ATTACHMENT 4

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 FINAL STATUS SURVEY RELEASE RECORD, $10C_11$,
EAST PROTECTED AREA

October 27, 2006

37 Pages

# Class 1 Final Status Survey
# Release Record $10C_11$

## East Protected Area

**SURVEY PACKAGE CLOSURE**

Final Status Survey Documentation is authorized for closure. All required reviews are complete and the evaluation of data results have satisfied the criteria established for unrestricted release.

Signed: _____ Date: 10/24/06
(ESSG )

Signed: _____ Date: 10/24/06
(ES Superintendent)

Signed: _____ Date: 10-25-06
(RP & ES Manager)

# Survey Area Requirements

## Final Status Survey, Release Record $10C_11$
## East Protected Area

### Survey Description

Final Status Survey $10C_11$ encompasses 1907 $m^2$ at or below the grade elevation present during plant power operations in the east section of the Protected Area. No materials of plant origin remain in the survey area.

### History

During power operations the Protected Area supported the components and systems necessary for electrical generation. The location of Survey Unit 10 is adjacent to the transport route used to move spent resin and filter media for radiological survey and offsite removal. Structures and enclosures formerly located in this area were once used for the storage of contaminated materials. A detailed review of the history and radiological characterization of Survey Unit 10 is provided in Appendix 2B and 2E of the LTP (License Termination Plan).

### Current Radiological Status

Scoping measurements and supporting surveys performed in the Protected Area following removal of subsurface components and demolition debris do not indicate the presence of elevated levels of residual radioactivity in this survey area. Based on operational history and former locations of radioactive systems and material transport pathways the radiological status of this survey unit is Class 1.

### Post-Construction Expectations

Final Status Survey $10C_11$ will be performed in the following activity sequence:

1. Walkdown: Environmental Services Survey Group (ESSG) personnel will perform a walkdown assessment to ensure survey area preparations are complete and confirm that the following post-construction expectations have been satisfied as applicable:

    - Groundwater and Surface water control is adequate
    - All construction debris has been removed from the survey area
    - The survey location 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 $10C_11$ in accordance with the survey requirements established in procedures RM-76, *Final Status Survey Design* and 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

## Final Status Survey, Release Record $10C_11$
## East Protected Area

1. STATE THE PROBLEM

*The Problem:*
To demonstrate that the level of residual radioactivity in Class 1 Survey Unit 10 does not exceed the release criteria of 25 mrem/year Total Effective Dose Equivalent (TEDE) as specified in the License Termination Plan (LTP).

*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 survey and 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) survey 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 survey. 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 survey measurements.

*Source of the Information:*
The soil sample data to be used for survey development are the radionuclide-specific measurements of representative soil samples collected for radiological characterization and excavated soil surveys conducted to determine suitability for transport of excavated soil to the SVA. The soil samples obtained were judgmentally selected as a result of multiple surveys conducted during the excavation and transport process. 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 Chapter 5, Table 5-1 and Procedure RM-76, *Final Status Survey Design*.

The survey will be conducted in accordance with applicable regulatory guidance as established in LTP Chapter 5 for Class 1 areas. 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 of 1907 $m^2$.

*Temporal Boundaries:*
Scanning and sampling in this survey unit will only be performed during daylight hours under dry weather conditions. 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 September 12, 2006.

*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 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.

*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.

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[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 1.

*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 one-half the $DCGL_w$ 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 survey 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 one-half the $DCGL_w$ 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 square grid spacing.

*Judgmental Sampling:*
Co-60 is the most limiting radionuclide for identification by surface scanning; judgmental 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 third 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:*
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. Soil samples will be collected in the same random locations as those selected for QA/QC evaluation and sent to an independent laboratory for Tritium analysis. Data results will be provided in the survey package.

*Investigation Levels:*
Investigation levels defined in LTP, Chapter 5 and BRP Procedure RM-76, *Final Status Survey Design,* shall be conservatively established for this survey as shown below:

**Investigation Levels for Survey $10C_1 1$**

| 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.

# FINAL STATUS SURVEY DESIGN

## Release Record $10C_11$
## East Protected Area

### Survey Unit Description

Survey $10C_11$ encompasses an area of 1907 $m^2$ in the east section of the Protected Area. No materials of plant origin exist in this survey unit.

### Soil Sample Design

Scoping Data

Scoping measurements and supporting surveys performed in the Protected Area following removal of subsurface components and demolition debris do not indicate the presence of elevated levels of residual radioactivity in this survey area. Input data for survey design were conservatively estimated based on supporting surveys of excavated soils resulting from subsurface structure and component removal within the Protected Area.

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

| Radionuclides | Cs-137 | Co-60 |
|---|---|---|
| $\sigma$ * | 0.524 | 0.255 |
| DCGL | 11.93 | 3.21 |

*Survey data detailed in Attachment 1

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:

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

$$\sigma = \sqrt{\left(\frac{0.524}{11.93}\right)^2 + \left(\frac{0.255}{3.21}\right)^2}$$

$$\sigma = 0.091$$

Relative Shift

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

$$\text{Relative Shift} = \frac{1 - 0.818}{0.091}$$

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

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).

Sample Locations

Sample locations are selected in a random start, systematic square grid pattern with the southwest corner of the survey unit as origin (X=0, Y=0). Two numbers between 0 and 1 have been randomly selected and then applied to the survey unit maximum X and Y dimensions to determine the random start location as shown below:

Table 2
Random Numbers

| Random #, X Axis | Random #, Y Axis |
|---|---|
| 0.244485 | 0.799886 |

Survey Unit Dimensions: X = 40 meters
Y = 70 meters

Random Start Location With SW Corner Origin: X = (0.244485)(40) = 9.8 meters
Y = (0.799886)(70) = 56.0 meters

Sample Spacing

As a conservative measure sample spacing will be calculated based on 18 samples for this survey. Samples are located in a systematic square grid pattern with sample spacing determined by the following:

$$L = \sqrt{\frac{A}{n}}$$

*Where:* A= area of survey unit, and
*n* = number of samples.

$$L = \sqrt{\frac{1907}{18}} = 10.2 \text{ meters}$$

With sample spacing established at 10.2 meters, 17 data points are available for this survey. Data point locations are identified in Attachment 2.

**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 for soil samples will be determined by random number selection.

The QA/QC scan starting point and track direction are also determined by random number selection. The first random data point selected will identify the scanning start point and the second random data point will determine the direction in which the scan will track. QA/QC location results are provided in Table 3 below:

Table 3
Random Numbers Generated for QA/QC

| QA/QC Soil Samples | Random Sample Number | Verification Scan | Random Sample Number |
|---|---|---|---|
| Split Sample: | 7 | Start Point: | 4 |
| Sample Recount: | 13 | Scan Toward: | 14 |
| Sample Recount: | 16 | Minimum Scan Area Requirement: | 191 $m^2$ |

**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:

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

Scan $_{DCGL}$ for Co-60 = 1818 CPM

Scan $_{DCGL}$ for Cs-137 = 3518 CPM

Where:[1]

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

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

$DCGL_w$ = 11.93 pCi/g Cs-137 and 3.21 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 survey will assume all residual radioactivity to originate from Co-60 and the instrument response at the Co-60 $DCGL_w$ (1818 cpm) will be used as the scanning investigation level for FSS $10C_11$.

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

# Attachment 1

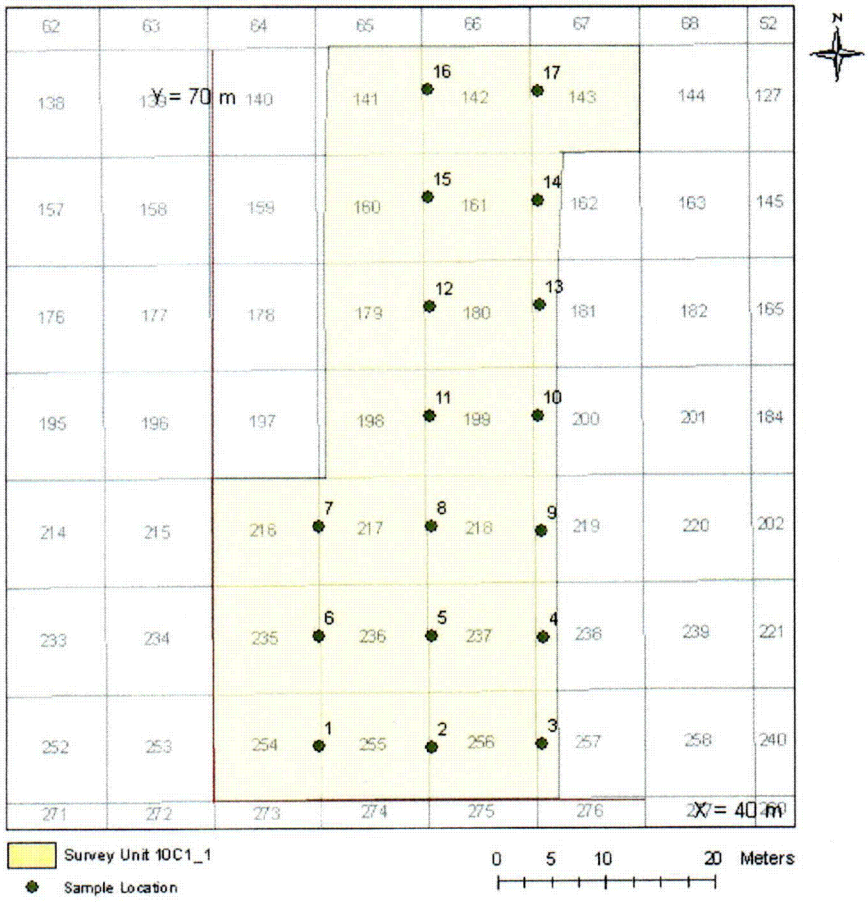
## Design Data - FSS $10C_11$
## Protected Area Supporting Surveys

| Survey No. | Sequence No. | Cs-137 Activity (pCi/g) | Co-60 Activity (pCi/g) |
|---|---|---|---|
| HH060705 | 16538 | 1.26 | 0.66 |
| HH060705 | 16539 | 0.06 | 0.06* |
| HH060705 | 16540 | 1.05 | 0.66 |
| TB062805 | 16755 | 1.16 | 0.27 |
| TB062805 | 16756 | 0.47 | 0.15* |
| TB062805 | 16774 | 0.19 | 0.31 |
| | **Mean:** | 0.698 | 0.352 |
| | **Std Dev:** | 0.524 | 0.255 |

* Measurement system MDA - Co-60 not identified in this sample

## Attachment 2

## Soil Sample Locations - Survey 10C$_1$1
## East Protected Area




| Sample No. | Grid Number | X Coord. | Y Coord. | Sample No. | Grid Number | X Coord. | Y Coord. |
|---|---|---|---|---|---|---|---|
| 1 | 254 | 10.0 | 5.0 | 10 | 200 | 0.4 | 5.6 |
| 2 | 256 | 0.2 | 5.0 | 11 | 199 | 0.2 | 5.6 |
| 3 | 257 | 0.4 | 5.0 | 12 | 180 | 0.2 | 5.8 |
| 4 | 238 | 0.4 | 5.2 | 13 | 181 | 0.4 | 5.8 |
| 5 | 237 | 0.2 | 5.2 | 14 | 162 | 0.4 | 6.0 |
| 6 | 235 | 10.0 | 5.2 | 15 | 161 | 0.2 | 6.0 |
| 7 | 216 | 10.0 | 5.4 | 16 | 142 | 0.2 | 6.2 |
| 8 | 218 | 0.2 | 5.4 | 17 | 143 | 0.4 | 6.2 |
| 9 | 219 | 0.4 | 5.4 | | | | |

Sample spacing is 10.2 meters

## Attachment 3

## Scan MDC In Varying Backgrounds

| | | | | CPM | MDER uR/hr | | Scan MDC pCi/g | |
|---|---|---|---|---|---|---|---|---|
| Background | d' | $i$ | $s_i$ | $MDCR_{surveyor}$ | 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 10$C_1$1

Survey Area Description:

Final Status Survey 10$C_1$1 encompasses 1907 $m^2$ at or below the grade elevation present during plant power operations in the east section of the Protected Area. No materials of plant origin remain in the survey area.

The survey area is authorized for Final Status Survey Implementation.

Jodie L. Reed — 09-12-2006
Designed by — Date

[illegible] — 9-12-06
Technical Review by — Date

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

| Step (+) | | Initial | Date |
|---|---|---|---|
| 1.0 | PREPARATION FOR SURVEY 10C, 1 (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. | JLR ESSG | 09/12/06 |
| ✓ | b. Survey area has been turned over to the Environmental Services Survey Group (ESSG) in acceptable condition for FSS. | JLR ESSG | 09/12/06 |
| 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) | JLR ESSG | 09/12/06 |

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

| | | Initial | Date |
|---|---|---|---|
| 2.0 | DATA COLLECTION | | |
| 2.1 | Soil Survey: | | |
| ✓ | All soil samples collected and controlled (Step 6.2.1). | ESSG | 09/12/06 |
| 2.2 | Surface Scan: | | |
| ✓ | Surface Scan complete. Action response requirements have been conducted on any identified areas exceeding the investigation level (Step 6.3). | ESSG | 09/12/06 |
| 2.3 | Judgmental Soil Samples: | | |
| N/A | a. Judgmental soil samples have been collected and controlled (Step 6.2.3). | | |
| N/A | b. Deep core profiles performed in areas identified to contain elevated residual activity (Step 6.2.3). | ESSG | 09/12/06 |
| 3.0 | SAMPLE PREPARATION AND LABORATORY ANALYSIS | | |
| 3.1 | Sample Preparation (Step 6.4.1): | | |
| ✓ | a. Soil samples are homogenous | | |
| ✓ | b. Soil samples are visibly dry prior to packing | | |
| ✓ | c. Non-soil materials have been removed from sample | | |
| ✓ | d. Soil samples have been transferred to one-liter Marinelli containers and are labeled and sealed. | ESSG | 09/13/06 |

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

| | | Initial | Date |
|---|---|---|---|
| 3.2 | Laboratory Analysis: | | |
| ✓ | 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). | JAR ESSG | 09/13/06 |
| 3.3 | Sample Control and Documentation: | | |
| ✓ | Chain of custody documentation exhibits control of soil samples (Step 6.4.3). | JAR ESSG | 09/13/06 |

Jodie L. Reed
Reviewed by

10/24/06
Date

ATTACHMENT RM-59-1
SAMPLING AND ANALYSIS REPORT

| Date: 09-12-2006 | Time: 1600 | Location: $10C_11$ | Tech: SSO/FK/WMH |
|---|---|---|---|

## SURVEY IDENTIFICATION / DESCRIPTION

Survey $10C_11$ encompasses 1907 $m^2$ at or below the grade elevation present during plant power operations in the east section of the Protected Area. No materials of plant origin remain in this area.

## SURVEY TYPE

Survey Type:
- ____ Characterization
- ____ Remediation
- X Final
- X Scan (Motive)
- ____ Scan (Static)
- ____ Trenching and Digging (use RM-59-4)

## SURVEY DESIGN

Sample Collection: ____ Judgmental ____ Random X Systematic ____ Large Container Assay
Scan Coverage: 100%

## ANALYSIS

| | | | | | |
|---|---|---|---|---|---|
| Inst.SN/Cal Due 186201/09-30-2006 | DAILY CHECK: | X SAT | ____ UNSAT | INIT: TRS |
| Inst.SN/Cal Due 201195/02-10-2007 | DAILY CHECK: | X SAT | ____ UNSAT | INIT: SSO |
| Inst.SN/Cal Due 186192/09-13-2006 | DAILY CHECK: | X SAT | ____ UNSAT | INIT: JHW |
| Inst.SN/Cal Due Det. # 6 | DAILY CHECK: | X SAT | ____ UNSAT | INIT: JP |
| Inst.SN/Cal Due ____ | DAILY CHECK: | ____ SAT | ____ UNSAT | INIT: ____ |
| Investigation of Unidentified Peaks: | | X SAT | ____ UNSAT | INIT: JLR |
| Minimum Detectable Activity (Section 5.3.2) | | X SAT | ____ UNSAT | INIT: JLR |

## COMMENTS

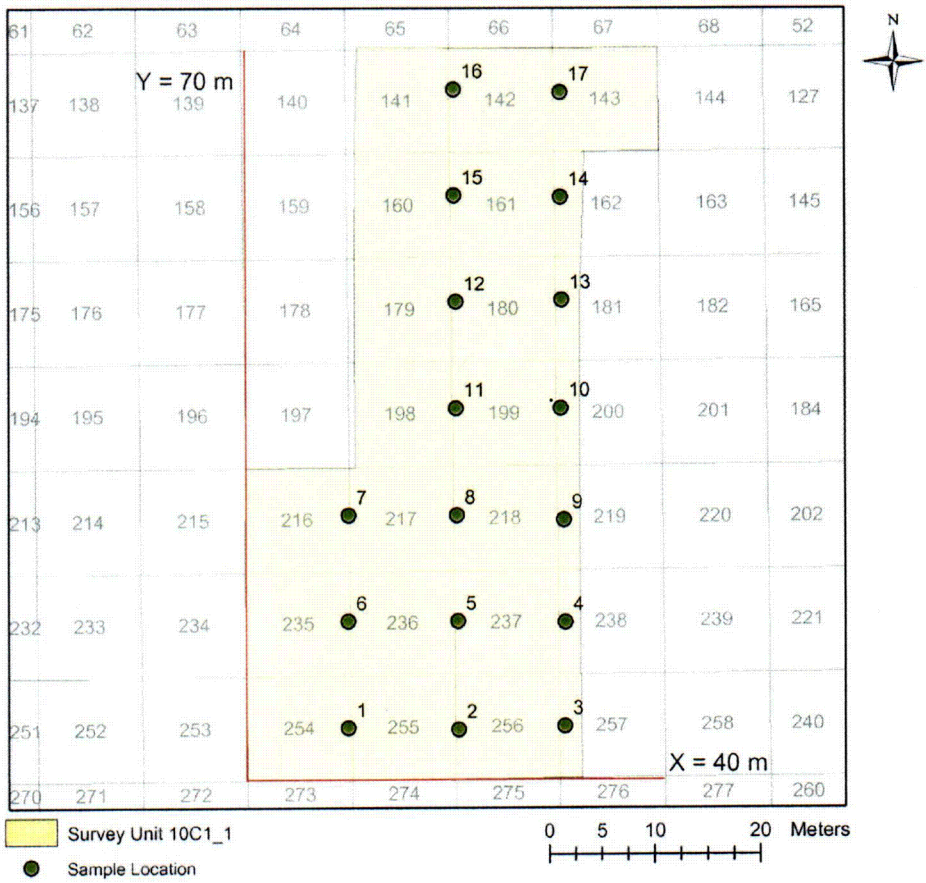
Survey $10C_11$ was performed in a random start, square grid, systematic sampling pattern with samples collected at 17 data point locations. Laboratory analyses did not identify residual radioactivity above trace levels of the DCGL value. Surface scanning identified no areas of elevated residual radioactivity. The results of the QA/QC verification scan (10%) were consistent with the findings of the primary survey scan.

Technician Signature: [signature] Date: 9/13/06

Second Level Review Signature: [signature] Date: 10/24/06

## Soil Sample Activity Summary

## Release Record $10C_11$
## East Protected Area

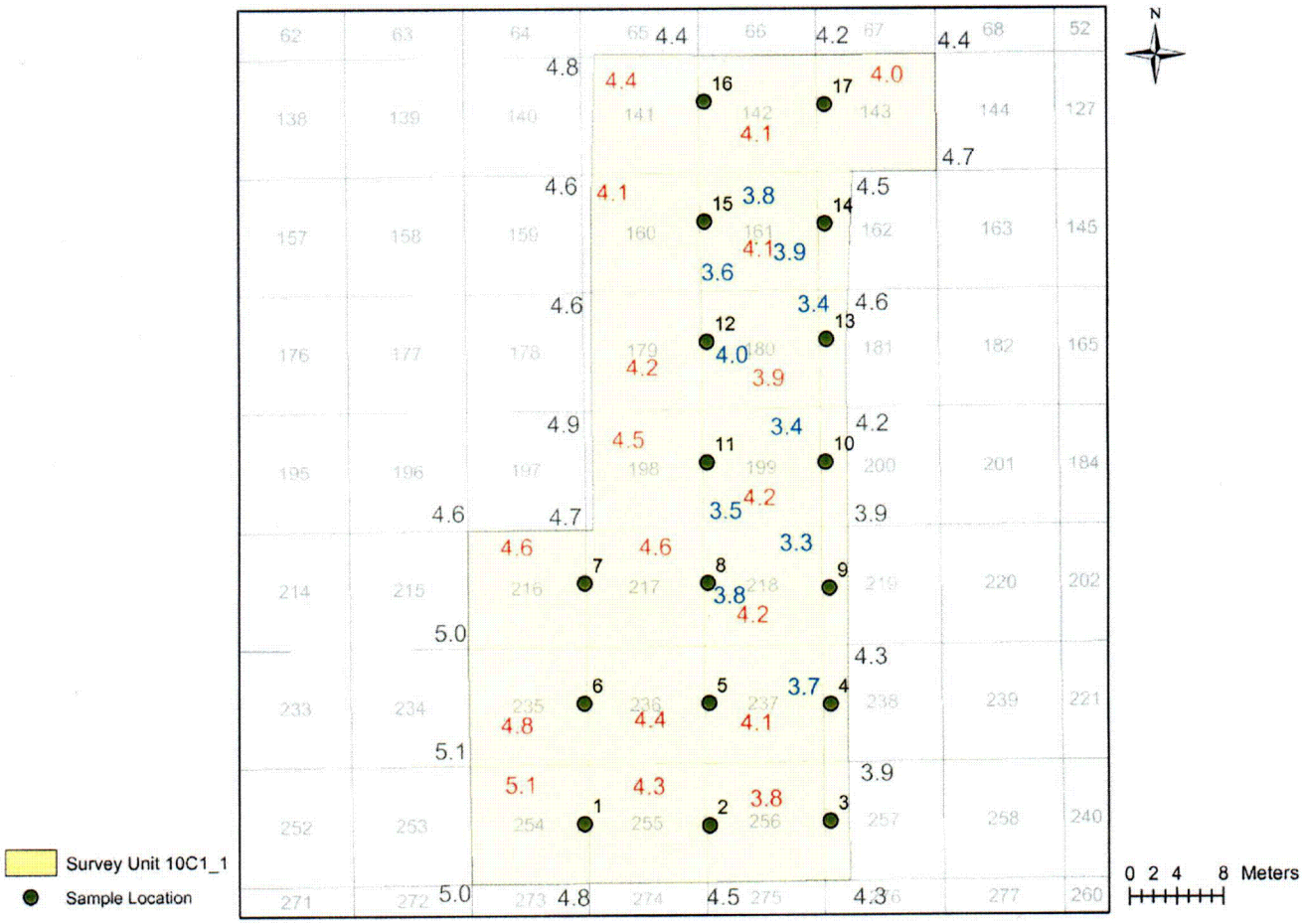



| Sample No. | Grid # | X Coord. | Y Coord. | Cs-137 (pCi/g) | | Co-60 (pCi/g) | |
|---|---|---|---|---|---|---|---|
| | | | | Activity | MDA | Activity | MDA |
| 1 | 254 | 10.0 | 5.0 | 0.0606 | | *0.0157 | 0.0546 |
| 2 | 256 | 0.2 | 5.0 | *0.0097 | 0.0498 | *0.0192 | 0.0564 |
| 3 | 257 | 0.4 | 5.0 | 0.4428 | | *0.0157 | 0.0685 |
| 4 | 238 | 0.4 | 5.2 | 0.0313 | | *-0.0082 | 0.0503 |
| 5 | 237 | 0.2 | 5.2 | 0.0478 | | *-0.0064 | 0.0561 |
| 6 | 235 | 10.0 | 5.2 | 0.0502 | | *0.0286 | 0.0612 |
| 7 | 216 | 10.0 | 5.4 | *0.0189 | 0.0527 | *-0.0049 | 0.0552 |
| 8 | 218 | 0.2 | 5.4 | *0.0289 | 0.0566 | *0.0129 | 0.0620 |
| 9 | 219 | 0.4 | 5.4 | 0.0439 | | *0.0071 | 0.0537 |
| 10 | 200 | 0.4 | 5.6 | 0.0803 | | *0.0296 | 0.0643 |
| 11 | 199 | 0.2 | 5.6 | 0.0364 | | *0.0094 | 0.0504 |
| 12 | 180 | 0.2 | 5.8 | *0.0282 | 0.0534 | *0.0289 | 0.0608 |
| 13 | 181 | 0.4 | 5.8 | 0.0462 | | *-0.0003 | 0.0607 |
| 14 | 162 | 0.4 | 6.0 | 0.0370 | | *0.0068 | 0.0549 |
| 15 | 161 | 0.2 | 6.0 | 0.0698 | | *0.0202 | 0.0586 |
| 16 | 142 | 0.2 | 6.2 | 0.0663 | | *0.0185 | 0.0589 |
| 17 | 143 | 0.4 | 6.2 | 0.0475 | | *0.0065 | 0.0442 |

*Forced-count values

## Surface Scan Summary

## Release Record $10C_1 1$
## East Protected Area




RED Values are Average Mobile Scan General Area Activity (kcpm)
BLUE Values are Average Verification Scan General Area Activity (kcpm)
GREY Values are Average General Background Area Activity (kcpm)

* No investigation levels exceeded.
09/12/06

**Primary Scan :** 100 %

**Technician Signature:** [signature] **Date:** 9.12.06
**Time:** 1345

**QC Verification Scan:** 10 %

**Technician Signature:** [signature] **Date:** 9.~~13~~ 12.06
**Time:** 1400

10C$_1$1
RM-72-1
CHAIN-OF-CUSTODY RECORD

| Sample Number | Sampling Location | Date | Time | Final Disposition of Sample |
|---|---|---|---|---|
| 1 | Grid # 254 (10.0) (5.0) | 9-12-06 | 1040 | Permanent Storage |
| 2 | Grid # 256 (0.2) (5.0) | 9-12-06 | 1042 | |
| 3 | Grid # 257 (0.4) (5.0) | 9-12-06 | 1044 | |
| 4 | Grid # 238 (0.4) (5.2) | 9-12-06 | 1046 | |
| 5 | Grid # 237 (0.2) (5.2) | 9-12-06 | 1047 | |
| 6 | Grid # 235 (10.0) (5.2) | 9-12-06 | 1048 | |
| 7 | Grid # 216 (10.0) (5.4) | 9-12-06 | 1049 | |
| 7 QA Split | Grid # 216 (10.0) (5.4) | 9-12-06 | 1049 | |
| 8 | Grid # 218 (0.2) (5.4) | 9-12-06 | 1053 | |
| 9 | Grid # 219 (0.4) (5.4) | 9-12-06 | 1055 | |
| 10 | Grid # 200 (0.4) (5.6) | 9-12-06 | 1056 | |
| 11 | Grid # 199 (0.2) (5.6) | 9-12-06 | 1057 | |
| 12 | Grid # 180 (0.2) (5.8) | 9-12-06 | 1100 | |
| 13 (R) | Grid # 181 (0.4) (5.8) | 9-12-06 | 1102 | |
| 14 | Grid # 162 (0.4) (6.0) | 9-12-06 | 1105 | |
| 15 | Grid # 161 (0.2) (6.0) | 9-12-06 | 1107 | |
| 16 (R) | Grid # 142 (0.2) (6.2) | 9-12-06 | 1111 | |
| 17 | Grid # 143 (0.4) (6.2) | 9-12-06 | 1113 | |
| | | | | |
| | | | | |
| | | | | |

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

| | | | |
|---|---|---|---|
| 1. Relinquished by: Wm Crawford | Date 9-12-06 | Time 1400 | Received in good condition by: Temp: ~~Permanent~~ storage JJR 10-16-06 |
| 2. Relinquished by: [illegible] | Date 9-13-06 | Time 0730 | Received in good condition by: Permanent Storage |
| 3. Relinquished by: | Date | Time | Received in good condition by: |
| 4. Relinquished by: | Date | Time | Received in good condition by: |

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

FINAL STATUS SURVEY: 10C, 1

1.0 DATA VERIFICATION

1.1 Data Acceptance

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

✓ 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:

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

Comments: _____

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

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

1.3 Review Verification:

✓ Verify that the Data Quality Objectives are complete.

✓ Verify that the survey design has been technically reviewed.

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

✓ Verify that gamma spectroscopy results have received a technical review.

✓ Verify the Sample and Analysis Report (RM-59-1) is completed and reviewed.

Data Verification Completed: (Yes) No

Comments _____

Jodie L Read 10/24/06
Assessor 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:

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

### 2.2 Detection Limit Review:

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

### 2.3 Quality Control (QC) Data Review:

- ✓ 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.

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: 15

b. Total number of statistical samples determined as valid: 17

c. Calculate % Completeness: $\frac{b \times 120}{a}$ = 136 %

✓ Qualified data are ≥100% completeness and are sufficient to support the Sign Test requirement for determination of unrestricted release.

Data Validation Completed: (Yes) No

Comments: _____

Jodie L. Reed
Assessor

10/24/06
Date

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

3.0 DATA QUALITY ASSESSMENT

3.1 Review the DQOs and Survey Design:

✓ Confirm that all inputs to the decision have been reviewed and are complete.

✓ Verify that boundaries or constraints identified in the survey area have not affected the quality of the data.

✓ Review the Statement of Hypothesis and confirm that it remains relevant.

✓ Confirm that Type I and Type II error limits are consistent with DQOs.

✓ 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:

N/A Quality Assessment (QA) reports consistent with procedure RM-79, Final Status Survey Quality Control.

✓ Survey is of sufficient intensity to satisfy classification requirement.

✓ 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 17

b. Calculation of the Mean 0.0093 (SOR)

c. Calculation of the Median 0.0064 (SOR)

d. Calculation Standard Deviation 0.0096 (SOR)

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

✓ 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 in not required and the survey unit meets the regulatory requirement for unrestricted release.

✓ All survey measurements are below the $DCGL_w$.

3.3.1 Verify Assumptions of the Survey Design

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

✓ 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

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

✓ 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

✓ Determine if data results have exceeded any investigation level. Document findings. No investigation levels exceeded

3.4.2 Evaluation for Unrestricted Release

Select applicable conclusion:

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

✓ 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
Page 8 of 8

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 $DCGL_w$. and the null hypothesis is confirmed.

N/A 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 Statistical quantities are provided in attachment 1.

Jodie L. Reed — Assessor — 10/24/06 Date

Reviews:

Technical Review — 10/24/06 Date

ES Superintendent — 10/24/06 Date

RP&ES Manager — 10-25-06 Date

**RM-78-3, Attachment 1**
**Statistical Quantities**

**Release Record $10C_11$**
**East Protected Area**

| Sample Number | Cs-137 (pCi/gm) | Co-60 (pCi/gm) | Weighted Sum (SOR) | **Weighted Sum <DCGLw? | DCGL-W. Sum | Sign |
|---|---|---|---|---|---|---|
| 1 | 0.0606 | 0.0157 | 0.0100 | yes | 0.9900 | +1 |
| 2 | 0.0097 | 0.0192 | 0.0068 | yes | 0.9932 | +1 |
| 3 | 0.4428 | 0.0157 | 0.0420 | yes | 0.9580 | +1 |
| 4 | 0.0313 | -0.0082 | 0.0001 | yes | 0.9999 | +1 |
| 5 | 0.0478 | -0.0064 | 0.0020 | yes | 0.9980 | +1 |
| 6 | 0.0502 | 0.0286 | 0.0131 | yes | 0.9869 | +1 |
| 7 | 0.0189 | -0.0049 | 0.0001 | yes | 0.9999 | +1 |
| 8 | 0.0289 | 0.0129 | 0.0064 | yes | 0.9936 | +1 |
| 9 | 0.0439 | 0.0071 | 0.0059 | yes | 0.9941 | +1 |
| 10 | 0.0803 | 0.0296 | 0.0160 | yes | 0.9840 | +1 |
| 11 | 0.0364 | 0.0094 | 0.0060 | yes | 0.9940 | +1 |
| 12 | 0.0282 | 0.0289 | 0.0114 | yes | 0.9886 | +1 |
| 13 | 0.0462 | -0.0003 | 0.0038 | yes | 0.9962 | +1 |
| 14 | 0.0370 | 0.0068 | 0.0052 | yes | 0.9948 | +1 |
| 15 | 0.0698 | 0.0202 | 0.0121 | yes | 0.9879 | +1 |
| 16 | 0.0663 | 0.0185 | 0.0113 | yes | 0.9887 | +1 |
| 17 | 0.0475 | 0.0065 | 0.0060 | yes | 0.9940 | +1 |

| | | | |
|---|---|---|---|
| Std. Dev | 0.0985 | 0.0121 | 0.0096 |
| Mean | 0.0674 | 0.0117 | 0.0093 |
| Median | 0.0462 | 0.0129 | 0.0064 |

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.*
***Note: 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 # 10C,1 QC Package # 10C,1

| QC Measurement Type | Acceptance Criteria Met*? | Reference |
|---|---|---|
| ✓ 1. Replicate Scan | (Yes) / No | Step 5.1.3 |
| 2. Sample Recounts | | Step 5.1.4.1 |
| ✓ a. In-house | (Yes) / No | |
| N/A b. Third party | Yes / No | |
| 3. Split Samples | | Step 5.1.4.2 |
| ✓ c. In-house | (Yes) / No | |
| N/A 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: Sample # 7 = QA/QC split; sample # 13 + #16 = recounts.

Reviews:

Jodie L Reed — Evaluator — 10/24/06 Date

[signature] — Technical Review — 10/24/06 Date

# QA Verification
## Split Sample Analysis

**Date:** 9/12/2006

**QA:** 10C,1 East Protected 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) |
| 7 | Co-60 | < | 0.0552 | n/a | n/a | n/a | < | 0.0718 | 1.30 | YES |
| 7 | Cs-137 | < | 0.0527 | n/a | n/a | n/a | < | 0.0933 | 1.77 | YES |
| | | | | | | | | | | |
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| | | | | | | | | | | |

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

*< Indicates results less than the MDA.*

**Note Results are considered in agreement for MDA and near-MDA measurement comparisons*
*Results fthat fail agreement must be investigated per RM-79.*

# QA Verification
## Sample Recount Analysis

**Date:** 9/12/2006

**QA:** 10C$_1$1 East Protected Area

**Type:** Sample Recounts

**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) |
| 13 | Co-60 | < | 0.0607 | n/a | n/a | n/a | < | 0.0487 | 0.80 | YES |
| 13 | Cs-137 | | 0.0462 | 54.17 | 1.85 | n/a | | 0.0638 | 1.38 | YES |
| 16 | Co-60 | < | 0.0589 | n/a | n/a | n/a | < | 0.0704 | 1.20 | YES |
| 16 | Cs-137 | | 0.0663 | 27.70 | 3.61 | n/a | < | 0.0598 | 0.90 | YES |
| | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |

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

*< Indicates results less than the MDA.*

**Note Results are considered in agreement for MDA and near-MDA measurement comparisons*
*Results fthat fail agreement must be investigated per RM-79.*

**Tritium in Soil**
**Data Results**
**Final Status Survey $10C_11$**

| Sample Number | Tritium in Soil pCi/g |
|---|---|
| 7 | 0.211 |
| 13 | 0.025 |
| 16 | 0.007 |

| | |
|---|---|
| Mean: | 0.0810 |
| Median: | 0.0250 |
| St. Dev: | 0.1129 |

*Note:* The DCGL for Tritium is 327 pCi/g.
Sample results are less than 0.1% of the DCGL

**Environmental, Inc.**
**Midwest Laboratory**
an Allegheny Technologies Co.

700 Landwehr Road • Northbrook, IL 60062-2310
ph. (847) 564-0700 • fax (847) 564-4517

| | | | |
|---|---|---|---|
| Mr. David W. Parish | | LABORATORY REPORT NO. | 8022-100-228 |
| Big Rock Point | | DATE: | 09-19-2006 |
| 10269 US-31 North | | SAMPLES RECEIVED: | 09-15-2006 |
| Charlevoix, MI 49720 | | PURCHASE ORDER NO: | |

Below are the results of the analyses for tritium on three soil samples.

**Excavated Soil Survey $10C_11$**

| Sample Description | Collection Date | Lab Code | Concentration (pCi/g of soil) H-3 | MDA (pCi/g of soil) |
|---|---|---|---|---|
| 7 | 09-12-06 | BRSO-6252 | 0.211 ± 0.013 | < 0.014 |
| 13 | 09-12-06 | BRSO-6253 | 0.025 ± 0.007 | < 0.012 |
| 16 | 09-12-06 | BRSO-6254 | 0.007 ± 0.006 | < 0.012 |

The error given is the probable counting error at 95 % confidence level. The less than, (<), value is based on 4.66 sigma counting error for background sample.

Sincerely,

Bronia Grob,
Laboratory Manager

APPROVED BY

Tony Coorlim,
Quality Assurance