0.04
14	(9.4)(6.1)	0.05		nd	0.05
15	(12.3)(6.1)	nd	0.05	nd	0.05
16	(12.3)(9.0)	0.02		nd	0.04
17	(9.4)(9.0)	0.08		nd	0.04
18	(6.5)(9.0)	0.05		nd	0.05
19	(3.6)(9.0)	0.06		nd	0.03

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

**Sample 12 is the random start location for the survey.

Note: nd indicates activity not detected above MDA values.

Activity Summary, FSS 02C_{x1}
Excavated Soil from Retention Pond Construction
05-27-2004



Scale: 0 1.5 3 6 Meters

Activity Summary

Legend

- Treeline
- Soil Sample Locations
- Survey Boundaries
- Excavated Soil

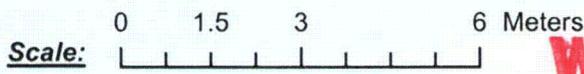
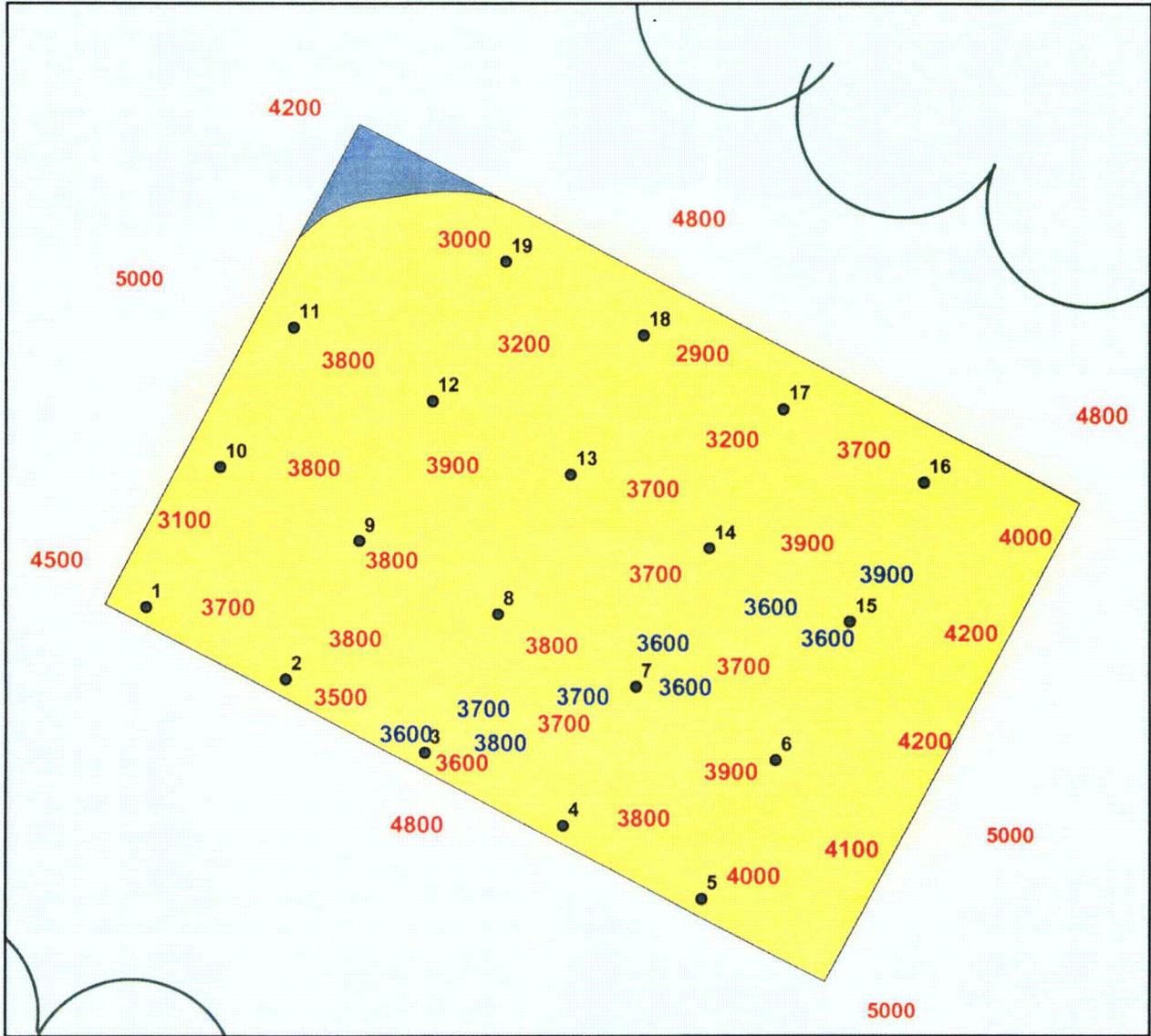
Sample No.	*Coordinate (x,y)	Cs-137 (pCi/g)		Co-60 (pCi/g)	
		Activity	MDA	Activity	MDA
1	(0.7)(0.3)	0.04		nd	0.04
2	(3.6)(0.3)	0.07		nd	0.05
3	(6.5)(0.3)	0.06		nd	0.06
4	(9.4)(0.3)	0.04		nd	0.04
5	(12.3)(0.3)	0.10		nd	0.06
6	(12.3)(3.2)	0.05		nd	0.06
7	(9.4)(3.2)	0.05		nd	0.05
8	(6.5)(3.2)	0.05		nd	0.05
9	(3.6)(3.2)	0.04		nd	0.06
10	(0.7)(3.2)	0.06		nd	0.03
11	(0.7)(6.1)	0.05		nd	0.05
12**	(3.6)(6.1)	0.08		nd	0.05
13	(6.5)(6.1)	0.04		nd	0.04
14	(9.4)(6.1)	0.05		nd	0.05
15	(12.3)(6.1)	nd	0.05	nd	0.05
16	(12.3)(9.0)	0.02		nd	0.04
17	(9.4)(9.0)	0.08		nd	0.04
18	(6.5)(9.0)	0.05		nd	0.05
19	(3.6)(9.0)	0.06		nd	0.03

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

**Sample 12 is the random start location for the survey.

nd/nr: nd indicates activity not detected above MDA values.

Mobile Scan, FSS 02C_{x1}
 Excavated Soil from Retention Pond Construction
 06-01-2004



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Legend

- Treeline
- Soil Sample Locations
- Survey Boundaries
- Excavated Soil

Primary Scan : 100 %
 Technician Signature: [Signature] Date: 06-01-04
 Time: 13:50

QC Verification Scan: 8 %
 Technician Signature: [Signature] Date: 06-01-04
 Time: 14:35

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

FSS 02C_{x11} - Excavated Soil from Retention Pond Construction

RM-72-1
CHAIN-OF-CUSTODY RECORD

Sample Number	Sampling Location*	Date	Time	Final Disposition of Sample
1	(0.7)(0.3)	5/27/04	08:52	68F
2	(3.6)(0.3)	↓	08:57	68F
3	(6.5)(0.3)		08:59	68F
4	(9.4)(0.3)		09:01	68F
5	(12.3)(0.3)		09:03	68F
6	(12.3)(3.2)		09:07	75A
7	(9.4)(3.2)		09:20	75A
8	(6.5)(3.2)		09:32	75A
9	(3.6)(3.2)		09:42	75A
10	(0.2)(3.2)		09:45	75B
11	(0.7)(6.1)		09:47	75B
12	(3.6)(6.1)		09:55	75B
13	(6.5)(6.1)		10:06	75B
14 (QA) (Resort)	(9.4)(6.1)		10:22	75B
15	(12.3)(6.1)		10:24	75C
16 (QA) (Resort)	(12.3)(9.0)		10:26	75C
17	(9.4)(9.0)		10:30	75C
18	(6.5)(9.0)		10:34	75C
19	(3.6)(9.0)		10:36	75C
QA SPLIT #6	(12.3)(3.2)		✓	10:32 - 09:07

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

* NOTE: SAMPLE LOCATIONS ARE IN METERS WRT THE ORIGIN (WHERE X=0, Y=0)

1. Relinquished by: <i>[Signature]</i>	Date 5/27/04	Time 11:15	Received in good condition by: <i>[Signature]</i>
2. Relinquished by: <i>[Signature]</i>	Date 6/14/04	Time 15:42	Received in good condition by: FINAL DISPOSITION - PERMANENT STORAGE
3. Relinquished by:	Date	Time	Received in good condition by:
4. Relinquished by:	Date	Time	Received in good condition by:

RM-72

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

FINAL STATUS SURVEY: 02C_{x1}1, Excavated Soil from Retention Pond

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.

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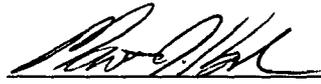
0000 4 22 8 07 2 9

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

06-02-02
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.
- N/A Results of judgmental samples have been reviewed and evaluated.
- N/A Review to ensure that the analytical results of judgmental samples do not impact the evaluation for unrestricted release of the survey area.

0000 4 9 2 8 0 7 3 0

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

2.4 Qualification of Data:

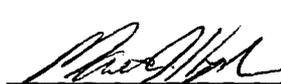
Statistical radionuclide-specific measurements for completeness. Evaluate the survey for determination of data usability and confirm that sufficient qualified data are present for the decision process.

- a. Total number of statistical samples planned for the survey: 18 * *19th statistical sample was obtained*
- b. Total number of statistical samples determined as valid: 19
- c. Calculate % Completeness: $\frac{b \times 120}{a} =$ 127%

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 *RM 78-3 Attachment 1*

Comments: Refer to Attachment 78-1 (attached) for verification of analysis results, 2.4.a, 2.4.b, and 2.4.c.



Assessor

06-02-04
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: No trends identified.

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

3.2.2 Calculate Basic Statistical Quantities:*

- | | | |
|----|--------------------------------------|--------------|
| a. | Number of qualified data points | <u>19</u> |
| b. | Calculation of the Mean (SOR) | <u>0.006</u> |
| c. | Calculation of the Median (SOR) | <u>0.006</u> |
| d. | Calculation Standard Deviation (SOR) | <u>0.004</u> |

***Note: Statistical Quantities calculated on RM-78-3, Attachment 1, Analyses of Data Results.**

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.

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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.

NA 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.

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

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

NA The mean concentration in the survey area exceeds the DCGL_w and the null hypothesis is confirmed.

NA The mean concentration of the survey area is below the DCGL_w but individual measurements in the Unit exceed the DCGL_w. The Sign Test and EMC evaluation are unsuccessful and the null hypothesis is confirmed.

Data Quality Assessment Completed: Yes No

Comments _____

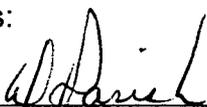


Assessor

06-02-04

Date

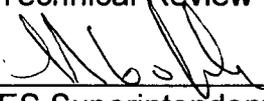
Reviews:



Technical Review

7/21/04

Date



ES Superintendent

8/2/04

Date



RP&ES Manager

10-13-04

Date

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**RM 78-3, Attachment 1:
Analysis of Data Results
Final Status Survey 02C_{x1}1
Excavated Soil from Retention Pond Construction**

Sample Number	Cs-137 (pCi/gm)	Co-60 (pCi/gm)	Weighted Sum	*Weighted Sum <DCGLw?	DCGL-W. Sum	Sign
1	0.042	0.0012	0.004	yes	0.996	+1
2	0.072	0.0072	0.008	yes	0.992	+1
3	0.057	0.0254	0.013	yes	0.987	+1
4	0.041	0.0017	0.004	yes	0.996	+1
5	0.104	0.0162	0.014	yes	0.986	+1
6	0.049	-0.0007	0.004	yes	0.996	+1
7	0.054	0.0010	0.005	yes	0.995	+1
8	0.051	0.0125	0.008	yes	0.992	+1
9	0.044	0.0168	0.009	yes	0.991	+1
10	0.058	-0.0070	0.003	yes	0.997	+1
11	0.047	-0.0013	0.003	yes	0.997	+1
12	0.081	0.0011	0.007	yes	0.993	+1
13	0.042	-0.0011	0.003	yes	0.997	+1
14	0.049	0.0063	0.006	yes	0.994	+1
15	0.032	0.0113	0.006	yes	0.994	+1
16	0.021	0.0024	0.002	yes	0.998	+1
17	0.076	0.0161	0.011	yes	0.989	+1
18	0.047	0.0124	0.008	yes	0.992	+1
19	0.063	-0.016	0.0001	yes	0.9999	+1

St. Deviation (SOR): 0.004
Mean (SOR): 0.006
Median (SOR): 0.006

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_w, then the Sign Test is not required.

RM-79-1
FSS QUALITY CONTROL EVALUATION RESULTS

FSS Package # 02C_{x1}1 QC Package # 02C_{x1}1

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:

[Signature]
Evaluator

6/22/04
Date

[Signature]
Technical Review

7/21/04
Date

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RM-79.doc

07/23/04

