ATTACHMENT 16

CONSUMERS ENERGY
BIG ROCKPOINT

DOCKET NUMBERS 50-155 AND 72-043

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

CLASS 1 AREA –FINAL STATUS SURVEY, $TBC_{X1}1$
EXCAVATED SOIL FROM TURBINE BUILDING DEMOLITION AREA,
SUPPORTING SUBSURFACE STRUCTURE AND COMPONENT REMOVAL

October 9, 2006

51 Pages

# Final Status Survey $TBC_{x1}1$

**Excavated Soil From Turbine Building Demolition Area**
**Supporting Subsurface Structure And Component Removal**
**Survey Date: 06-22-2005**

**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 and onsite use for excavation backfill.

Signed: _____ Date: 8/23/05
(ESSG Supervisor)

Signed: _____ Date: 8/23/05
(ES Superintendent)

Signed: _____ Date: 8-24-05
(RP & ES Manager)

**Final Status Survey Area Requirements**
**Survey $TBC_{X1}1$**
**Excavated Soil From Turbine Building Demolition Area**

## Survey Description

Final Status Survey $TBC_{x1}1$ consists of excavated soils that were removed from the Turbine Building demolition area for subsurface structure and component removal. Areas of excavation included the foundation walls beneath the Turbine Building in Survey Unit 8 and the heavy-haul roadway traversing Survey Units 5(1), and 5(2). The excavated soil was transported to the soil verification area (SVA) and graded to depth of approximately 0.5 meters. The physical size of the excavated soil survey area is 3100 square meters[1].

Final status evaluation of this excavated soil will be in accordance with procedure RM-76, Final Status Survey Design and the requirements established in LTP 5.4.2.4. Sample locations will be established by random start, systematic square grid pattern over the graded area. Each soil sample will be a full core homogenized composite that is representative of total soil thickness. Surface scanning will be conducted over 100% of the survey area.

## History

The soil for survey evaluation originated from a Class 1 area. This soil is a combination of sand and sandy gravel fill material that has been excavated to remove subsurface piping components and expose the concrete foundations beneath the Turbine Building. The foundation walls and footings from this area have been surveyed and released for offsite disposition to the local landfill in accordance with the LTP and provisions established in the NRC approved 10 CFR20.2002 alternate disposal method for BRP demolition debris. Soil remediation efforts were required during demolition for some minor areas associated with subsurface component removal.

Physical inspection and routine surveys performed following transport to the low background area (SVA) identified contaminated demolition debris and several discrete particles of elevated activity that were moved with the soil. These materials were remediated by repetitive grading of the soil and surface scanning in successive layers of reduced thickness until all elevated residual radioactivity and demolition debris were removed.

## Current Radiological Status

Based on post remediation analyses and supporting surveys the residual radioactivity in the excavated soil for this survey is not expected to exceed fractional concentrations of the DCGL value. Survey documentation is maintained in the 10 CFR 50.75.G files. Input for this evaluation includes the following survey data:

**Turbine Building Demolition**
**Supporting Surveys for Soil Transport and Evaluation**

| | | | | |
|---|---|---|---|---|
| TB051005 | SB040405 | SB042905 | TB062805 | HH060705 |
| TB052405 | SB040605 | SB050205 | HH050505 | TB060905 |
| TB052505 | SB040705 | SB051705 | HH051705 | |
| TB052605 | SB041205 | SB051805 | HH051905 | |
| TB060105 | SB041905 | HH042705 | HH041905 | |

[1] The Survey Design section contains a technical justification for the physical size of this survey area.

### Quality Assurance/Quality Control

As a minimum 5% of the sample population of this survey shall be selected for QA/QC verification in accordance with 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 determined by random number selection.

### Additional Sample Analysis Requirements

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

### Post-Construction Expectations

Survey $TBC_{x1}1$ 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:

    - 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 $TBC_{x1}1$ 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

## Survey $TBC_{X1}1$
## Excavated Soils from Turbine Building Demolition

1. STATE THE PROBLEM

*The Problem:*
To demonstrate that the level of residual radioactivity in soil excavated from the Turbine Building demolition area 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 has been relocated to the soil verification area (SVA) and 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 soils in this survey area satisfy the criteria established for unrestricted release prior to disposition as fill material for onsite usage.

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

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

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

*Resources:*
The primary resources needed to determine the answer to the problem are two (2) technicians to perform fieldwork, one (1) technician to prepare the samples and conduct laboratory analyses, and two (2) FSS 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 to determine transport suitability and final status evaluation. The soil samples obtained are judgmentally selected as a result of multiple surveys of the excavated soil. The ALARA analysis for potential soil remediation is provided in LTP, Section 4.4. Site-specific DCGL values and BRP radionuclides of interest are defined in LTP Section 5, Table 5-1 and Procedure RM-76, *Final Status Survey Design*.

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

## 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 3100 $m^2$. The Survey Design section provides technical justification for this survey area size.

*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 06-29-05.

*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.

[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.

*Decision Rule (4):*
If the potential dose from residual radioactivity in the survey unit is ALARA, then no further action is necessary. If the potential dose from residual radioactivity in the survey unit is not ALARA, then remediate and resurvey.

## 6. SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

*The Null Hypothesis:*
It is assumed that residual radioactivity in the survey unit exceeds the release criterion.

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

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

*The Lower Bound of the Gray Region (LBGR):*
The LBGR is initially set at 0.5 for this survey unit. The LBGR may be adjusted during survey design to achieve an optimum relative shift between 1.0 and 3.0.

*Relative Shift ($\Delta/\sigma$):*
The relative shift will be maintained within the range of 1.0 and 3.0 by adjusting the LBGR as appropriate.

## 7. OPTIMIZE DESIGN FOR OBTAINING DATA

Statistical Test

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

*Number of Samples Determined:*
The number of samples required for this survey will be determined based on the relative shift as defined by the requirements of the Sign Test (LTP, Chapter 5.) and Procedure RM-76, *Final Status Survey Design*. The LBGR is initially set at 0.5 and may be adjusted as necessary for optimizing the survey design to achieve a relative shift between 1.0 and 3.0. Sample point locations are to be determined using a random start, systematic square grid spacing.

*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.*

*Additional Sample Analysis Requirements:*
A minimum quantity of 10% of the sample population shall be collected for tritium analysis in the same locations as samples selected for QA/QC. Tritium analyses will be performed by an independent laboratory. Data results will be provided in the FSS 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 $TBC_{x1}1$**

| 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 $TBC_{x1}1$
Final Status Survey Design
Excavated Soils from Turbine Building Demolition

### Survey Unit Description

Final Status Survey $TBC_{x1}1$ consists of excavated soils that have been removed from the Turbine Building demolition area for subsurface structure and component removal. Areas of excavation include the foundation walls beneath the Turbine Building in Survey Unit 8 and the heavy-haul roadway traversing Survey Units 5(1), and 5(2).

The physical size of this survey area is approximately 3100 $m^2$. In accordance with LTP Section 5.2.3.1, Class 1 survey unit sizes exceeding 2000 $m^2$ require a technical justification. Since the prepared area of excavated soil required grading to a depth of approximately 0.5 meters to allow demolition debris removal (typically small pieces of concrete and rebar), it was determined that the final status evaluation could be performed at this depth thereby utilizing site resources efficiently without compromising the quality of the survey design. The larger survey area, at 0.5 meter depth, will result in an increase in the soil surface exposed for FSS scanning. Sample density for this survey will be consistent with that required for the same volume of excavated soil in the standard Class geometry (2000 $m^2$ at 1 meter depth).

Soil sample locations for this survey will be determined using a random start, systematic, square-grid pattern over the graded area. Each soil sample will be a homogenized composite representative of the total thickness of soil. Surface scanning will be conducted over 100% of the graded area.

### Soil Sample Design

Scoping Data

Sample measurements obtained to determine suitability for soil transport to the designated FSS area have not identified residual radioactivity above fractional concentrations of the DCGL value. Input data for survey design were based on values identified in characterization and supporting surveys for transport suitability.

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

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

*see 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

The $DCGL_w$ for the weighted sum is 1.0. The relative shift is determined using an LBGR value set at approximately 82% of the $DCGL_w$.

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

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

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

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). As a conservative measure a minimum of 18 samples will be collected for this survey.

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 |
|---|---|
| 0.417274 | 0.810911 |

Survey Unit $TBC_{X1}1$ Dimensions: X = 149 meters
Y = 20.8 meters

Random Start Location: X = (0.417274)(149) = 62.2 meters
With SW Corner Origin Y = (0.810911)(20.8) = 16.9 meters

Sample Spacing

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.

$$L = \sqrt{\frac{3100}{18}} = 13.1 \text{ meters}$$

With Sample spacing established at 13.1 meters, 22 data point locations are available for survey as 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 willbe determined by random number selection.

The starting point and track direction are also determined by random number selection for QA/QC scanning. 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: | 10 | Start Point: | 4 |
| Sample Recount: | 14 | Scan Towards : | 3 |
| Sample Recount: | 17 | Minimum Scan Area Requirement: | 310 $m^2$ |

**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 4. 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]

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

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

$DCGL_w$ = 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 Final Status 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 Survey $TBC_{x1}1$.

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

## Attachment 1

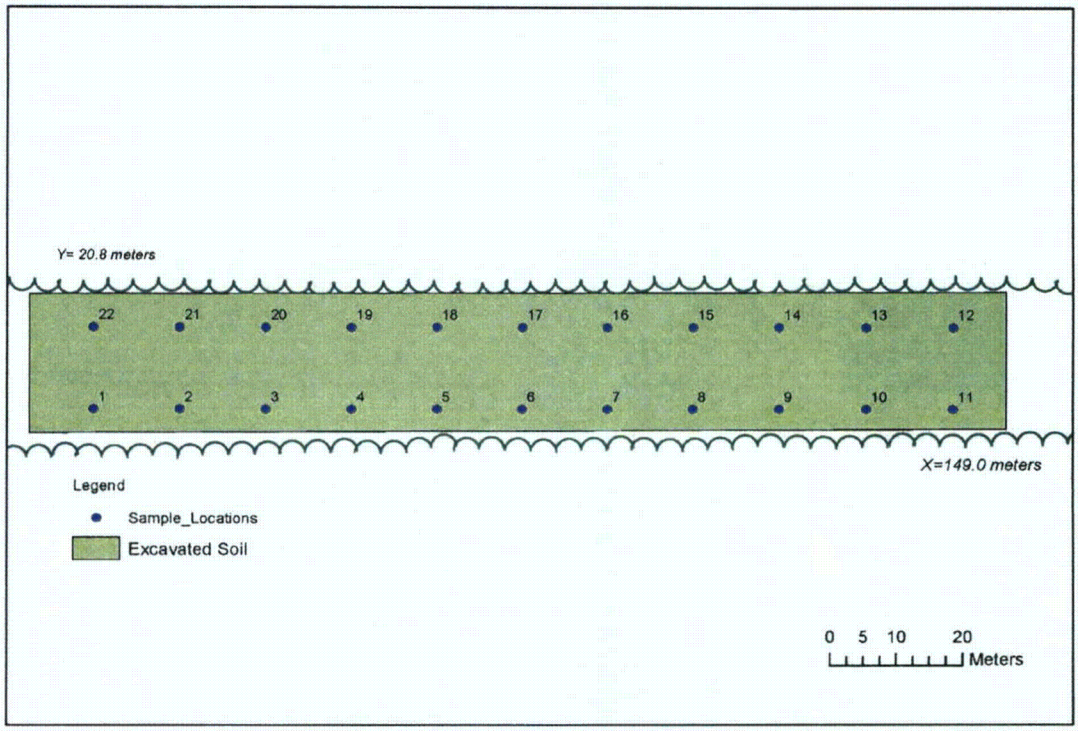
Design Data - Survey $TBC_{x1}1$
Excavated Soil from Turbine Building Demolition Area

| 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
Final Status Evaluation Survey $TBC_{X1}1$
Excavated Soil from Turbine Building Area




| Sample No. | X Coord. | Y Coord. |
|---|---|---|
| 1 | 9.8 | 3.8 |
| 2 | 22.9 | 3.8 |
| 3 | 36.0 | 3.8 |
| 4 | 49.1 | 3.8 |
| 5 | 62.2 | 3.8 |
| 6 | 75.3 | 3.8 |
| 7 | 88.4 | 3.8 |
| 8 | 101.5 | 3.8 |
| 9 | 114.6 | 3.8 |
| 10 | 127.6 | 3.8 |
| 11 | 140.7 | 3.8 |

| Sample No. | X Coord. | Y Coord. |
|---|---|---|
| 12 | 140.7 | 16.9 |
| 13 | 127.6 | 16.9 |
| 14 | 114.6 | 16.9 |
| 15 | 101.5 | 16.9 |
| 16 | 88.4 | 16.9 |
| 17 | 75.3 | 16.9 |
| 18* | 62.2 | 16.9 |
| 19 | 49.1 | 16.9 |
| 20 | 36.0 | 16.9 |
| 21 | 22.9 | 16.9 |
| 22 | 9.8 | 16.9 |

**Sample no. 18 is the random start location*
*Sample spacing is 13.1 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 TBCx1

Survey Area Description:
Excavated soil from the Turbine Building demolition area

The survey area is authorized for Final Status Survey Implementation.

| | |
|---|---|
| Designed by | 6/29/05 Date |
| Technical Review by | 6/29/05 Date |

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

| Step (✓) | | Initial | Date |
|---|---|---|---|
| 1.0 | PREPARATION FOR SURVEY TBC-1 (Survey #) | [illegible] | 6/28/05 |

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.

[illegible] ESSG 6/29/05

✓ b. Survey area has been turned over to the Environmental Services Survey Group (ESSG) in acceptable condition for FSS.

[illegible] ESSG 6/29/05

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)

[illegible] ESSG 6/29/05

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). | JLP ESSG | 6/30/05 |
| 2.2 | Surface Scan: | | |
| ✓ | Surface Scan complete. Action response requirements have been conducted on any identified areas exceeding the investigation level (Step 6.3). | JLP ESSG | 6/30/05 |
| 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). | JLP ESSG | 6/30/05 |
| 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. | JLP ESSG | 07/02/05 |

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). | ESSG | 7/7/05 |
| 3.3 | Sample Control and Documentation: | | |
| | Chain of custody documentation exhibits control of soil samples (Step 6.4.3). | ESSG | 7/7/05 |

Reviewed by — Date: 7/7/05

ATTACHMENT RM-59-1
SAMPLING AND ANALYSIS REPORT

| Date: 06-29-05 | Time: 1400 | Location: SVA | Tech: DWParish |
|---|---|---|---|

**SURVEY IDENTIFICATION / DESCRIPTION**

Survey $TBC_{x1}1$ Final Status Survey of excavated soil from the Turbine Building demolition area.

**SURVEY TYPE**

Survey Type:
- ___ Characterization
- ___ Remediation
- ✓ Final
- ✓ Scan (Motive)
- ___ Scan (Static)
- ___ Trenching and Digging (use RM-59-3)

**SURVEY DESIGN**

Sample Collection: ___ Judgmental ___ Random ✓ Systematic
Scan Coverage: 100 %

**ANALYSIS**

| | | | | | |
|---|---|---|---|---|---|
| Inst./Serial No. 18620 / 18685 JB635 / AA-2650-I | DAILY CHECK: ✓ | SAT | ___ UNSAT | INIT: | |
| Inst./Serial No. Det 6 | DAILY CHECK: ✓ | SAT | ___ UNSAT | INIT: | |
| Investigation Of Unidentified Peaks: | | ✓ SAT | ___ UNSAT | INIT: | |
| Minimum Detectable Activity (Section 5.3.2) | | ✓ SAT | ___ UNSAT | INIT: | |

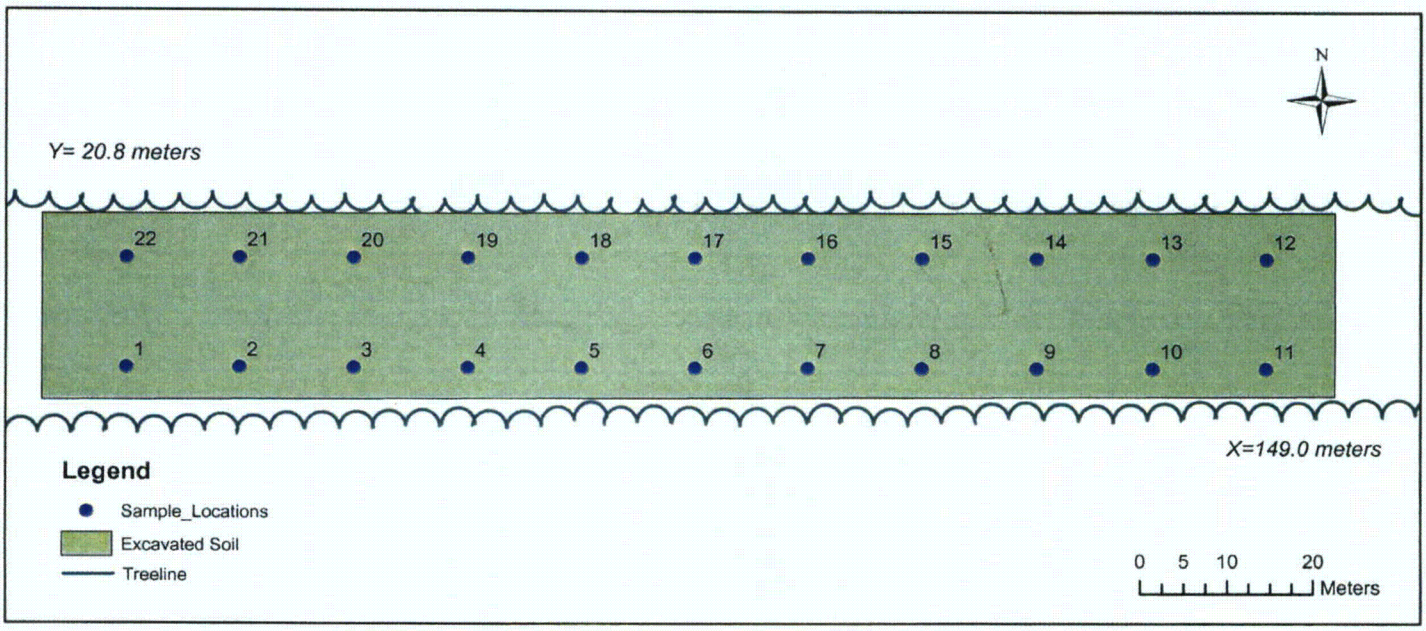
**COMMENTS**

FSS $TBC_{x1}1$ was performed in a random start, square grid, systematic sampling pattern resulting in the collection of 22 soil samples. Laboratory gamma spectroscopy analyses do not identify the presence of residual radioactivity above trace levels of the DCGL values. Surface scanning at 100% coverage identified no areas of elevated residual radioactivity. The results of the QA/QC verification scan (10% coverage) were consistent with the surface scanning results as detailed in the Surface Scan Summary attachment.

Technician Signature: [signature] Date: 7/6/05

Second Level Review:
Signature: [signature] Date: 8/2/05

Activity Summary
Soil Sample Analysis-FSS TBC $_{X1}$1
Excavated Soil from Turbine Building Area

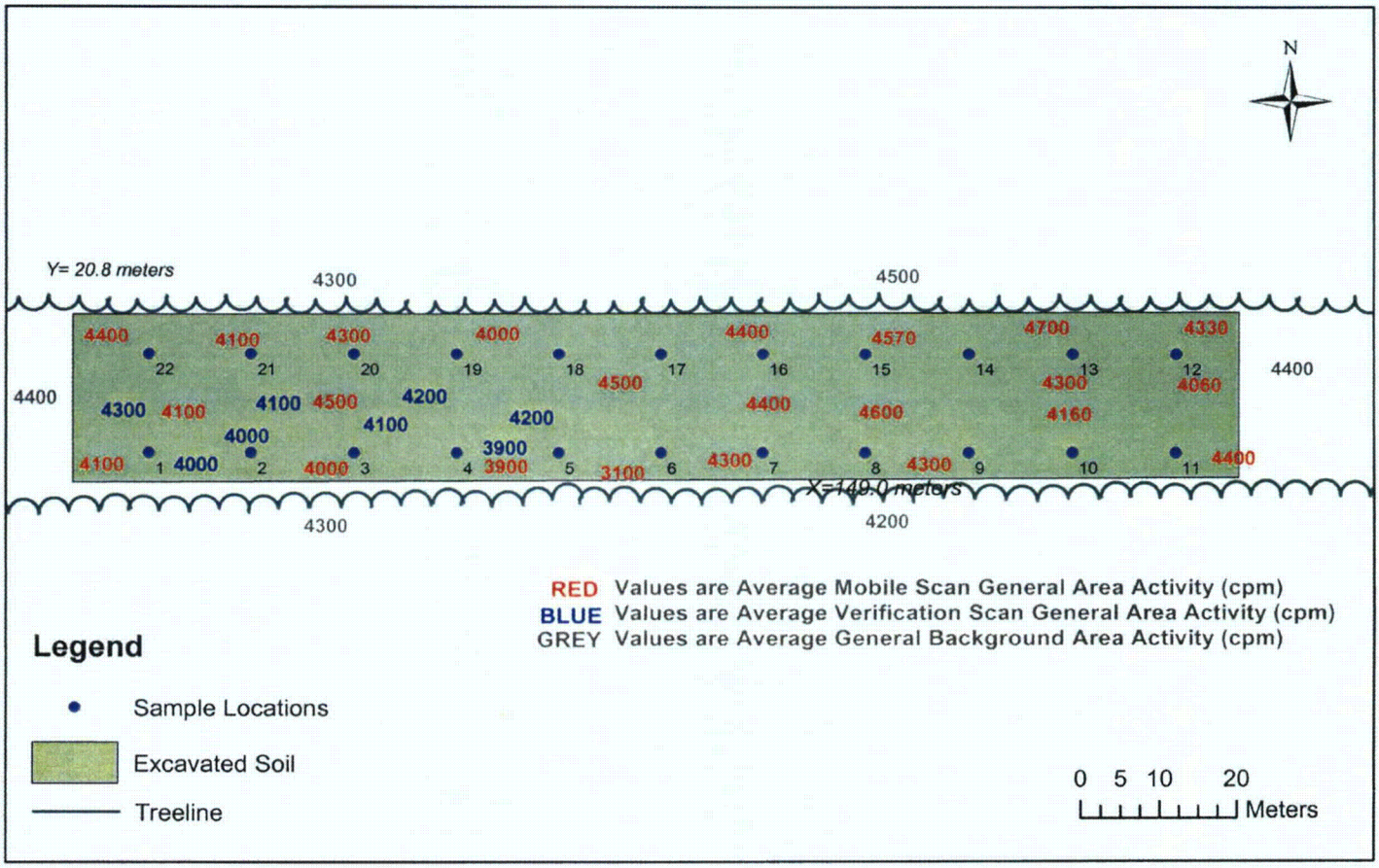



| Sample No. | X Coord. | Y Coord. | Cs-137 (pCi/g) | | Co-60 (pCi/g) | |
|---|---|---|---|---|---|---|
| | | | Activity | MDA | Activity | MDA |
| 1 | 9.8 | 3.8 | 0.13 | | ** 0.06 | 0.08 |
| 2 | 22.9 | 3.8 | 0.08 | | ** 0.07 | 0.08 |
| 3 | 36.0 | 3.8 | 0.13 | | ** 0.01 | 0.07 |
| 4 | 49.1 | 3.8 | 0.07 | | 0.06 | |
| 5 | 62.2 | 3.8 | 0.07 | | ** 0.03 | 0.07 |
| 6 | 75.3 | 3.8 | 0.09 | | ** 0.02 | 0.07 |
| 7 | 88.4 | 3.8 | 0.11 | | ** 0.01 | 0.06 |
| 8 | 101.5 | 3.8 | 0.10 | | ** 0.06 | 0.08 |
| 9 | 114.6 | 3.8 | 0.06 | | ** 0.02 | 0.07 |
| 10 | 127.6 | 3.8 | 0.02 | | ** 0.01 | 0.06 |
| 11 | 140.7 | 3.8 | ** 0.02 | 0.05 | ** 0.01 | 0.05 |
| 12 | 140.7 | 16.9 | ** 0.02 | 0.04 | ** 0.01 | 0.05 |
| 13 | 127.6 | 16.9 | ** 0.02 | 0.05 | ** 0.02 | 0.06 |
| 14 | 114.6 | 16.9 | 0.04 | | ** 0.02 | 0.06 |
| 15 | 101.5 | 16.9 | 0.05 | | 0.09 | |
| 16 | 88.4 | 16.9 | 0.08 | | ** 0.04 | 0.08 |
| 17 | 75.3 | 16.9 | 0.09 | | ** 0.02 | 0.08 |
| 18 | 62.2 | 16.9 | 0.12 | | ** 0.07 | 0.09 |
| 19 | 49.1 | 16.9 | 0.13 | | ** 0.04 | 0.08 |
| 20 | 36.0 | 16.9 | 0.10 | | ** 0.04 | 0.07 |
| 21 | 22.9 | 16.9 | 0.09 | | ** 0.02 | 0.06 |
| 22 | 9.8 | 16.9 | 0.07 | | ** 0.02 | 0.06 |

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

** Forced-count values

Surface Scan Summary
Scan Survey Data - FSS $TBC_{X1}1$
Excavated Soil from Turbine Building Area




**Primary Scan :** 100 %

**Technician Signature:** [signature] **Date:** 6/29/05
**Time:** 1500

**QC Verification Scan:** 10 %

**Technician Signature:** [signature] **Date:** 7-6-05
**Time:** 1300

FSS. TBCx.1

RM-72-1

## CHAIN-OF-CUSTODY RECORD

| Sample Number | Sampling Location | Date | Time | Final Disposition of Sample |
|---|---|---|---|---|
| 1 | (9.8)(3.8) | 6-30-05 | 1243 | 82B |
| 2 | (22.9)(3.8) | 6-30-05 | 1245 | 82B |
| 3 | (36.0)(3.8) | 6-30-05 | 1248 | 82B |
| 4 | (49.1)(3.8) | 6-30-05 | 1250 | 82B |
| 5 | (62.2)(3.8) | 6-30-05 | 1252 | 82C |
| 6 | (75.3)(3.8) | 6-30-05 | 1254 | 82C |
| 7 | (88.4)(3.8) | 6-30-05 | 1256 | 82C |
| 8 | (101.5)(3.8) | 6-30-05 | 1257 | 82C |
| 9 | (114.6)(3.8) | 6-30-05 | 1258 | 82C |
| 10 | (127.6)(3.8) | 6-30-05 | 1303 | 82D |
| 11 | (140.7)(3.8) | 6-30-05 | 1305 | 82D |
| 12 | (140.7)(16.9) | 6-30-05 | 1308 | 82D |
| 13 | (127.6)(16.9) | 6-30-05 | 1310 | 82D |
| 14 | (114.6)(16.9) | 6-30-05 | 1312 | 82D |
| 15 | (101.5)(16.9) | 6-30-05 | 1313 | 82E |
| 16 | (88.4)(16.9) | 6-30-05 | 1315 | 82E |
| 17 | (75.3)(16.9) | 6-30-05 | 1317 | 82E |
| 18 | (62.2)(16.9) | 6-30-05 | 1318 | 82E |
| 19 | (49.1)(16.9) | 6-30-05 | 1320 | 82E |
| 20 | (36.0)(16.9) | 6-30-05 | 1347 | 82F |

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

| | | | |
|---|---|---|---|
| 1. Relinquished by: [signature] | Date 6/30/05 | Time 1420 | Received in good condition by: Chem Lab. Locked in Storage Cabinet |
| 2. Relinquished by: J.L. Reed | Date 07/01/05 | Time 1220 | Received in good condition by: Locked in oven |
| 3. Relinquished by: J.L. Reed | Date 07/02/05 | Time 0740 | Received in good condition by: Chem lab. Locked in Storage Cabinet |
| 4. Relinquished by: J.L. Reed | Date 07/08/05 | Time 1138 | Received in good condition by: Locked in Env. Seavan for permanent storage. |

FSS-TBC-11
RM-72-1
CHAIN-OF-CUSTODY RECORD

| Sample Number | Sampling Location | Date | Time | Final Disposition of Sample |
|---|---|---|---|---|
| 21 | (22.9)(16.9) | 6-30-05 | 1349 | 82F |
| 22 | (9.8)(16.9) | 6-30-05 | 1351 | 82F |
| 10 split | (127.6)(3.8) | 6-30-05 | 1302 | Environmental Lab |
| 10 H3 | (127.6)(3.8) | 6-30-05 | 1300 | GEL |
| 14 H3 | (114.6)(16.9) | 6-30-05 | 1351 | GEL |
| 17 H3 | (75.3)(16.9) | 6-30-05 | 1350 | GEL |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

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

| | | | |
|---|---|---|---|
| 1. Relinquished by: [signature] | Date 6/30/05 | Time 1420 | Received in good condition by: Chem. Lab Locked in Storage Cabinet |
| 2. Relinquished by: J.L. Reed | Date 07/01/05 | Time 1220 | Received in good condition by: 10 split, 21 & 22 locked in oven 10 H3, 14 H3, & 17 H3 locked in Cabinet |
| 3. Relinquished by: J.L. Reed | Date 07/02/05 | Time 0740 | Received in good condition by: Chem lab. Locked in Storage Cabinet. |
| 4. Relinquished by: J.L. Reed | Date 07/08/05 | Time 1138 | Received in good condition by: #21 & 22 locked in Env. season for Perm. Storage #10 split & Tritium Samples Shipped to GEL. |

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

FINAL STATUS SURVEY: TBC x1

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 _____

_____

_____

_____

_____

_____ 07-07-05
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.
- ✓ Results of judgmental samples have been reviewed and evaluated.
- ✓ 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: 22

c. Calculate % Completeness: $\frac{b \times 120}{a}$ = 176%

✓ 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: _____

Assessor

07-07-05
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:

NA 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 22

b. Calculation of the Mean 0.017 SOR

c. Calculation of the Median 0.014 SOR

d. Calculation Standard Deviation 0.010 SOR

NA 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 Statistical Test

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

NA 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

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

NA 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

✓ 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.

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.

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 Statistical quantities provided in RM 78-3, Attachment 1

Assessor — 8/13/05 Date

Reviews:

Technical Review — 8/21/05 Date

ES Superintendent — 8/23/05 Date

RP&ES Manager — 8-24-05 Date

**Attachment 1**
**Statistical Quantities**
**Final Status Survey $TBC_{x1}1$**
**Excavated Soil from Turbine Building Demolition Area**

| Sample Number | Cs-137 (pCi/g) | Co-60 (pCi/g) | Weighted Sum (SOR) | *Weighted Sum <DCGLw? | DCGL-W. Sum | Sign |
|---|---|---|---|---|---|---|
| 1 | 0.13 | 0.06 | 0.030 | yes | 0.970 | +1 |
| 2 | 0.08 | 0.07 | 0.029 | yes | 0.971 | +1 |
| 3 | 0.13 | 0.01 | 0.014 | yes | 0.986 | +1 |
| 4 | 0.07 | 0.06 | 0.025 | yes | 0.975 | +1 |
| 5 | 0.07 | 0.03 | 0.015 | yes | 0.985 | +1 |
| 6 | 0.09 | 0.02 | 0.014 | yes | 0.986 | +1 |
| 7 | 0.11 | 0.01 | 0.012 | yes | 0.988 | +1 |
| 8 | 0.10 | 0.06 | 0.027 | yes | 0.973 | +1 |
| 9 | 0.06 | 0.02 | 0.011 | yes | 0.989 | +1 |
| 10 | 0.02 | 0.01 | 0.005 | yes | 0.995 | +1 |
| 11 | 0.02 | 0.01 | 0.005 | yes | 0.995 | +1 |
| 12 | 0.02 | 0.01 | 0.005 | yes | 0.995 | +1 |
| 13 | 0.02 | 0.02 | 0.008 | yes | 0.992 | +1 |
| 14 | 0.04 | 0.02 | 0.010 | yes | 0.990 | +1 |
| 15 | 0.05 | 0.09 | 0.032 | yes | 0.968 | +1 |
| 16 | 0.08 | 0.04 | 0.019 | yes | 0.981 | +1 |
| 17 | 0.09 | 0.02 | 0.014 | yes | 0.986 | +1 |
| 18 | 0.12 | 0.07 | 0.032 | yes | 0.968 | +1 |
| 19 | 0.13 | 0.04 | 0.023 | yes | 0.977 | +1 |
| 20 | 0.10 | 0.04 | 0.021 | yes | 0.979 | +1 |
| 21 | 0.09 | 0.02 | 0.014 | yes | 0.986 | +1 |
| 22 | 0.07 | 0.02 | 0.012 | yes | 0.988 | +1 |

St. Deviation (SOR): 0.010
Mean (SOR): 0.017
Median (SOR): 0.014

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 # TBCx4 1 QC Package # TBCx4 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 N/A | |
| 3. Split Samples | | Step 5.1.4.2 |
| ✓ c. In-house | (Yes) / 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:

Reviews:

Evaluator — Date: 8/13/05

Technical Review — Date: 8/23/05

# QA Verification
## Sample Recount Analysis

**Date:** 8/3/2005

**QA:** FSS $TBC_{x1}1$ Excavated Soil From TB Area

**Type:** Sample Recount

**Lab:** In- House

Table 1

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

| | | | A | B | C | D | E | F | G | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Radionuclide | BRP Result Below MDA | BRP Results (pCi/g) | BRP % Error (Sigma) | BRP Resolution | Acceptance Ratio ( Table 1) | Recount Result Below MDA | Recount Results (pCi/g) | Comparison Ratio F/A | Results in Agreement Compare G with D) |
| 14 | Co-60 | < | 0.0572 | n/a | n/a | n/a | < | 0.0592 | 1.03 | YES |
| 14 | Cs-137 | | 0.0388 | 28.82 | 3.47 | n/a | | 0.0666 | 1.72 | YES |
| 17 | Co-60 | < | 0.0760 | n/a | n/a | n/a | < | 0.0756 | 0.99 | YES |
| 17 | Cs-137 | | 0.0939 | 19.76 | 5.06 | 0.5-2.0 | < | 0.0803 | 0.86 | YES |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

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

*< Indicates results less than the MDA.*

**Note: Results fthat fail agreement must be investigated per RM-79.*

## QA Verification
## Split Sample Analysis

**Date:** 8/3/2005

**QA:** FSS $TBC_{x1}1$ Excavated Soil from TB Area

**Type:** Split Samples

**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) |
| 10 | Co-60 | < | 0.0623 | n/a | n/a | n/a | < | 0.0516 | 0.83 | YES |
| 10 | Cs-137 | | 0.0247 | 50.96 | 1.96 | 0.5-2.0 | | 0.0532 | 2.15 | YES |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

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

*< Indicates results less than the MDA.*

# QA Verification
# Split Sample Analysis

**Date:** 8/3/2005

**QA:** FSS $TBC_{x1}1$ Excavated Soil from TB Area

**Type:** Split Samples

**Lab:** Environmental Inc.

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) |
| 10 | Co-60 | < | 0.0623 | n/a | n/a | n/a | < | 0.0200 | 0.32 | YES |
| 10 | Cs-137 | | 0.0247 | 50.96 | 1.96 | 0.5-2.0 | < | 0.0400 | 1.62 | YES |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

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

*< Indicates results less than the MDA.*

General Engineering Laboratories, LLC
$TBC_{x1}1$ Tritium Report Summary

| Sample | Tritium pCi/g |
|---|---|
| 10 | 0.193 |
| 14 | 0.394 |
| 17 | 1.24 |
| Mean | 0.609 |
| Median | 0.394 |
| Std Dev | 0.556 |

**Environmental Incorporated**
**Midwest Laboratory**
**An Allegheny Technologies Company**
700 Landwehr Road • Northbrook, IL 60062-2310
Phone (847) 564-0700 • Fax (847) 564-4517

Mr. Chuck Barsy
Big Rock Point
10269 US-31 North
Charlevoix, Michigan 49720

LABORATORY REPORT NO. 8022-100-190
DATE: 08-02-2005
SAMPLES RECEIVED: 07-11-2005
PURCHASE ORDER NO:

Dear Mr. Barsy:

Below are the results of the gamma scan on one soil sample. The sample was analyzed as received.

| | |
|---|---|
| Sample Description: | FSS TBCX-1 #10 |
| Collection Date: | 06-30-05 |
| Sample weight (gram): | 1724 |
| Lab Code: | BRSO-3916 |

| Isotope | Concentration (pCi/g) |
|---|---|
| K-40 | 7.84 ± 1.11 |
| Mn-54 | < 0.02 |
| Fe-59 | < 0.04 |
| Co-58 | < 0.02 |
| Co-60 | < 0.02 |
| Zn-65 | < 0.09 |
| Nb/Zr-95 | < 0.03 |
| Cs-134 | < 0.04 |
| Cs-137 | < 0.04 |
| Ce-141 | < 0.09 |
| Ce-144 | < 0.21 |

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

Sincerely,

Bronia Grob, M.S.
Laboratory Manager

APPROVED BY

Tony Coorlim,
Quality Assurance

Page: _____ of _____
Project #:
GEL Quote #:
COC Number (1):
PO Number:

# GEL Chain of Custody and Analytical Request

140319 %

General Engineering Laboratories, LLC
2040 Savage Road
Charleston, SC 29407
Phone: (843) 556-8171
Fax: (843) 766-1178

Client Name: C. BARRY
Phone #: 231-887-8120
Project/Site Name: BIG ROCK
Fax #: 231-237-2594
Address:
Collected by:
Send Results To:

**Sample Analysis Requested** (5) (Fill in the number of containers for each test)

| Sample ID | Date Collected (mm-dd-yy) | Time Collected (Military) (hhmm) | QC Code (2) | Field Filtered (3) | Sample Matrix (4) | Should this sample be considered: Radioactive | Should this sample be considered: TSCA Regulated | Total number of containers | TRITIUM | % MOISTURE | <-- Preservative Type (6) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FSS TBCX-1 # 10 | 06/30/05 | 1300 | | | | | | 1 | X | X | |
| FSS TBCX-1 # 14 | 06/30/05 | 1351 | | | | | | 1 | X | X | |
| FSS TBCX-1 # 17 | 06/30/05 | 1350 | | | | | | 1 | X | X | |

**Comments**
Note: extra sample is required for sample specific QC

TAT Requested: Normal: _____ Rush: X Specify: _____ (Subject to Surcharge)
Fax Results: Yes / No
Circle Deliverable: C of A / QC Summary / Level 1 / Level 2 / Level 3 / Level 4

***Remarks:*** *Are there any known hazards applicable to these samples? If so, please list the hazards*
TRITIUM VIA VACUUM EXTRACTION, REPORT TRITIUM AS PCi/L IN $H_2O$ WITH A MDA < 500 PCi/L
ALSO PROVIDE TRITIUM CONCENTRATION IN PCi/g SOIL AND PROVIDE % MOISTURE

**Chain of Custody Signatures**

| | Relinquished By (Signed) | Date | Time | Received by (signed) | Date | Time |
|---|---|---|---|---|---|---|
| 1 | | 7/6/05 | 1430 | | 7.11.05 | 820 |
| 2 | | | | | | |
| 3 | | | | | | |

**Sample Shipping and Delivery Details**

GEL PM:
Method of Shipment:
Date Shipped:
Airbill #:
Airbill #:

1.) Chain of Custody Number = Client Determined
2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite
3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.
4.) Matrix Codes: DW = Drinking Water, GW = Groundwater, SW = Surface Water, WW = Waste Water, W = Water, SO = Soil, SD = Sediment, SL = Sludge, SS = Solid Waste, O = Oil, F = Filter, P = Wipe, U = Urine, F = Fecal, N = Nasal
5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1).
6.) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank



*For Lab Receiving Use Only*
*Custody Seal Intact?* YES NO
*Cooler Temp:* _____ C

WHITE = LABORATORY YELLOW = FILE PINK = CLIENT

# SAMPLE RECEIPT & REVIEW FORM

PM use only

| | |
|---|---|
| Client: Big Rock | SDG/ARCOC/Work Order: 140819, 140320 |
| Date Received: 7.11.05 | PM(A) Review (ensure non-conforming items are resolved prior to signing): |
| Received By: AM | |

| | Sample Receipt Criteria | Conforming | NA | Non-Conforming | Comments/Qualifiers (Required for Non-Conforming Items) |
|---|---|---|---|---|---|
| 1 | Shipping containers received intact and sealed? | ✓ | | | Circle Applicable: seals broken damaged container leaking container other (describe) |
| 2 | Samples requiring cold preservation within (4 +/- 2 C)? Record preservation method. | | ✓ | | Circle Temp device serial # ice bags blue ice dry ice none other(describe) 25.0° |
| 3 | Chain of custody documents included with shipment? | ✓ | | | |
| 4 | Sample containers intact and sealed? | ✓ | | | Circle Applicable: seals broken damaged container leaking container other (describe) |
| 5 | Samples requiring chemical preservation at proper pH? | | ✓ | | Sample ID's, containers affected and observed pH: |
| 6 | VOA vials free of headspace (defined as < 6mm bubble)? | | ✓ | | Sample ID's and containers affected: |
| 7 | Samples received within holding time? | ✓ | | | Id's and tests affected: |
| 8 | Sample ID's on COC match ID's on bottles? | ✓ | | | Sample ID's and containers affected: |
| 9 | Date & time on COC match date & time on bottles? | ✓ | | | Sample ID's affected: |
| 10 | Number of containers received match number indicated on COC? | ✓ | | ✓ | Sample ID's affected: |
| 11 | COC form is properly signed in relinquished/received sections? | ✓ | | | |
| 12 | Air Bill ,Tracking #'s, & Additional Comments | 8504 1240 8460 | | | |

| Radiological Information | Non-RAD | RAD | RADI | RSO RAD Receipt # |
|---|---|---|---|---|
| What is the radiological classification of the samples? | | ✓ | | Comments: |
| Radioactivity Screening Results (maximum observed CPM) | 40cpm | | | *If > x2 area background is observed on a non-radioactive sample, contact the RSO to investigate. |

PM (or PMA) review of Receiving Rad classification: _____ Initials 7/11/05 Date

**GENERAL ENGINEERING LABORATORIES, LLC**
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# Certificate of Analysis Report for
for
ROCK001 Big Rock Nuclear Facility
Client SDG: 140319 GEL Work Order: 140319

**Sample(s) Contained within this report:**

| Lab Sample ID | Client Sample ID | Sample Description | Collected |
|---|---|---|---|
| 140319001 | FSS TBCX-1#10 | N/A | 06/30/2005 13:00 |
| 140319002 | FSS TBCX-1#14 | N/A | 06/30/2005 13:51 |
| 140319003 | FSS TBCX-1#17 | N/A | 06/30/2005 13:50 |
| 140319004 | FSS TBCX-1#10 | N/A | 06/30/2005 13:00 |
| 140319005 | FSS TBCX-1#14 | N/A | 06/30/2005 13:51 |
| 140319006 | FSS TBCX-1#17 | N/A | 06/30/2005 13:50 |

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones.

Reviewed by

# GENERAL ENGINEERING LABORATORIES, LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

**10 CFR Part 50/61 Certificate of Analysis**

| | | | |
|---|---|---|---|
| **GEL Sample ID:** | **140319001** | **Client:** | **Big Rock Nuclear Facility** |
| **Client Sample ID:** | **FSS TBCX-1#10** | **Collect Date:** | **June 30, 2005** |
| **Matrix:** | **Misc Solid** | **Receive Date:** | **July 11, 2005** |
| **Amount of Sample Received:** | | **Report Date:** | **July 25, 2005** |

| Analyte | Aliquot () | Run Date | Activity[2] | Uncertainty | MDA[1] | RL | Units | Qualifier |
|---|---|---|---|---|---|---|---|---|
| H-3 | | 07/19/05 | 5.15E+03 | 4.51E+02 | 3.45E+02 | 5.00E+02 | pCi/L | 3 |
| Moisture | | 07/13/05 | 3.03E+00 | | | | percent | |

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

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

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

**U Target analyte was analyzed for but not detected above the MDL or LOD.**

# GENERAL ENGINEERING LABORATORIES, LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## 10 CFR Part 50/61 Certificate of Analysis

| | | | |
|---|---|---|---|
| **GEL Sample ID:** | **140319002** | **Client:** | **Big Rock Nuclear Facility** |
| **Client Sample ID:** | **FSS TBCX-1#14** | **Collect Date:** | **June 30, 2005** |
| **Matrix:** | **Misc Solid** | **Receive Date:** | **July 11, 2005** |
| **Amount of Sample Received:** | | **Report Date:** | **July 25, 2005** |

| Analyte | Aliquot () | Run Date | Activity [2] | Uncertainty | MDA [1] | RL | Units | Qualifier |
|---|---|---|---|---|---|---|---|---|
| H-3 | | 07/19/05 | 6.52E+03 | 4.96E+02 | 3.43E+02 | 5.00E+02 | pCi/L | 3 |
| Moisture | | 07/13/05 | 5.81E+00 | | | | percent | |

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

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

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

**U Target analyte was analyzed for but not detected above the MDL or LOD.**

# GENERAL ENGINEERING LABORATORIES, LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

**10 CFR Part 50/61 Certificate of Analysis**

| | | | |
|---|---|---|---|
| **GEL Sample ID:** | **140319003** | **Client:** | **Big Rock Nuclear Facility** |
| **Client Sample ID:** | **FSS TBCX-1#17** | **Collect Date:** | **June 30, 2005** |
| **Matrix:** | **Misc Solid** | **Receive Date:** | **July 11, 2005** |
| **Amount of Sample Received:** | | **Report Date:** | **July 25, 2005** |

| Analyte | Aliquot () | Run Date | Activity [2] | Uncertainty | MDA [1] | RL | Units | Qualifier |
|---|---|---|---|---|---|---|---|---|
| H-3 | | 07/19/05 | 1.87E+04 | 7.94E+02 | 3.40E+02 | 5.00E+02 | pCi/L | 3 |
| Moisture | | 07/13/05 | 5.75E+00 | | | | percent | |

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

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

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

**U Target analyte was analyzed for but not detected above the MDL or LOD.**

# GENERAL ENGINEERING LABORATORIES, LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com


## 10 CFR Part 50/61 Certificate of Analysis

| | | | |
|---|---|---|---|
| **GEL Sample ID:** | **140319004** | **Client:** | **Big Rock Nuclear Facility** |
| **Client Sample ID:** | **FSS TBCX-1#10** | **Collect Date:** | **June 30, 2005** |
| **Matrix:** | **Misc Solid** | **Receive Date:** | **July 11, 2005** |
| **Amount of Sample Received:** | | **Report Date:** | **July 25, 2005** |

| Analyte | Aliquot (L) | Run Date | Activity [2] | Uncertainty | MDA [1] | RL | Units | Qualifier |
|---|---|---|---|---|---|---|---|---|
| H-3 | 1.00E-02 | 07/19/05 | 1.93E-01 | 1.69E-02 | 1.29E-02 | 6.00E+00 | pCi/g | 3 |

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

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

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

**U Target analyte was analyzed for but not detected above the MDL or LOD.**

# GENERAL ENGINEERING LABORATORIES, LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com


## 10 CFR Part 50/61 Certificate of Analysis

| | | | |
|---|---|---|---|
| **GEL Sample ID:** | **140319005** | **Client:** | **Big Rock Nuclear Facility** |
| **Client Sample ID:** | **FSS TBCX-1#14** | **Collect Date:** | **June 30, 2005** |
| **Matrix:** | **Misc Solid** | **Receive Date:** | **July 11, 2005** |
| **Amount of Sample Received:** | | **Report Date:** | **July 25, 2005** |

| Analyte | Aliquot (L) | Run Date | Activity [2] | Uncertainty | MDA [1] | RL | Units | Qualifier |
|---|---|---|---|---|---|---|---|---|
| H-3 | 1.00E-02 | 07/19/05 | 3.94E-01 | 2.99E-02 | 2.07E-02 | 6.00E+00 | pCi/g | 3 |

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

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

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

**U Target analyte was analyzed for but not detected above the MDL or LOD.**

# GENERAL ENGINEERING LABORATORIES, LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com


## 10 CFR Part 50/61 Certificate of Analysis

| | | | |
|---|---|---|---|
| **GEL Sample ID:** | **140319006** | **Client:** | **Big Rock Nuclear Facility** |
| **Client Sample ID:** | **FSS TBCX-1#17** | **Collect Date:** | **June 30, 2005** |
| **Matrix:** | **Misc Solid** | **Receive Date:** | **July 11, 2005** |
| **Amount of Sample Received:** | | **Report Date:** | **July 25, 2005** |

| Analyte | Aliquot (L) | Run Date | Activity [2] | Uncertainty | MDA [1] | RL | Units | Qualifier |
|---|---|---|---|---|---|---|---|---|
| H-3 | 1.00E-02 | 07/19/05 | 1.24E+00 | 5.28E-02 | 2.26E-02 | 6.00E+00 | pCi/g | 3 |

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

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

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

**U Target analyte was analyzed for but not detected above the MDL or LOD.**

# GENERAL ENGINEERING LABORATORIES, LLC
2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com


## QC Summary

Report Date: July 25, 2005


Big Rock Nuclear Facility
10269 US 31 North
Charlevoix, Michigan
**Contact:** Mr. Chuck Barsy

**Workorder:** 140319

| Parmname | NOM | Sample | Qual | QC | Units | RPD% | REC% | Range | Anlst | Date Time |
|---|---|---|---|---|---|---|---|---|---|---|
| **Gravimetric Solids** | | | | | | | | | | |
| Batch 441799 | | | | | | | | | | |
| QC1200886009 140319001 DUP | | | | | | | | | | |
| Moisture | | 3.03 | | 2.87 | percent | 5 | | (0%-20%) | TC1 | 07/13/05 11:14 |
| **Rad Liquid Scintillation** | | | | | | | | | | |
| Batch 441910 | | | | | | | | | | |
| QC1200886233 140319001 DUP | | | | | | | | | | |
| Tritium | | 5150 +/-451 | | 5610 +/-468 | pCi/L | 9 | | (0%-20%) | LAG1 | 07/19/05 19:38 |
| QC1200886235 LCS | | | | | | | | | | |
| Tritium | 5110 | | | 5610 +/-459 | pCi/L | | 110 | (75%-125%) | | 07/19/05 21:10 |
| QC1200886232 MB | | | | | | | | | | |
| Tritium | | | U | 189 +/-207 | pCi/L | | | | | 07/19/05 18:52 |
| QC1200886234 140319001 MS | | | | | | | | | | |
| Tritium | 15400 | 5150 +/-451 | | 20900 +/-845 | pCi/L | | 103 | (75%-125%) | | 07/19/05 20:24 |
| Batch 441989 | | | | | | | | | | |
| QC1200886451 140319004 DUP | | | | | | | | | | |
| Tritium | | 0.193 +/-0.0169 | | 0.210 +/-0.0175 | pCi/g | 9 | | (0%-20%) | LAG1 | 07/19/05 19:38 |
| QC1200886453 LCS | | | | | | | | | | |
| Tritium | 5.11 | | | 5.61 +/-0.459 | pCi/g | | 110 | (75%-125%) | | 07/19/05 21:10 |
| QC1200886450 MB | | | | | | | | | | |
| Tritium | | | U | 0.189 +/-0.207 | pCi/g | | | | | 07/19/05 18:52 |
| QC1200886452 140319004 MS | | | | | | | | | | |
| Tritium | 0.575 | 0.193 +/-0.0169 | | 0.782 +/-0.0316 | pCi/g | | 103 | (75%-125%) | | 07/19/05 20:24 |

Notes:
The Qualifiers in this report are defined as follows:

- ** Indicates the analyte is a surrogate compound.
- B Target analyte was detected in the sample as well as the associated blank.
- BD Results below the MDC or low tracer recovery.
- E Concentration of the target analyte exceeds the instrument calibration range.
- H Analytical holding time exceeded.
- J Indicates an estimated value.
- U Target analyte was analyzed for but not detected above the MDL or LOD.
- UI Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier-please see case narrative, data summary package or contact your project manager for details.

**GENERAL ENGINEERING LABORATORIES, LLC**
2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

# QC Summary

**Workorder:** 140319



| Parmname | NOM | Sample | Qual | QC | Units | RPD% | REC% | Range | Anlst | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|

d the 2:1 depletion requirement was not met for this sample

h Sample preparation or preservation holding time exceeded.

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.
^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.