

## Appendix A (pages 1 to 9)

# SNEC CALCULATION COVER SHEET

## CALCULATION DESCRIPTION

Calculation Number	Revision Number	Effective Date	Page Number
E900-05-021	0	4/8/05	1 of 9

Subject

OL11 & Remaining OL12 Open Land Area - Survey Design

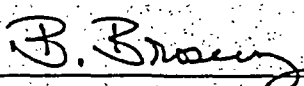
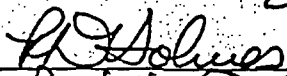
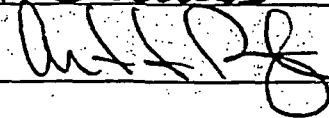
Question 1 - Is this calculation defined as "In QA Scope"? Refer to definition 3.5. Yes ☒ No ☐

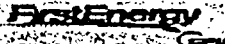
Question 2 - Is this calculation defined as a "Design Calculation"? Refer to definitions 3.2 and 3.3. Yes ☒ No ☐

NOTES: If a "Yes" answer is obtained for Question 1, the calculation must meet the requirements of the SNEC Facility Decommissioning Quality Assurance Plan. If a "Yes" answer is obtained for Question 2, the Calculation Originator's immediate supervisor should not review the calculation as the Technical Reviewer.

## DESCRIPTION OF REVISION

## APPROVAL SIGNATURES

Calculation Originator	B. Brosey/ 	Date	3/30/05
Technical Reviewer	R. Holmes/ 	Date	4/1/05
Additional Review	A. Paynter/ 	Date	23 April 2005
Additional Review		Date	

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## 1.0 PURPOSE

- 1.1 The purpose of this calculation is to develop a survey design for the SNEC site area designated "OL11" and a section of OL12 which resides outside of the PENELEC Switch Yard. These areas are ~13,352 square meters in total surface area, and are divided into three (3) - Class 2 survey units. This design applies only to open land areas. Additional designs may be developed for structural surfaces as deemed appropriate by SNEC management. These areas are shown on **Attachment 1-1**.
- 1.2 OL11 is sub-divided into two (2) survey units while the remaining section of OL12 (designated OL12-1) is one survey unit. These areas have the following individual surface areas:
  - OL11-1, ~5,000 square meters,
  - OL11-2, ~5,200 square meters, and
  - OL12-1, ~1,152 square meters

## 2.0 SUMMARY OF RESULTS

The following information should be used to develop a survey request for these survey units.

The effective DCGLw value is listed below for these survey units. The US NRC has reviewed and concurred with the methodology used to derive these values. See **Attachment 2-1** through **2-3**. This mix is developed from samples taken from the OL11 area.

**Table 1, DCGLw Values**

Survey Units	Volumetric DCGLw (pCi/g – Cs-137)
All	3.22 (2.41 A.L.)

NOTE: A.L. is the site Administrative Limit (75% of effective DCGLw)


### 2.1 Survey Design

- 2.1.1 Scanning of soil (and fill materials) shall be performed using a 2" D by 2" L NaI detector with a Cs-137 window setting (**Reference 3.1**). The window shall straddle the Cs-137 662 keV full energy peak width (see typical calibration information on **Attachment 3-1**).
- 2.1.2 The instrument conversion factor/efficiency shall not be less than 206 cpm/uR/h – Cs-137.
- 2.1.3 Other instruments of the type specified in Section 2.1.1 above may be used during the final status survey (FSS), but must demonstrate detection efficiencies at or above the value listed in Section 2.1.2.

**Table 2, Soil Scanning Parameters**

MDCscan (pCi/g) – Cs-137*	Scan Speed (cm/sec)	Maximum Distance from Surface	Action Level	% Coverage
5.97	25	4" (gap between detector face & soil surface)	> 350 gcpm	100% of Designated Grids

See Attachment 4-1 through 4-3 for actual calculations\*

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2.1.4 If a count rate greater than the action level of Table 2 is encountered during the scanning process, the surveyor should stop and locate the boundary of the elevated area. The surveyor should then mark the elevated area with stakes and/or other appropriate marking methods. To complete the investigation, sample elevated areas(s) IAW SNEC procedure E900-IMP-4520.04 (Reference 3.2), and Section 2.2 of this calculation.

2.1.4.1 **Class 2** soil should be scanned using a serpentine pattern that is ~0.5 meters wide.

2.1.4.2 Scanning locations are randomly chosen on a per grid basis. Grids that can not be accessed should be clearly noted along with the reason for not completing the scan in that area. Scanning of partial grid areas is permitted with proper documentation.

2.1.4.3 The minimum number of scan locations (~50% of each survey unit) are identified by the VSP computer program (Reference 3.3), and are listed in Table 3 (see Attachment 5-1). Additional randomly chosen grids are provided so that a 50% scanning goal can be reached even if some grid areas (or grid sections) are deemed inaccessible. There is no need to scan these extra grid areas if the minimum scanning goal is attained (i.e., ~50% coverage).

**Table 3, Randomly Located Grids for Scanning**

Survey Unit	Number of Grids
OL11-1	25 (29 provided)
OL11-2	26 (30 provided)
OL12-1	< 6 (~ 6 provided)

See Attachment 5-1.


2.1.5 The minimum number of randomly located sample points required for these survey units are listed in the following Table (see Compass output on Attachment 6-1 through 6-10). The surveyor should attempt to collect all samples listed below, but must collect the minimum values listed for each survey unit.

**Table 4, Randomly Located Sample Points**

Survey Unit	No. of Samples
OL11-1	14 min. (17 provided)
OL11-2	14 min. (17 provided)
OL12-1	14 min. (17 provided)

See Attachment 7-1 to 7-2.

2.1.6 Sampling depth should be IAW Section 2.2.

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2.1.7 Because the MDCscan (soil) is above the  $DCGLW_{Cs-137}$ , these Class 2 survey units are assumed to be Class 1 areas for purposes of data entry into the Compass computer program, thus forcing Compass to evaluate the number of samples based on the "Hot Spot" design criteria (see **Attachment 6-4** and **6-10**).

2.1.8 VSP (Reference 3.3) is used to plot all scan and sample point locations in the included diagrams. The actual number of random start systematically spaced measurement points may be greater than that required by the Compass computer code because of any or all of the following:

- placement of the initial random starting point (edge effects),
- odd shaped diagrams, and/or
- coverage concerns/Hot Spot design requirements

2.1.11 The starting points for physically locating sample sites in the survey unit are based on measurements from selected site grid pins (see **Attachment 7-1** diagram). Remaining soil sampling points are positioned using coordinates/measurements developed from these markers and the current site grid map.

2.1.12 Some sampling points may need to be adjusted to accommodate obstructions within these survey units. Contact the SR coordinator to report any difficulties encountered when laying out sampling points.

2.1.13 When an obstruction is encountered that will not allow collection of a sample, **contact the cognizant SR coordinator** for permission to delete the sampling point.

**NOTE**

If remediation actions are taken as a result of this survey, this survey design must be revised or re-written entirely.

2.2 Sample elevated areas(s) IAW SNEC procedure E900-IMP-4520.04 (Reference 3.2) and the following.

2.2.1 Collect a one meter deep sample at all locations.


**NOTE**

Since the site surface dose model is 1 meter in depth, 1 meter deep samples must be collected to satisfy the initial sampling requirements of Section 2.1.5 (of this design).

Sections 4.2.3, 4.2.6 or 4.2.7 of site procedure E900-IMP-4520.04 are applicable when satisfying sampling requirements of this calculation.

2.2.2 Clearly mark, identify and document all sample locations.

2.3.1 As a part of the investigation process, sample any location that is above the action level cited in Table 2.


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### 3.0 REFERENCES

- 3.1 SNEC Calculation No. E900-03-018, "Optimize Window and Threshold Settings for the Detection of Cs-137 Using the Ludlum 2350-1 and a 44/10 NaI Detector", 8/7/03.
- 3.2 SNEC Procedure E900-IMP-4520.04, "Survey Methodology to Support SNEC License Termination".
- 3.3 Visual Sample Plan, Version 2.0 (or greater), Copyright 2002, Battelle Memorial Institute.
- 3.4 Compass Computer Program, Version 1.0.0, Oak Ridge Institute for Science and Education.
- 3.5 Plan SNEC Facility License Termination Plan.
- 3.6 SNEC Procedure E900-IMP-4500.59, "Final Site Survey Planning and DQA".
- 3.7 SNEC Survey Request No. SR-135, MA6 and MA7 Areas (now OL11), 6-10-04.
- 3.8 GPU Nuclear, SNEC Facility, "Site Area Grid Map", SNECRM-020, Sheet 1, Rev 2, 1/29/03.
- 3.9 SNEC Calculation No. E900-03-012, Effective DCGL Worksheet Verification.
- 3.10 SNEC Procedure E900-IMP-4520.06, "Survey Unit Inspection in Support of FSS Design".
- 3.11 NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual", August, 2000.
- 3.12 Microsoft Excel 97, Microsoft Corporation Inc., SR-2, 1985-1997.

### 4.0 ASSUMPTIONS AND BASIC DATA

- 4.1 The Compass computer program is used to calculate the required number of random start systematic samples to be taken in the survey unit (Reference 3.4).
- 4.2 Characterization soil samples from this area are used as the initial estimate of variability. These results are shown on Attachment 8-1. The grid locations where these samples were taken are also shown (Reference 3.7).
- 4.3 The MARSSIM Sign Test will be applicable for this survey design. No background subtraction will be performed under this criteria during the application of the DQA.
- 4.4 The number of points chosen by Compass are located on the survey map for the survey unit by the Visual Sample Plan (VSP) computer code (Reference 3.4).
- 4.5 Reference 3.5 and 3.6 were used as guidance during the survey design development phase.
- 4.6 Background in the OL11 area is less than 300 cpm (Reference 3.7). For purposes of calculating the MDCscan value used for planning purposes, background is assumed to be approximately 200 cpm.
- 4.7 The site area drawing used to determine the physical extent of the area is listed as Reference 3.8.

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#### 4.8 Remediation History

No significant remediation has occurred in the OL11 or OL12 areas with respect to open land area. Miscellaneous concrete structures in these survey areas will be addressed in a separate survey designs as deemed appropriate by SNEC management.

- 4.9 This survey design uses Cs-137 as a surrogate to bound the average concentration for all SNEC facility related radionuclides in the survey unit. The effective DCGLw is just the permitted Cs-137 concentration (6.6 pCi/g) lowered to compensate for the presence (or potential presence) of other SNEC related radionuclides. In addition, an administrative limit (75%) has been set that further lowers the permissible Cs-137 concentration to an effective DCGLw for this radionuclide.
- 4.10 The sample database used to determine the effective radionuclide mix for the OL11 area has been drawn from samples that were assayed at off-site laboratories. This list is shown on **Attachment 2-2**. The data shows Cs-137 to be the predominant radioactive contaminant found in these areas.
- The decayed set of sample results were input to the spreadsheet titled "Effective DCGL Calculator for Cs-137" (Reference 3.9) to determine the effective volumetric DCGLw values. The output of this spreadsheet is shown on **Attachment 2-3**.
- 4.11 The NaI scan MDC calculation is determined based on a 25 cm/sec scan rate, a 1.38 index of sensitivity (95% correct detection probability and 60% false positive) and a detector sensitivity of 206 cpm/uR/h for Cs-137. Additionally, the detection system incorporates a Cs-137 window that lowers sensitivity to background in the survey unit.
- 4.12 The survey units described in this survey design were inspected by site personnel. A copy of portions of the SNEC facility post-remediation inspection report (Reference 3.10), is included as **Attachment 9-1 to 9-2**.
- 4.13 No special area characteristics including any additional residual radioactivity (not previously noted during characterization) have been identified in this survey area.
- 4.14 The decision error for this survey design is 0.05 for the  $\alpha$  value and 0.1 for the  $\beta$  value.
- 4.15 "Special measurements" (as described in the SNEC LTP) are not included in this survey design.
- 4.16 No additional sampling will be performed IAW this survey design beyond that described herein.
- 4.17 SNEC site radionuclides and their individual DCGLw values are listed on **Exhibit 1** of this calculation.
- 4.18 The survey design checklist is listed in **Exhibit 2**.
- 4.19 Area factors are shown as part of Compass output (see **Attachment 6-1**).

## 5.0 CALCULATIONS

- 5.1 All calculations are performed internal to applicable computer codes or within an Excel spreadsheet.

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## 6.0 APPENDICES

- 6.1 **Attachment 1-1**, is a diagram of survey area OL11 & OL12-1 areas (in northwest quadrant of SNEC site).
- 6.2 **Attachment 2-1 to 2-10** is the sample results from the OL11 site area including. In addition, the DCGL calculation sheets have been included.
- 6.3 **Attachment 3-1**, is a copy of calibration data from typical NaI radiation detection instrumentation that may be used in this survey area (IAW Section 2.1.2).
- 6.4 **Attachment 4-1 through 4-3**, is the MDCscan calculation and supporting MicroShield output for volumetric materials.
- 6.5 **Attachment 5-1**, is the scan locations for the OL11 survey units.
- 6.6 **Attachment 6-1 through 6-10**, are Compass output for the OL11, and the OL12-1 areas showing the number of required sampling points for these survey units.
- 6.7 **Attachment 7-1**, is the sample point locations with dimensions for each survey unit.
- 6.8 **Attachment 8-1**, is the soil variability results for selected soil samples from the OL11 area.
- 6.9 **Attachment 9-1 to 9-2**, is a copy of selected portions of the inspection reports for these areas.



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## Exhibit 1

SNEC Facility Individual Radionuclide DCGL Values <sup>(a)</sup>

Radionuclide	25 mrem/y Limit Surface Area (dpm/100cm <sup>2</sup> )	25 mrem/y Limit (All Pathways) Open Land Areas (Surface & Subsurface) (pCi/g)	4 mrem/y Goal (Drinking Water) Open Land Areas <sup>(b)</sup> (Surface & Subsurface) (pCi/g)
Am-241	2.7E+01	9.9	2.3
C-14	3.7E+06	2	5.4
Co-60	7.1E+03	3.5	67
Cs-137	2.8E+04	6.6	397
Eu-152	1.3E+04	10.1	1440
H-3	1.2E+08	132	31.1
Ni-63	1.8E+06	747	1.9E+04
Pu-238	3.0E+01	1.8	0.41
Pu-239	2.8E+01	1.6	0.37
Pu-241	8.8E+02	86	19.8
Sr-90	8.7E+03	1.2	0.61

## NOTES:

(a) While drinking water DCGLs will be used by SNEC to meet the drinking water 4 mrem/y goal, only the DCGL values that constitute the 25 mrem/y regulatory limit will be controlled under this LTP and the NRC's approving license amendment.

(b) Listed values are from the subsurface model. These values are the most conservative values between the two models (i.e., surface & subsurface).

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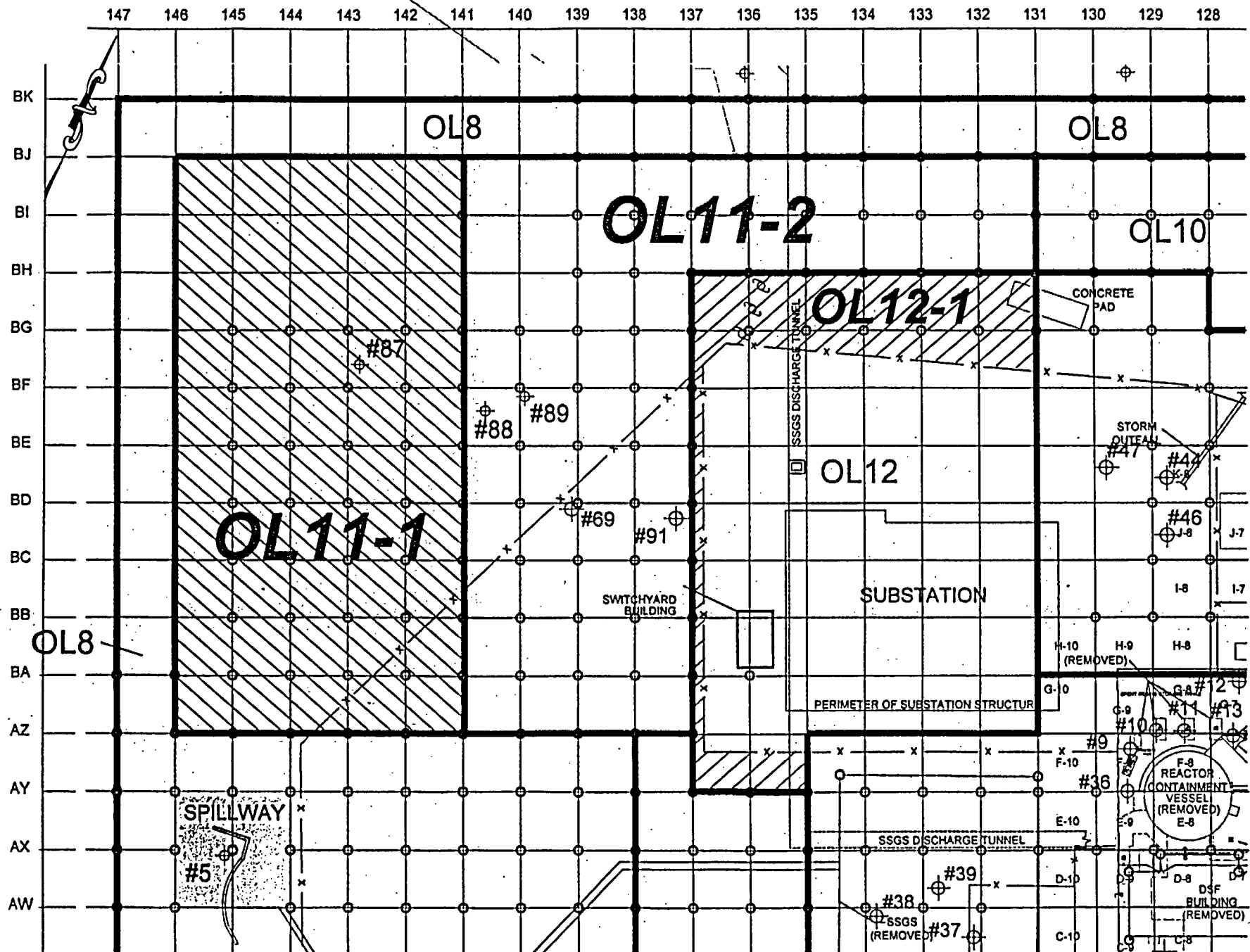
OL11 &amp; Remaining OL12 Open Land Area - Survey Design

**Exhibit 2**  
**Survey Design Checklist**

Calculation No. E900-05-021		Location Codes OL11 & OL12-1 Outside the PENELEC Switch Yard	
ITEM	REVIEW FOCUS	Status (Circle One)	Reviewer Initials & Date
1	Has a survey design calculation number been assigned and is a survey design summary description provided?	(Yes) N/A	AKH 4/7/05
2	Are drawings/diagrams adequate for the subject area (drawings should have compass headings)?	(Yes) N/A	AKH 4/7/05
3	Are boundaries properly identified and is the survey area classification clearly indicated?	(Yes) N/A	AKH 4/7/05
4	Has the survey area(s) been properly divided into survey units IAW EXHIBIT 10	(Yes) N/A	AKH 4/7/05
5	Are physical characteristics of the area/location or system documented?	(Yes) N/A	AKH 4/7/05
6	Is a remediation effectiveness discussion included?	Yes, (N/A)	AKH 4/7/05
7	Have characterization survey and/or sampling results been converted to units that are comparable to applicable DCGL values?	(Yes) N/A	AKH 4/7/05
8	Is survey and/or sampling data that was used for determining survey unit variance included?	(Yes) N/A	AKH 4/7/05
9	Is a description of the background reference areas (or materials) and their survey and/or sampling results included along with a justification for their selection?	Yes, (N/A)	AKH 4/7/05
10	Are applicable survey and/or sampling data that was used to determine variability included?	(Yes) N/A	AKH 4/7/05
11	Will the condition of the survey area have an impact on the survey design, and has the probable impact been considered in the design?	Yes, (N/A)	AKH 4/7/05
12	Has any special area characteristic including any additional residual radioactivity (not previously noted during characterization) been identified along with its impact on survey design?	Yes, (N/A)	AKH 4/7/05
13	Are all necessary supporting calculations and/or site procedures referenced or included?	(Yes) N/A	AKH 4/7/05
14	Has an effective DCGLw been identified for the survey unit(s)?	(Yes) N/A	AKH 4/7/05
15	Was the appropriate DCGL <sub>EMC</sub> included in the survey design calculation?	(Yes) N/A	AKH 4/7/05
16	Has the statistical tests that will be used to evaluate the data been identified?	(Yes) N/A	AKH 4/7/05
17	Has an elevated measurement comparison been performed (Class 1 Area)?	Yes, (N/A)	AKH 4/7/05
18	Has the decision error levels been identified and are the necessary justifications provided?	(Yes) N/A	AKH 4/7/05
19	Has scan instrumentation been identified along with the assigned scanning methodology?	(Yes) N/A	AKH 4/7/05
20	Has the scan rate been identified, and is the MDCscan adequate for the survey design?	(Yes) N/A	AKH 4/7/05
21	Are special measurements e.g., in-situ gamma-ray spectroscopy required under this design, and is the survey methodology, and evaluation methods described?	Yes, (N/A)	AKH 4/7/05
22	Is survey instrumentation calibration data included and are detection sensitivities adequate?	(Yes) N/A	AKH 4/7/05
23	Have the assigned sample and/or measurement locations been clearly identified on a diagram or CAD drawing of the survey area(s) along with their coordinates?	(Yes) N/A	AKH 4/7/05
24	Are investigation levels and administrative limits adequate, and are any associated actions clearly indicated?	(Yes) N/A	AKH 4/7/05
25	For sample analysis, have the required MDA values been determined?	Yes, (N/A)	AKH 4/7/05
26	Has any special sampling methodology been identified other than provided in Reference 6.3?	Yes, (N/A)	AKH 4/7/05

NOTE: a copy of this completed form or equivalent, shall be included within the survey design calculation.

## Appendix A (attachments 1-1 to 4-3)



Attachment 1 - 1

## DCGL Calculation Logic – SNEC Facility Open Land Area OL11

- I. **Survey Units:** SNEC Site survey unit named OL11
- II. **Description:** The purpose of this calculation is to determine a representative isotopic mix from available sample analyses for the OL11 (and a section of the OL12) survey areas of the SNEC Facility site. The effective volumetric DCGL<sub>w</sub>s are then determined from the mean percent of applicable samples.
- III. **Data Selection Logic Tables:** The radionuclide selection logic and subsequent DCGL calculations are provided in five (5) tables. These tables were developed using Microsoft Excel. Table explanation is as follows.

**Table 1: Raw Data Listing** – This table provides a list of three (3) representative sample analysis results. Results are from scoping, and characterization survey activities of the OL11 site area. The samples consist of soil and sediment samples that were taken in support of the aforementioned activities. As applicable, a sample number, sample location/description, radionuclide concentration, and analysis date are provided for each sample. Positive nuclide concentrations are noted with yellow shaded background fields while MDA values are noted in the gray shaded fields.

**Table 2: Reduced Data Listing of Positive Results, MDAs Removed** – This table provides the best overall representation of the raw data from table 1. Non-positive nuclide columns have been removed as well as all the MDA values leaving three (3) sample results. Thus, eleven (11) nuclides have been reduced to four (4) in this table.

**Table 3: Decayed Sample List of Positive Results** – This table decays the data from Table 2. Half-life values (in days) are listed above each respective nuclide column. Samples are decayed from their respective analysis date to March 15, 2005. Only positive results were decayed.

**Table 4: Ratio to Cs-137 for Positive Sample Data** – This table provides the calculation methodology for determining the surrogate ratio to Cs-137 for each radionuclide. From this information the mean, and mean % of total are calculated. The mean % of total values (normalized to 100%) are then used to calculate the effective volumetric DCGL<sub>w</sub> per MARSSIM equation I-14. See Table 5. Note that the mean percent values were averaged using only the positive sample results in each column. In some cases only a single nuclide value (e.g. Sr-90) had a positive result. This value is listed as the mean value in the tabulation. Therefore, this treatment results in a higher "mean percent of total" value for the mix, which is considered a conservative approach.

**Table 5: Effective DCGL Calculator for Cs-137 (in pCi/g)** – This table provides the surrogate volumetric modified Cs-137 DCGL<sub>w</sub> calculation results from data derived from Table 4.

- IV. **Summary** – The OL11 site area is largely soils and or rock material thus the release limit is based on a volumetric DCGL<sub>w</sub>. Using the above data selection logic tables the calculated Cs-137 surrogate volumetric DCGL<sub>w</sub> is 3.22 pCi/g. This value is reduced by 25% as part of SNEC's commitment to apply an administrative limit as discussed in the License Termination Plan (LTP). Since positive sample result concentrations for Cs-137 are low in these open land areas, any ratios developed are influenced by background levels of other radionuclides such as C-14. Thus this methodology is considered a conservative approach.

TABLE 1 - RAW DATA LISTING

SIIEC Sample Ilo	LAB Ilo.	Location/Description	H-3	Sr-90	Co-60	Cs-137	Am-241	Pu-238	Pu-239	Pu-241	C-14	III-63	Eu-152	Analysis Date
SXSL7483	Teledyne, L25070-1-3	Soil, SR-164, BG-138, SP2, OL11	<0.748	0.0771	<0.0246	1.57	<0.0174	<0.0297	<0.0407	<3.17	0.362	1.9	<0.095	September 15, 2004
SXSL0087	Teledyne; L21441-4 & L21898-1	BF-143, SURFA01, OL11	<2.04	<0.0333	<0.0165	2.34	<0.0147	<0.00651	<0.0653	<2.11	<0.139	<18.4	<0.345	October 6, 1999
SXSL0089	Teledyne; L21441-5	BE-140, SURFA01, OL11	<2.05	<0.0355	<0.0121	1.21	<0.0136	<0.0326	<0.023	<1.42	<0.114	<16.2	<0.028	October 6, 1999

## KEY

Yellow Shaded Background = Positive Result

Gray Shaded Background = MDA

TABLE 2 - REDUCED DATA LISTING OF POSITIVE RESULTS, MDAs REMOVED

SIIEC Sample Ilo	LAB Ilo.	Location/Description	Sr-90	Cs-137	C-14	III-63	Analysis Date
SXSL0087	Teledyne; L21441-4 & L21898-1	BF-143, SURFA01, OL11		2.34			October 6, 1999
SXSL0089	Teledyne; L21441-5	BE-140, SURFA01, OL11		1.21			October 6, 1999
SXSL7483	Teledyne, L25070-1-3	Soil, SR-164, BG-138, SP2, OL11	0.0771	1.57	0.362	1.9	September 15, 2004

TABLE 3 - DECAYED SAMPLE LIST OF POSITIVE RESULTS

SIIEC Sample Ilo	LAB Ilo.	Location/Description	T 1/2 (d)				Elapsed (d)	Analysis Date
			Sr-90	Cs-137	C-14	III-63		
			10446.15	11019.5925	2092882.5	36561.525		3/15/2005
SXSL0087	Teledyne; L21441-4 & L21898-1	BF-143, SURFA01, OL11		2.065			1987	October 6, 1999
SXSL0089	Teledyne; L21441-5	BE-140, SURFA01, OL11		1.068			1987	October 6, 1999
SXSL7483	Teledyne, L25070-1-3	Soil, SR-164, BG-138, SP2, OL11	0.076	1.552	0.362	1.893	181	September 15, 2004

TABLE 4 - RATIO TO Cs-137 FOR POSITIVE SAMPLE DATA

SIIEC Sample Ilo	LAB Ilo.	Location/Description	Sr-90	Cs-137	C-14	III-63	Analysis Date
SXSL0087	Teledyne; L21441-4 & L21898-1	BF-143, SURFA01, OL11		1			October 6, 1999
SXSL0089	Teledyne; L21441-5	BE-140, SURFA01, OL11		1			October 6, 1999
SXSL7483	Teledyne, L25070-1-3	Soil, SR-164, BG-138, SP2, OL11	0.049	1	0.233	1.220	September 15, 2004
Average=>			0.049	1	0.233	1.220	2.502
Normalized to 100%=>			1.96%	39.97%	9.32%	48.75%	100.00%

Table 5

Effective DCGL Calculator for Cs-137 (In pCi/g)				SNEC AL	75%	Total Activity Limit DCGLw	Administrative Limit
				8.06	pCi/g	6.04	pCi/g
SAMPLE NUMBER(a) ⇒ OL11 Open Land Area							
				Cs-137 Limit		Cs-137 Administrative Limit	
				3.22	pCi/g	2.41	pCi/g
31.06%		25.0 mrem/y TEDE Limit					
12.62%		4.0 mrem/y Drinking Water (DW) Limit		<input checked="" type="checkbox"/> Check for 25 mrem/y			
Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	25 mrem/y TEDE Limits (pCi/g)	4 mrem/y DW Limits (pCi/g)	A - Allowed pCi/g for 25 mrem/y TEDE	B - Allowed pCi/g for 4 mrem/y DW	Value Checked from Column A or B
1 Am-241		0.000%	9.9	2.3	0.00	0.00	0.00
2 C-14	0.23	9.312%	2.0	5.4	0.75	1.85	0.75
3 Co-60		0.000%	3.5	67.0	0.00	0.00	0.00
4 Cs-137	1.00	39.966%	6.6	397	3.22	7.92	3.22
5 Eu-152		0.000%	10.1	1440	0.00	0.00	0.00
6 H-3		0.000%	132	31.1	0.00	0.00	0.00
7 NI-63	1.22	48.759%	747	19000	3.93	9.66	3.93
8 Pu-238		0.000%	1.8	0.41	0.00	0.00	0.00
9 Pu-239		0.000%	1.6	0.37	0.00	0.00	0.00
10 Pu-241		0.000%	86	19.8	0.00	0.00	0.00
11 Sr-90	0.049	1.963%	1.2	0.61	0.16	0.39	0.16
2.50E+00		100.000%			8.06	19.82	8.06
					Maximum Permissible pCi/g (25 mrem/y)	Maximum Permissible pCi/g (4 mrem/y)	
This Sample mrem/y TEDE		This Sample mrem/y DW					
0.00		0.00		Am-241			
2.91		0.17					
0.00		0.00					
3.79		0.01					
0.00		0.00					
0.00		0.00		C-14			
0.00		0.00					
0.04		0.00					
0.00		0.00					
0.00		0.00					
0.00		0.00		Co-60			
0.00		0.00					
0.00		0.00					
0.00		0.00					
0.00		0.00					
1.02		0.32		Cs-137			
7.764		0.505					
To Use This Information, Sample Input Units Must Be In pCi/g							

# 2350 INSTRUMENT AND PROBE EFFICIENCY CHART

02/22/05 Added 2350-1 #126218 with 43-68 #095080 and 2350-1 #126188 with 43-68 #099186. Returned from DURATEK following calibration. *Typical - 2" by 2" Nal (w) Inst. Response*

Inst.#	Cal Due	AP #		Probe #	Cal Due	cpm/mR/h
95361	6/25/05	P & W		25686 Pk	6/28/05	211,799
98620	12/01/05	G&W		196022 Pk	12/01/05	204,609
98642	9/28/05	B&W		85844 Pk	9/28/05	209,771
98647	1/02/05	G & Y		211667 Pk	1/02/05	213,180
117566	01/05/06	ROR		402PK	01/13/06	205411
117573	5/18/05	O & Y		211674 Pk	5/18/05	212,173
129407	12/17/05	White		206280	12/17/05	222,724
129423	5/18/05	P & Y		211687 Pk	5/18/05	213,539
129440	11/01/05	O&W		210938 Pk	11/01/05	196,636
126198	11/22/05	R&W		196021	11/22/05	210398

Different Instrument/Probe Cal. Due Cesium only instruments (10mV to 100)

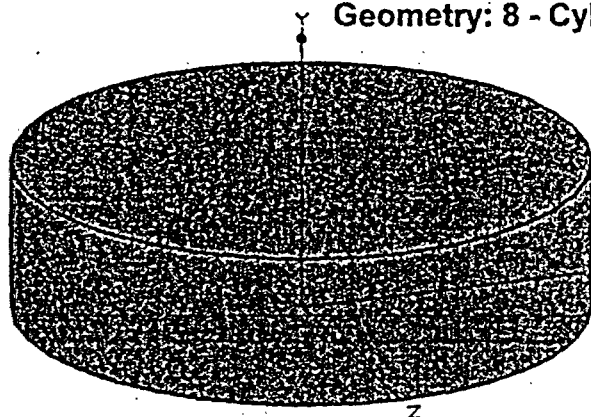


**MicroShield v5.05 (5.05-00121)**  
GPU Nuclear

: 1  
ile : SOIL.MS5  
ate: March 29, 2005  
me: 3:38:06 PM  
on : 00:00:03

File Ref: \_\_\_\_\_  
Date: \_\_\_\_\_  
By: \_\_\_\_\_  
Checked: \_\_\_\_\_

**Case Title: Soil**  
**Description: Soil Density 1.45 g/cc, 6" Deep Cylinder @ 4" from Surface**  
**Geometry: 8 - Cylinder Volume - End Shields**



**Source Dimensions**

Height	15.24 cm	6.0 in
Radius	28.21 cm	11.1 in

**Dose Points**

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	0 cm 0.0 in	27.94 cm 11.0 in	0 cm 0.0 in

**Shields**

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	3.81e+04 cm <sup>3</sup>	Concrete	1.45
Air Gap		Air	0.00122

**Source Input**

**Grouping Method : Actual Photon Energies**

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>μCi/cm<sup>3</sup></u>	<u>Bq/cm<sup>3</sup></u>
Ba-137m	5.2264e-008	1.9338e+003	1.3717e-006	5.0753e-002
Cs-137	5.5247e-008	2.0441e+003	1.4500e-006	5.3650e-002

**Buildup**

The material reference is : Source

**Integration Parameters**

Radial	60
Circumferential	60
Y Direction (axial)	60

**Results**

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm<sup>2</sup>/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm<sup>2</sup>/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.0318	4.003e+01	6.785e-06	8.211e-06	5.652e-08	6.840e-08
0.0322	7.386e+01	1.305e-05	1.589e-05	1.050e-07	1.278e-07
0.0364	2.688e+01	7.222e-06	9.428e-06	4.103e-08	5.357e-08
0.6616	1.740e+03	5.968e-02	1.023e-01	1.157e-04	1.983e-04
<b>TOTALS:</b>	1.881e+03	5.971e-02	1.023e-01	1.159e-04	1.986e-04

Nal Scan MDC Calculation

$$b := 200 \quad p := 0.5 \quad HS_d := 56.42 \quad SR := 25 \quad d := 1.38$$

$$Conv := 206$$

$$MS_{output} := 1.157 \cdot 10^{-4}$$

$$\frac{HS_d}{SR} = 2.257 \quad \text{Observation Interval (seconds)}$$

$$O_i := \frac{HS_d}{SR} \quad \text{Observation Interval (seconds)}$$

$$b_i := \frac{(b \cdot O_i)}{60}$$

$$b_i = 7.523 \quad \text{Counts}$$

$$MDCR_i := \left( d \cdot \sqrt{b_i} \right) \cdot \frac{60}{O_i}$$

$$MDCR_i = 100.629 \quad \text{net counts per minute}$$

$$MDCR_{surveyor} := \frac{MDCR_i}{\sqrt{p}}$$

$$MDCR_{surveyor} = 142.311 \quad \text{net counts per minute}$$

$$MDER := \frac{MDCR_{surveyor}}{Conv}$$

$$MDER = 0.691 \quad \mu R/h$$

$$MDC_{scan} := \frac{MDER}{MS_{output} \cdot 1 \cdot 10^3}$$

$$MDC_{scan} = 5.971 \quad pCi/g$$

where:

$b$  = background in counts per minute

$b_i$  = background counts in observation interval

$Conv$  = Nal manufacturers reported response to energy of contaminant (cpm/uR/h)

$d$  = index of sensitivity (Table 6.5 MARSSIM), 1.38 = 95% of correct detection's, 60% false positives

$HS_d$  = hot spot diameter (in centimeters)

$MDC_{scan}$  = Minimum Detectable Concentration for scanning (pCi/g)

$MDCR_i$  = Minimum Detectable Count Rate (ncpm)

$MDCR_{surveyor}$  =  $MDCR_i$  corrected by human performance factor (ncpm)

$MDER$  = Minimum Detectable Exposure Rate (uR/h)

$MS_{output}$  = MicroShield output exposure rate for 1 pCi/g of contaminant (mR/h)

$O_i$  = observation Interval (seconds)

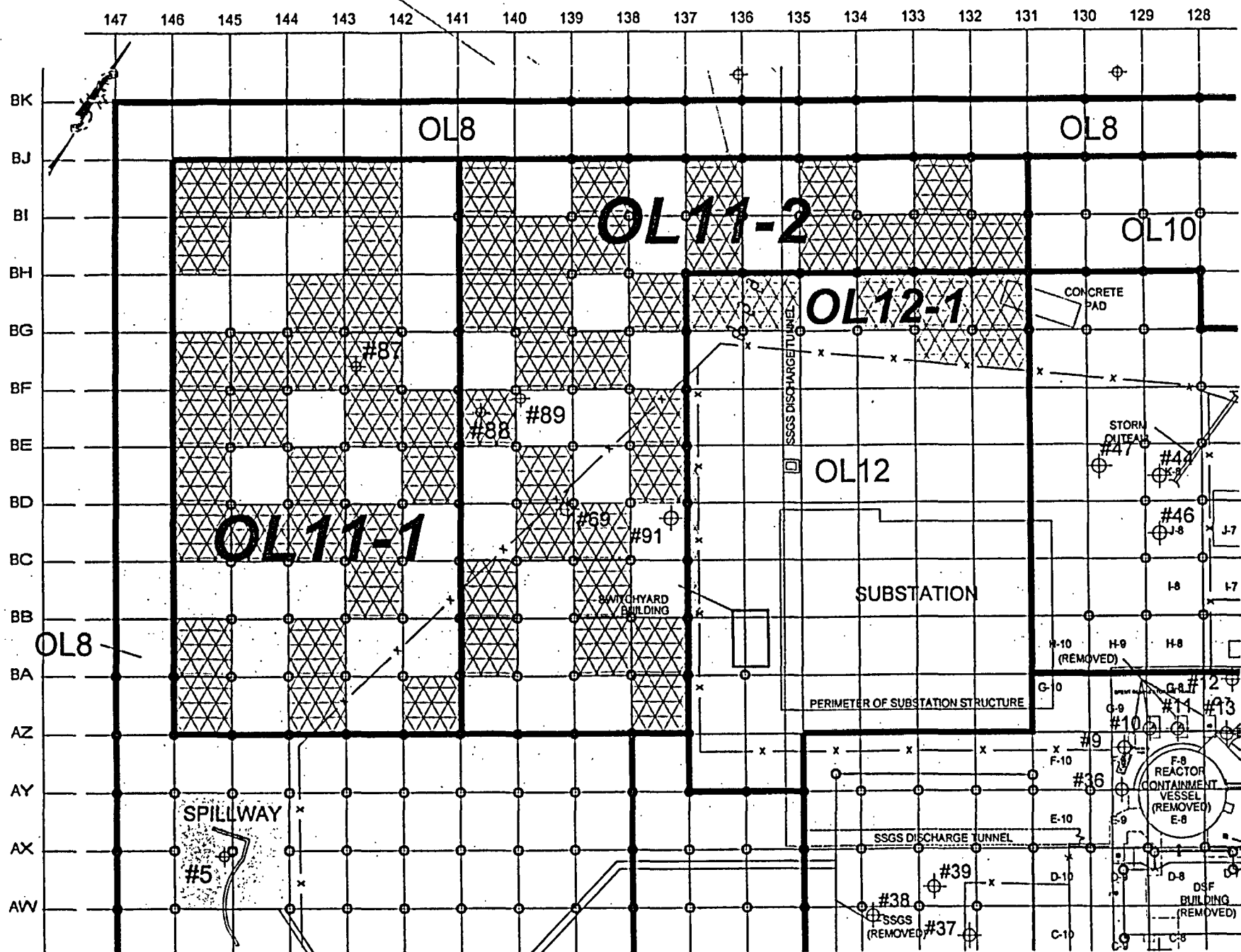
$p$  = human performance factor

$SR$  = scan rate in centimeters per second

#### NOTE

This is an example of an MDCscan calculation that is valid for a specific set of site conditions, and assumptions. These variables include the computer model used, soil density, soil moisture content, surveyor efficiency, ground cover, soil background radionuclide content and other variables that influence calculated results. However, this scan MDC has been deemed appropriate for initial survey planning purposes at this site location.

## Appendix A (attachments 5-1 to 9-2)



ATTACHMENT 5 - 1



# Site Report

## Site Summary

---

Site Name: OL11, Open Land Area

Planner(s): BHB

## Contaminant Summary

---

NOTE: Surface soil DCGLw units are pCi/g.  
Building surface DCGLw units are dpm/100 cm².

Contaminant	Type	DCGLw	Screening Value Used?	Area (m²)	Area Factor
Cs-137	Surface Soil	2.41	No	10,000	1
				2,500	2.3
				400	3
				100	3.6
				25	4.7
				1	28.7

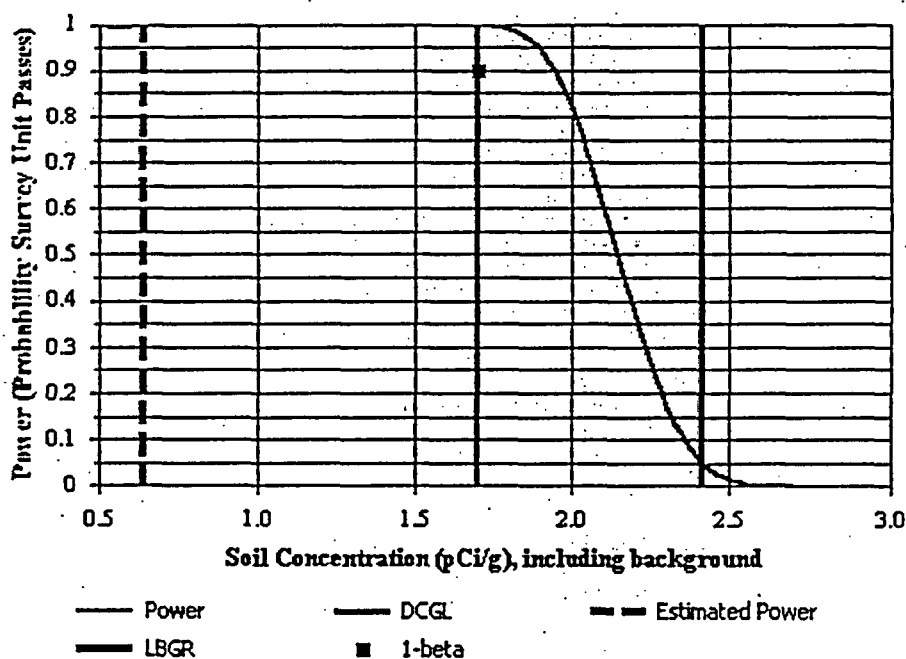


# Surface Soil Survey Plan

## Survey Plan Summary

Site:	OL11, Open Land Area		
Planner(s):	BHB		
Survey Unit Name:	OL11-1, Open Land Area		
Comments:	Class 2 Area Entered as Class 1		
Area (m <sup>2</sup> ):	5,000	Classification:	1
Selected Test:	Sign	Estimated Sigma (pCi/g):	0.468
DCGL (pCi/g):	2.41	Sample Size (N):	14
LBGR (pCi/g):	1.7	Estimated Conc. (pCi/g):	0.6
Alpha:	0.050	Estimated Power:	1
Beta:	0.100	EMC Sample Size (N):	14
Scanning Instrumentation:	2" by 2" Nal (w)		

## Prospective Power Curve





# Surface Soil Survey Plan

## Contaminant Summary

Contaminant	DCGLW (pCi/g)	Inferred Contaminant	Ratio	Modified DCGLW (pCi/g)	Scan MDC (pCi/g)
Cs-137	2.41	N/A	N/A	N/A	5.971

Contaminant	Survey Unit Estimate (Mean $\pm$ 1-Sigma) (pCi/g)	Reference Area Estimate (Mean $\pm$ 1-Sigma) (pCi/g)
Cs-137	0.641 $\pm$ 0.468	0.28 $\pm$ 0.39



COMPASS

No additional samples are required because the actual scan MDC is less than the required scan MDC.

OK

son (EMC)

ing instrumentation used. Then enter a scan MDC for each  
ALCULATE button to view the integrated survey design  
scan MDC and DCGL units are in pCi/g.

Scanning Instrumentation Description: 2" by 2" NaI (w)

Contaminant	Scan MDC
Cs-137	5.971

Enter Scan MDC

Scan MDC:

SAVE

NUREG-1507

CALCULATE

Statistical Design

N: 14

Bounded Area (m<sup>2</sup>): 357.1

Area Factor: 3.09

DCGLw: 2.41

Scan MDC Required: 7.4

Hot Spot Design

Actual Scan MDC: 5.971

Area Factor: N/A

Bounded Area (m<sup>2</sup>): N/A

Post-EMCN: 14

☒ Enable Training Card Help  
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←

BACK

→

NEXT

ATTACHMENT 6.4



# Surface Soil Survey Plan

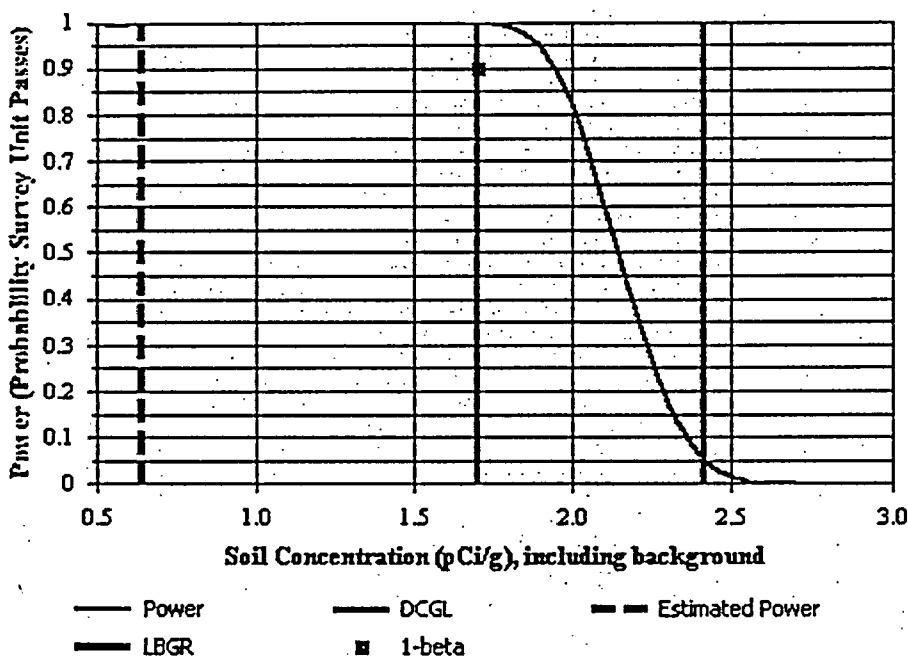
## Survey Plan Summary

Site: OL11, Open Land Area  
Planner(s): BHB  
Survey Unit Name: OL11-2, Open Land Area

### Comments:

Area (m <sup>2</sup> ):	5,200	Classification:	2
Selected Test:	Sign	Estimated Sigma (pCi/g):	0.468
DCGL (pCi/g):	2.41	Sample Size (N):	14
LBGR (pCi/g):	1.7	Estimated Conc. (pCi/g):	0.6
Alpha:	0.050	Estimated Power:	1
Beta:	0.100		

## Prospective Power Curve





# Surface Soil Survey Plan

## Contaminant Summary

Contaminant	DCGLW (pCi/g)	Inferred Contaminant	Ratio	Modified DCGLW (pCi/g)	Scan MDC (pCi/g)
Cs-137	2.41	N/A	N/A	N/A	N/A

Contaminant	Survey Unit Estimate (Mean $\pm$ 1-Sigma) (pCi/g)	Reference Area Estimate (Mean $\pm$ 1-Sigma) (pCi/g)
Cs-137	0.641 $\pm$ 0.468	0.28 $\pm$ 0.39



# Site Report

## Site Summary

---

Site Name: OL12, Open Land Area (OL12-1)  
Planner(s): BHB

## Contaminant Summary

---

NOTE: Surface soil DCGLw units are pCi/g.  
Building surface DCGLw units are dpm/100 cm<sup>2</sup>.

Contaminant	Type	DCGLw	Screening Value Used?	Area (m <sup>2</sup> )	Area Factor
Cs-137	Surface Soil	2.41	No	10,000	1
				2,500	2.3
				400	3
				100	3.6
				25	4.7
				1	28.7

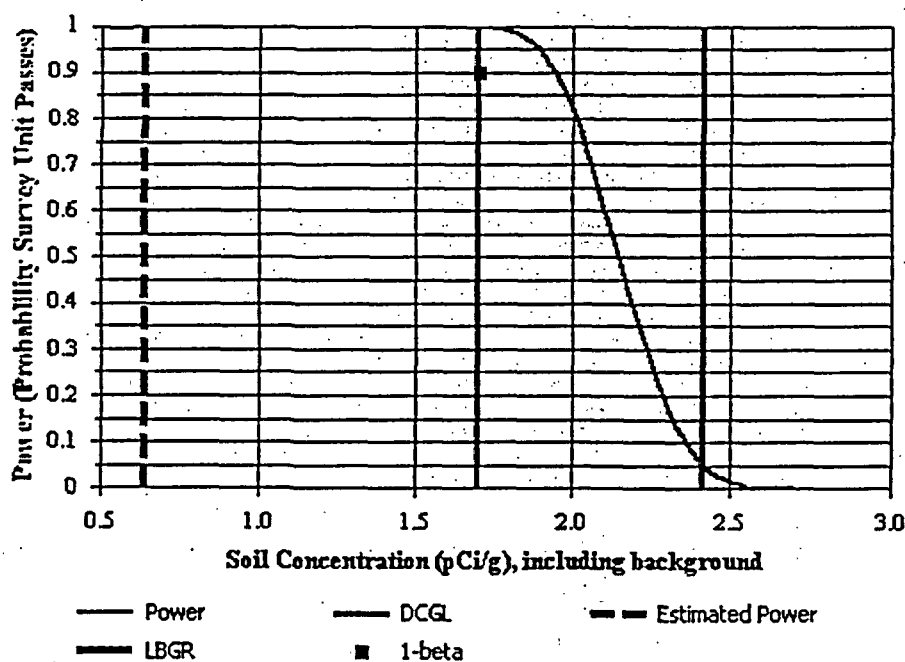


# Surface Soil Survey Plan

## Survey Plan Summary

Site:	OL12, Open Land Area (OL12-1)		
Planner(s):	BHB		
Survey Unit Name:	OL12-1		
Comments:	Class 2 Area Entered as Class 1		
Area (m <sup>2</sup> ):	1,152	Classification:	1
Selected Test:	Sign	Estimated Sigma (pCi/g):	0.468
DCGL (pCi/g):	2.41	Sample Size (N):	14
LBGR (pCi/g):	1.7	Estimated Conc. (pCi/g):	0.6
Alpha:	0.050	Estimated Power:	1
Beta:	0.100	EMC Sample Size (N):	14
Scanning Instrumentation:	2" by 2" NaI (w)		

## Prospective Power Curve





# Surface Soil Survey Plan

## Contaminant Summary

Contaminant	DCGLw (pCi/g)	Inferred Contaminant	Ratio	Modified DCGLw (pCi/g)	Scan MDC (pCi/g)
Cs-137	2.41	N/A	N/A	N/A	5.971

Contaminant	Survey Unit Estimate (Mean $\pm$ 1-Sigma) (pCi/g)	Reference Area Estimate (Mean $\pm$ 1-Sigma) (pCi/g)
Cs-137	0.641 $\pm$ 0.468	0.28 $\pm$ 0.39

**COMPASS**



No additional samples are required because the actual scan MDC is less than the required scan MDC.

OK

**Comparison (EMC)**

ing instrumentation used. Then enter a scan MDC for each CALCULATE button to view the integrated survey design scan MDC and DCGL units are in pCi/g.

Scanning Instrumentation Description: 2" by 2" NaI (w)

Contaminant	Scan MDC
Cs-137	5.971

Enter Scan MDC

Scan MDC:



SAVE



NUREG-1507



CALCULATE

**Statistical Design**

N:	14
Bounded Area (m²):	82.3
Area Factor:	3.86
DCGLw:	2.41
Scan MDC Required:	9.3

**Hot Spot Design**

Actual Scan MDC:	5.971
Area Factor:	N/A
Bounded Area (m²):	N/A
Post-EMCN:	14



☒ Enable Training Card Help

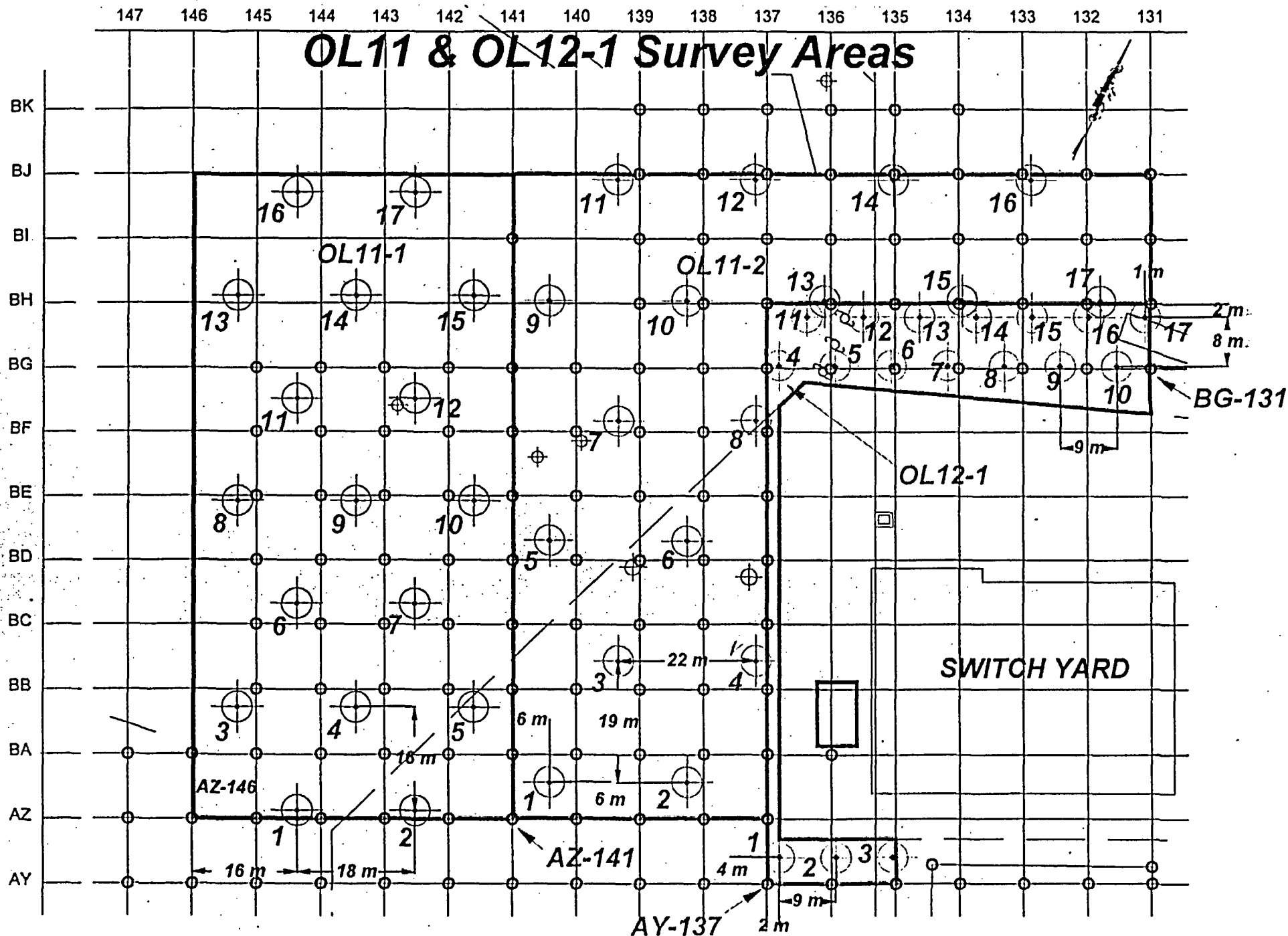
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BACK



NEXT





SR-135

Sample No.	Grid	pCi/g (Cs-137)
SXSL6066	BF-144, SP-1	0.4
SXSL6067	BF-144, SP-2	0.2
SXSL6068	BF-144, SP-3	1
SXSL6069	BF-144, SP-4	0.86
SXSL6070	BF-144, SP-5	0.86
SXSL6071	BF-144, SP-5	0.95
SXSL6072	BF-143, SP-1	0.24
SXSL6073	BF-143, SP-2	0.4
SXSL6074	BF-143, SP-3	2
SXSL6075	BF-143, SP-4	0.8
SXSL6075	BF-143, SP-5	0.5
SXSL6077	BD-140, SP-1	0.23
SXSL6078	BD-140, SP-2	0.1
SXSL6079	BD-140, SP-3	0.1
SXSL6080	BD-140, SP-4	1
SXSL6081	BD-140, SP-5	0.65
SXSL6082	BD-140, SP-5	0.27
SXSL6083	BD-146, SP-1	0.27
SXSL6084	BD-146, SP-1	0.4
SXSL6085	BD-146, SP-2	0.16
SXSL6086	BE-146, SP-1	1.5
SXSL6087	BE-146, SP-2	0.4
SXSL6088	BF-146, SP-1	0.2
SXSL6089	BF-146, SP-2	0.3
SXSL6090	BD-145, SP-1	1.3
SXSL6091	BD-145, SP-2	1.5
SXSL6092	BE-145, SP-1	0.6
SXSL6093	BE-145, SP-2	0.12
SXSL6094	BD-144, SP-1	0.9
SXSL6095	BD-144, SP-2	0.8
SXSL6240	BG-145, SP-1	1
SXSL6241	BG-145, SP-2	1
SXSL6242	BG-144, SP-1	0.4
SXSL6243	BG-144, SP-2	0.1
SXSL6244	BF-145, SP-1	0.55
SXSL6245	BF-145, SP-1	0.82
SXSL6246	BE-144, SP-1	1.2
SXSL6247	BE-144, SP-2	1.6
SXSL6248	BD-142, SP-1	0.4
SXSL6249	BD-142, SP-2	0.36
SXSL6250	BD-141, SP-1	0.4
SXSL6251	BD-141, SP-2	0.2
SXSL6252	BE-141, SP-1	0.5
SXSL6253	BE-141, SP-2	0.5
SXSL6304	BD-143, SP-1	0.4
SXSL6305	BD-143, SP-2	0.32
SXSL6306	BE-142, SP-1	0.5
SXSL6307	BE-142, SP-2	0.6
SXSL6308	BF-142, SP-1	0.4
SXSL6309	BF-142, SP-2	0.34
SXSL6310	BF-142, SP-2	0.2
SXSL6324	BE-143, SP-1	0.86
SXSL6325	BE-143, SP-2	0.13
SXSL6331	BG-143, SP-1	1.1
SXSL6332	BG-143, SP-2	1
SXSL6333	BG-142, SP-1	1.9
SXSL6334	BG-142, SP-2	0.29
SXSL6335	BG-141, SP-1	0.4
SXSL6336	BG-141, SP-2	0.3
SXSL6337	BG-140, SP-1	1
SXSL6338	BG-140, SP-2	0.53
SXSL6339	BF-141, SP-1	1.4
SXSL6340	BF-141, SP-2	1.3
SXSL6341	BF-140, SP-1	0.6
SXSL6342	BF-140, SP-2	0.7
SXSL6343	BE-140, SP-1	0.2
SXSL6344	BE-140, SP-2	1.3
SXSL6345	BE-139, SP-1	0.42
SXSL6346	BE-139, SP-2	0.5
SXSL6347	BC-141, SP-1	0.1
SXSL6348	BC-141, SP-2	0.12
SXSL6349	BC-140, SP-1	0.8
SXSL6350	BC-140, SP-2	0.94
SXSL6351	BD-139, SP-1	1.2
SXSL6352	BD-139, SP-2	1.6
SXSL6353	BC-139, SP-1	1.2
SXSL6354	BC-139, SP-2	0.45
SXSL6355	BF-144, L2	0.08
SXSL6356	BF-144, L21	0.14
SXSL6357	BF-144, L21.5	0.15
MEAN		0.641
Sigma		0.468

**ORIGINAL**Exhibit 1  
Survey Unit Inspection Check Sheet

SECTION 1 - SURVEY UNIT INSPECTION DESCRIPTION							
Survey Unit #	OL11		Survey Unit Location	Northwest Open Land Area			
Date	4/6/05	Time	1230	Inspection Team Members	D.Sarge		
SECTION 2 - SURVEY UNIT INSPECTION SCOPE							
Inspection Requirements (Check the appropriate Yes/No answer.)					Yes	No	N/A
1.	Have sufficient surveys (i.e., post remediation, characterization, etc.) been obtained for the survey unit?				X		
2.	Do the surveys (from Question 1) demonstrate that the survey unit will most likely pass the FSS?				X		
3.	Is the physical work (i.e., remediation & housekeeping) in or around the survey unit complete?				X		
4.	Have all tools, non-permanent equipment, and material not needed to perform the FSS been removed?				X		
5.	Are the survey surfaces relatively free of loose debris (i.e., dirt, concrete dust, metal filings, etc.)?				X		
6.	Are the survey surfaces relatively free of liquids (i.e., water, moisture, oil, etc.)?				X		
7.	Are the survey surfaces free of all paint, which has the potential to shield radiation?				X		
8.	Have the Surface Measurement Test Areas (SMTA) been established? (Refer to Exhibit 2 for instructions.)						X
9.	Have the Surface Measurement Test Areas (SMTA) data been collected? (Refer to Exhibit 2 for instructions.)						X
10.	Are the survey surfaces easily accessible? (No scaffolding, high reach, etc. is needed to perform the FSS)				X		
11.	Is lighting adequate to perform the FSS?				X		
12.	Is the area industrially safe to perform the FSS? (Evaluate potential fall & trip hazards, confined spaces, etc.)				X		
13.	Have photographs been taken showing the overall condition of the area?				X		
14.	Have all unsatisfactory conditions been resolved?				X		
<p>NOTE: If a "No" answer is obtained above, the Inspector should immediately correct the problem or initiate corrective actions through the responsible site department, as applicable. Document actions taken and/or justifications in the "Comments" section below. Attach additional sheets as necessary.</p> <p>Comments:</p>							
<p>Survey Unit Inspector (print/sign) D. Sarge / <i>D. Sarge</i> Date 4/6/05</p> <p>Survey Designer (print/sign) B. BODSEY / <i>B. Bodsey</i> Date 4/6/05</p>							

ATTACHMENT 9-1



## Appendix B to Appendix C

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	0209	AREA/LOCATION	OL11-1
SPECIFIC SAMPLING/SURVEY INSTRUCTIONS OR COMMENTS			

### RESULTS SUMMARY FOR SR-0209

SR-0209 was issued to obtain radiological survey and sampling data to ensure Final Site Survey activities are complete. The survey unit covered under this SR is OL11-1 (grids are listed in the SR). The SR required the following radiological measurements.

- Surface scan measurements using a 2" x 2" NaI detector (set to identify Cs-137). Survey techniques will be IAW the SR.
- A total of 17 Site Surface Dose Model Samples (SSDM) were provided to be taken for analysis. SNEC Calculation Sheet using "COMPASS" program required 14 samples to be taken.
- Site Surface Dose Model Samples (Auger Method). Obtain samples as directed in the SR. Using the auger, obtain a sample 1 meter in depth.
- QC Repeat Measurements: A minimum of 5% of all surface scan measurements and sampling were re-performed using identical methodology. SSDM sampling was performed by taking a second sample from the same drill hole.
- QC Repeat Analysis: A minimum of 1 sample per SR or 5%, whichever is greater, of all SSDM samples were analyzed using identical methodology.
- Additional sampling/surveys were not performed.

#### 1. Summary of Results

##### A. Surface Scan Measurements (2" x 2" NaI Detector)

A 100% surface scan was required of all accessible areas of certain grids, IAW the SR. A total of 57.52% of this Class 2 area was surveyed, which is well within design basis.

**Results:** No areas indicated activity above the action level of >350 GCPM (gross counts per minute).

##### B. Surface Static Measurements

No static measurements were obtained.

**Results:** Not Applicable.

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	0209	AREA/LOCATION	OL11-1
SPECIFIC SAMPLING/SURVEY INSTRUCTIONS OR COMMENTS			

### C. Site Surface Dose Model Sampling

Seventeen (17) SSDM samples were obtained. Two (2) SSDM QC samples were taken. These samples were statistically spaced based on a random starting point due to the lack of noticeable elevated activity during final post remediation scan/static surveys.

**Results:** Four (4) SSDM samples taken for this SR were less than MDA. MDA activity range is from 0.09 pCi/g to 0.16 pCi/g (for the surrogate isotope, Cs-137). For the thirteen (13) samples, not including QC samples, that did contain positive Cs-137 activity, activities ranged from 0.07 pCi/g to 0.26 pCi/g. No other licensed isotopes identified for this particular SR.

### 2. Quality Control (QC) Measurements and Comparisons

- Repeat Scan measurements and SSDM samples were performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04. QC scan measurements were repeated for 5.56% of the area scanned. SSDM sample QC measurements were repeated for 11.76% of SSDM samples.

### 3. Quality Control Sample Recounts


- Repeat QC replicate recount – SNEC has determined that, at a minimum, one SSDM sample, or five per cent (5%) of SSDM samples from each SR will have replicate gamma spectroscopy counts performed on them. In the case of this SR, 1 SSDM sample had a replicate count performed; sample #5-23774, satisfying this requirement.

### 4. Exceptions and Discrepancies

- Grids requiring 100% survey by the SR that were not completely surveyed had trees, brush and stone located in the grids, making these points inaccessible. See the scan worksheet for a synopsis of the obstacles

### 5. Special Note(s)

- As stated previously, as this is a Class 2 area, scan coverage of approximately 10%-50% will suffice to show due diligence in survey technique for release of the site for unrestricted use.

BRYAN S. PELL 

Print/Signature

JUNE 1, 2005

Date

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	0210	AREA/LOCATION	OL11-2
SPECIFIC SAMPLING/SURVEY INSTRUCTIONS OR COMMENTS			

### RESULTS SUMMARY FOR SR-0210

SR-0210 was issued to obtain radiological survey and sampling data to ensure Final Site Survey activities are complete. The survey unit covered under this SR is OL11-2 (grids are listed in the SR). The SR required the following radiological measurements.

- Surface scan measurements using a 2" x 2" NaI detector (set to identify Cs-137). Survey techniques will be IAW the SR.
- A total of 17 Site Surface Dose Model Samples (SSDM) were provided to be taken for analysis. SNEC Calculation Sheet using "COMPASS" program required 14 samples to be taken.
- Site Surface Dose Model Samples (Auger Method). Obtain samples as directed in the SR. Using the auger, obtain a sample 1 meter in depth.
- QC Repeat Measurements: A minimum of 5% of all surface scan measurements and sampling were re-performed using identical methodology. SSDM sampling was performed by taking a second sample from the same drill hole.
- QC Repeat Analysis: A minimum of 1 sample per SR or 5%, whichever is greater, of all SSDM samples were analyzed using identical methodology.
- Additional sampling/surveys were performed at the direction of the SR Coordinator.

#### 1. Summary of Results

##### A. Surface Scan Measurements (2" x 2" NaI Detector)

A 100% surface scan was required of all accessible areas of certain grids, IAW the SR. A total of 57.41% of this Class 2 area was surveyed, which is well within design basis.

**Results:** With the exception of one (1) point in grid BD-138, no areas indicated activity above the action level of >350 GCPM (gross counts per minute).

##### B. Surface Static Measurements

One static measurement was obtained in grid BD-138 at the alarm point (AP).

**Results:** AP-1: 368 gcpm.

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	0210	AREA/LOCATION	OL11-2
SPECIFIC SAMPLING/SURVEY INSTRUCTIONS OR COMMENTS			

### C. Site Surface Dose Model Sampling

Seventeen (17) SSDM samples were obtained. Two (2) SSDM QC samples were taken. These samples were statistically spaced based on a random starting point due to the lack of noticeable elevated activity during final post remediation scan/static surveys.

**Results:** Five (5) SSDM samples taken for this SR were less than MDA. MDA activity range is from 0.07 pCi/g to 0.23 pCi/g (for the surrogate isotope, Cs-137). For the twelve (12) samples, not including QC samples, that did contain positive Cs-137 activity, activities ranged from 0.07 pCi/g to 0.87 pCi/g. No other licensed isotopes identified for this particular SR.

## 2. Quality Control (QC) Measurements and Comparisons

- Repeat Scan measurements and SSDM samples were performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04. QC scan measurements were repeated for 5.69% of the area scanned. SSDM sample QC measurements were repeated for 11.76% of SSDM samples.

## 3. Quality Control Sample Recounts

- Repeat QC replicate recount – SNEC has determined that, at a minimum, one SSDM sample, or five per cent (5%) of SSDM samples from each SR will have replicate gamma spectroscopy counts performed on them. In the case of this SR, 2 SSDM samples had replicate counts performed; sample #5-23714 and #5-23734, satisfying this requirement.

## 4. Exceptions and Discrepancies

- Grids requiring 100% survey by the SR that were not completely surveyed had trees located in the grids, making these points inaccessible.
- See # 5 for AP-1 information



**SURVEY REQUEST CONTINUATION SHEET****SR NUMBER**

0210

**AREA/LOCATION**

OL11-2

**SPECIFIC SAMPLING/SURVEY INSTRUCTIONS OR COMMENTS****5. Special Note(s)**

- As stated previously, as this is a Class 2 area, scan coverage of approximately 10%-50% will suffice to show due diligence in survey technique for release of the site for unrestricted use.
- QC Static measurement taken at AP-1 was 329 gcpm.
- One (1) SSDM sample was taken at the AP. Three (3) additional samples were taken to bound the AP to ensure no activity migration has occurred. All samples were taken in grid BD-138.
- Cs-137 activity found in soil at the AP was 0.15 pCi/g.
- One (1) bounding sample showed Cs-137 activity greater than MDA at 0.12 pCi/g.
- MDA for samples taken for AP resolution ranged from 0.07 to 0.21 pCi/g.

Print/Signature

Date