ORIGINAL

FirstEnergy Corp.

SNEC CALCULATION COVER SHEET

CALCULATION DESCRIPTION

Calculation Number	Revision Number	Effective Date	Page Number
E900-04-006	0	4/27/04	1 of 8

Subject

CV Yard Boulder and Soil Lift Survey Designs

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 ☐

Question 3 - Does the calculation have the potential to affect an SSC as described in the USAR? 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. If a "YES" answer is obtained for Question 3, SNEC Management approval is required to implement the calculation. Calculations that do not have the potential to affect SSC's may be implemented by the TR.

DESCRIPTION OF REVISION

APPROVAL SIGNATURES

Calculation Originator	**B. Brosey/** B. Brosey	Date	4/26/04
Technical Reviewer	**P. Donnachie/** P. Donnachie	Date	4/26/04
Additional Review	**A. Paynter/** A. Paynter	Date	28 Apr 04
Additional Review		Date	
SNEC Management Approval		Date	

1.0 PURPOSE

1.1 The purpose of this calculation is to develop a survey design for boulder and soil pile materials that were taken from the CV yard area (OL1 & OL2). Attachments 1-1 and 1-2 show these survey areas. The first survey area was placed on top of the floor slab of the former DSB. In this area soil from the CV excavation will be surveyed and sampled.

1.2 The second area is in the northern section of OL2 where boulder materials from the CV yard excavation are stored. A portion of this material will be surveyed and sampled.

1.3 These materials have no survey area title but were removed from the OL1 area and therefore should be designated ***OL1-Misc.-B*** and ***OL1-Misc.-S***. The (B) and (S) designation is for boulders (B) and soil (S) respectively. Each batch from each of these areas should be labeled consecutively as batch 1, 2, 3...x, until the survey work is complete. As an example; "OL1-Misc.-B, Batch 1".

2.0 SUMMARY OF RESULTS

The following information should be used to develop a survey request for these survey materials. The effective DCGLw value is listed below. The US NRC has reviewed and concurred with these derived values. See Reference 3.1.

Volumetric DCGLw (pCi/g – Cs-137)
5.73 (4.3 A.L.)

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

2.1 Soil and Boulder Materials Survey Design

2.1.1 Scanning of soil and boulder materials shall be performed using a ***2" D by 2" L NaI detector*** with a Cs-137 window setting. The window will straddle the Cs-137 662 keV full energy peak width (see Reference 3.1).

Soil Scanning Parameters

MDCscan (pCi/g) – Cs-137	Scan Speed (cm/sec)	Maximum Distance from Surface	% Coverage
3.2	25	4" (gap between)	100%

2.1.2 The instrument conversion factor/efficiency shall be not less than the value reported in Reference 3.1 (***208 cpm/uR/h***).

2.1.3 These ***Class 1*** materials should be scanned using a serpentine pattern that is ~0.5 meters wide.

2.1.4 The MDCscan is determined using a MicroShield model which was developed in Reference 3.1. Calculations are shown on Attachments 2-1 and 2-2.

2.1.5 Background has been measured over the area where these materials will be placed, and ranges from about 100 cpm to 200 cpm (see Attachment 3-1 and Reference 3.13).

2.1.6 If a ***count rate*** of greater than ***200 ncpm*** 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 or other appropriate

marking methods. Sample these elevated areas(s) IAW SNEC procedure E900-IMP-4520.04 (Reference 3-2).

2.1.7 Sampling points are to be clearly marked, identified and documented.

2.1.8 All survey personnel shall be trained to identify 200 ncpm above background based on an audible instrument response.

2.1.9 Other instruments of the type specified in Section 2.1.1 above may be used during this FSS but they must demonstrate a detection efficiency at or above the value listed in Section 2.1.2 (~208 cpm/uR/h).

2.1.10 Survey Process

The following are the recommended steps for surveying these materials:

1. Using 44-10 NaI detector, survey the lift areas without any soil or boulder materials added. Document this survey.

> **NOTE**
>
> It is not necessary to re-survey empty lift areas between surveys unless there is an elevated batch of materials discovered during a survey or sampling evolution.

2. Fill the lifts with soil to approximately 6" deep and level off to the edge of the form. Ensure soil and/or boulder materials are put in the appropriate lift areas as per Attachment 1-1 or 1-2.

3. For boulder materials, ensure that only boulder fines or shards are placed into the lift areas. Boulders larger than about 6" in diameter are not the subject of this survey effort and should be excluded.

4. Scan the soil or boulder lifts at the required coverage using the necessary technique.

5. Select a sampling plan from the attachments and lay out a sampling pattern for the respective soil or boulder areas.

> **NOTE**
>
> There may be several evolutions of filling, surveying, sampling and removing materials from these lift areas. Ten (10) random start systematic grid sampling patterns are provided for each lift area (10 for the soil and 10 for boulder material). If additional patterns are needed, contact the cognizant SR coordinator.

6. Lay out and sample the locations indicated on the selected pattern.

7. Evaluate the results of each survey, i.e., look over the survey and sampling results. If the materials pass the survey criteria, they may be used as re-fill materials.

NOTE

Materials that do not meet the release criteria must be segregated for disposal.

8. As necessary, repeat the above sequence of steps for each batch.

2.1.11 The minimum number of sampling points (*11*) indicated for these survey areas is calculated using the Compass computer program (see Attachment 4-1 to 4-8) (Reference 3.3). VSP (Reference 3.4) is then used to plot these points on diagrams called "sampling patterns". Obtain a soil or boulder sampling pattern from the cognizant SR coordinator (see examples of sampling patterns in Attachment 5-1 and/or Attachment 6-1).

2.1.12 An orientation mark (0, 0), for physically locating sample points in each fill area should be marked on the surrounding forms or lift areas. These point locations should be kept the same throughout the survey effort.

2.1.13 Some sampling point locations may need to be adjusted to accommodate obstructions within the survey area. Contact the SR coordinator to report any difficulties encountered when laying out systematic grid sampling points.

2.1.14 When an obstruction is encountered during the sampling phase that will not allow collection of a sample, contact the cognizant SR coordinator for permission to delete or re-assign the sample point.

3.0 REFERENCES

3.1 SNEC Calculation No. E900-04-005, Rev 0, "CV Yard Survey Design – Northwest Side of CV".

3.2 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.

3.3 SNEC Procedure E900-IMP-4520.04, "Survey Methodology to Support SNEC License Termination".

3.4 Compass Computer Program, Version 1.0.0, Oak Ridge Institute for Science and Education.

3.5 Visual Sample Plan, Version 2.0 (or greater), Copyright 2002, Battelle Memorial Institute.

3.6 SNEC Calculation No. 6900-02-028, GFPC Instrument Efficiency Loss Study.

3.7 SNEC Calculation No. E900-03-022, Rev 0, "CV Yard Soil – Survey Design to El 803'".

3.8 Plan SNEC Facility License Termination Plan.

3.9 SNEC Procedure E900-IMP-4500.59, "Final Site Survey Planning and DQA".

3.10 SNEC Calculation No. E900-03-012, Effective DCGL Worksheet Verification.

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.

3.13 Radiological Surveys 900-04-0351 and 900-04-0486, "East Yard at Stone Storage Area", 3-22-04, and "PAF and DSB Pads", 4-21-04, respectively.

4.0 ASSUMPTIONS AND BASIC DATA

4.1 The Compass computer program is used to calculate the required number of random start systematically spaced samples to be taken in each lift area (Reference 3.3).

4.2 Soil samples and boulder samples from these areas are used as the initial estimate of variability for each fill and survey evolution. These results are shown on Attachment 7-1.

4.3 The MARSSIM Sign Test will be applicable for the this soil/boulder survey design. No background subtraction will be performed under this criteria.

4.4 VSP is used to plot the random start systematically spaced sampling points. The dimensions of selected survey points are provided for each survey unit referenced to an existing survey area landmark (origin (0, 0)).

4.5 Reference 3.6, 3.7 and 3.8 was used as guidance during the survey design development phase.

4.6 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.

4.7 The sample data base used to determine the effective radionuclide mix for the CV Yard area has been drawn from previous samples that were assayed at off-site laboratories. This list is shown as Attachment 8-1 and 8-4, and includes (23) analysis results. Review of the data shows several radionuclides have not been positively identified at any significant concentration. These radionuclides have been removed from the data set and will not be considered further. Radionuclides removed include Am-241, C-14, Eu-152, Ni-63, Pu-238, Pu-239 and Pu-241. Additionally, the data shows Cs-137 to be the predominant radioactive contaminant found in this area. Sr-90 on the other hand, was positively identified in only one (1) sample. H-3 was identified as a positive contaminant in six (6) samples, and Co-60 was identified in three (3) samples.

Remediation has impacted radionuclide concentration levels in the materials to be surveyed. Remediation efforts have been shown to be effective in lowering the average concentration of Cs-137 in these survey materials. Therefore, remediation is considered in determining the effective Cs-137 DCGLw surrogate value. The final sample listing was decayed to January 15th, 2004. In all, about twenty three (23) sample results were used to determine the best representative mix for these materials.

The decayed sample result were input to the spreadsheet titled "Effective DCGL Calculator for Cs-137" (Reference 3-10) to determine the effective volumetric and surface DCGLw values for the OL1 area. The output of this spreadsheet is shown on Attachment 8-5 and 8-6.

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 208 cpm/uR/h for Cs-137. The detection system incorporates a Cs-137

window that lowers sensitivity to background in the survey unit. The resulting range of background values varies from about 100 cpm to ~200 cpm. The resulting MDCscan is ~3.2 pCi/g (see Attachment 2-1 and 2-2). This value is based on the nominal background value of 200 cpm.

4.8 No special area characteristics including any additional residual radioactivity (not previously noted during characterization) have been identified in these survey areas.

4.9 The decision error for this survey design is 0.05 for the α value and 0.1 for the β value.

4.10 Special measurements including gamma-ray spectroscopy are not included in this survey design.

4.11 No additional sampling will be performed IAW this survey design beyond that described herein.

4.12 The applicable SNEC site radionuclides and their individual DCGLw values are listed on **Exhibit 1** of this calculation.

4.13 The survey design checklist is listed in **Exhibit 2.**

4.14 Area factors are not applicable in subsurface soil volumes (below 1 meter). Therefore, the area factor input requirement for soil in the Compass computer program is set to 1 for the 10,000 square meter area as well as for a 1 square meter area (see Attachment 4-1 and 4-5).

5.0 CALCULATIONS

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

6.0 APPENDICES

6.1 **Attachment 1-1** and **1-2**, are diagrams of survey areas in the OL1 and OL2 areas.

6.2 **Attachment 2-1** and **2-2**, are the calculation sheets used to determine the MDCscan results using a selected set of parameters.

6.3 **Attachment 3-1**, is the results of initial background NaI measurements in the boulder lift area (pre-job surveys).

6.4 **Attachment 4-1** to **4-8**, is the Compass output for the soil and boulder survey work.

6.5 **Attachment 5-1**, is a typical sampling pattern for soil materials.

6.6 **Attachment 6-1**, is a typical sampling pattern for boulder materials.

6.7 **Attachment 7-1**, is the soil and boulder variability results for selected samples from these materials.

6.8 **Attachment 8-1** to **8-4**, is the sample results for the OL1 and OL2 areas and the resulting effective DCGLw calculation sheets.

Exhibit 1

SNEC Facility Individual Radionuclide DCGL Values [a]

Radionuclide	25 mrem/y Limit Surface Area ($dpm/100cm^2$)	25 mrem/y Limit (All Pathways) Open Land Areas (Surface & Subsurface) (pCi/g)	4 mrem/y Goal (Drinking Water) Open Land Areas [b] (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).

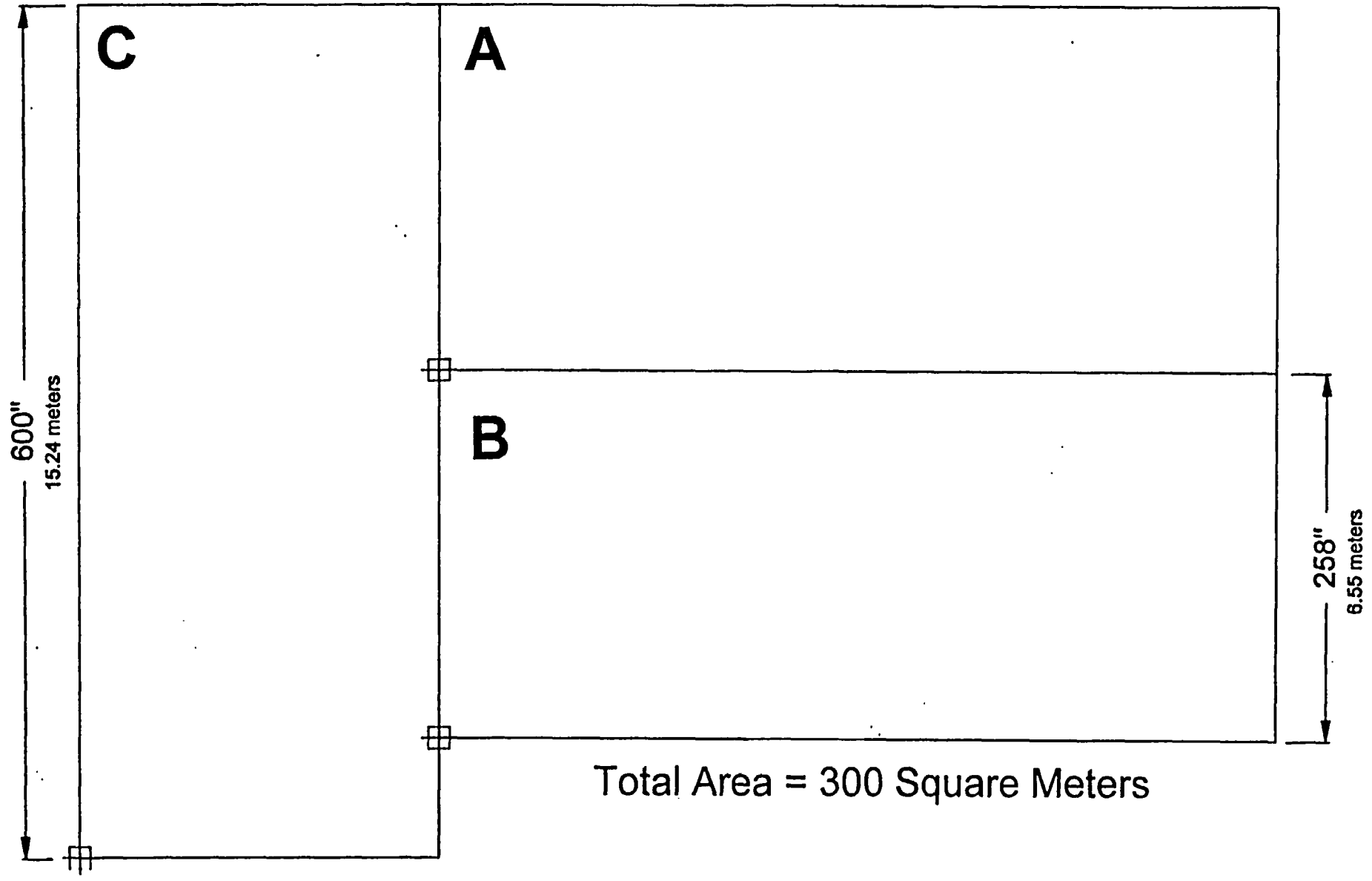
Exhibit 2
Survey Design Checklist

Calculation No. E900-04-006	Location Codes OL1-MISC- B/S, where B = Boulders, S = Soil

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	4/26/04
2	Are drawings/diagrams adequate for the subject area (drawings should have compass headings)?	(Yes) N/A	4/26/04
3	Are boundaries properly identified and is the survey area classification clearly indicated?	(Yes) N/A	4/26/04
4	Has the survey area(s) been properly divided into survey units IAW EXHIBIT 10	(Yes,) N/A	4/26/04
5	Are physical characteristics of the area/location or system documented?	(Yes,) N/A	4/26/04
6	Is a remediation effectiveness discussion included?	(Yes,) N/A	4/26/04
7	Have characterization survey and/or sampling results been converted to units that are comparable to applicable DCGL values?	(Yes) N/A	4/26/04
8	Is survey and/or sampling data that was used for determining survey unit variance included?	(Yes,) N/A	4/26/04
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	4/26/04
10	Are applicable survey and/or sampling data that was used to determine variability included?	(Yes,) N/A	4/26/04
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)	4/26/04
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)	4/26/04
13	Are all necessary supporting calculations and/or site procedures referenced or included?	(Yes,) N/A	4/26/04
14	Has an effective DCGLw been identified for the survey unit(s)?	(Yes,) N/A	4/26/04
15	Was the appropriate $DCGL_{EMC}$ included in the survey design calculation?	(Yes,) N/A	4/26/04
16	Has the statistical tests that will be used to evaluate the data been identified?	(Yes,) N/A	4/26/04
17	Has an elevated measurement comparison been performed (Class 1 Area)?	Yes, (N/A)	4/26/04
18	Has the decision error levels been identified and are the necessary justifications provided?	(Yes) N/A	4/26/04
19	Has scan instrumentation been identified along with the assigned scanning methodology?	(Yes) N/A	4/26/04
20	Has the scan rate been identified, and is the MDCscan adequate for the survey design?	(Yes) N/A	4/26/04
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)	4/26/04
22	Is survey instrumentation calibration data included and are detection sensitivities adequate?	(Yes,) N/A	4/26/04
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	4/26/04
24	Are investigation levels and administrative limits adequate, and are any associated actions clearly indicated?	(Yes,) N/A	4/26/04
25	For sample analysis, have the required MDA values been determined.?	Yes, (N/A)	4/26/04
26	Has any special sampling methodology been identified other than provided in Reference 6.3?	Yes, (N/A)	4/26/04

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

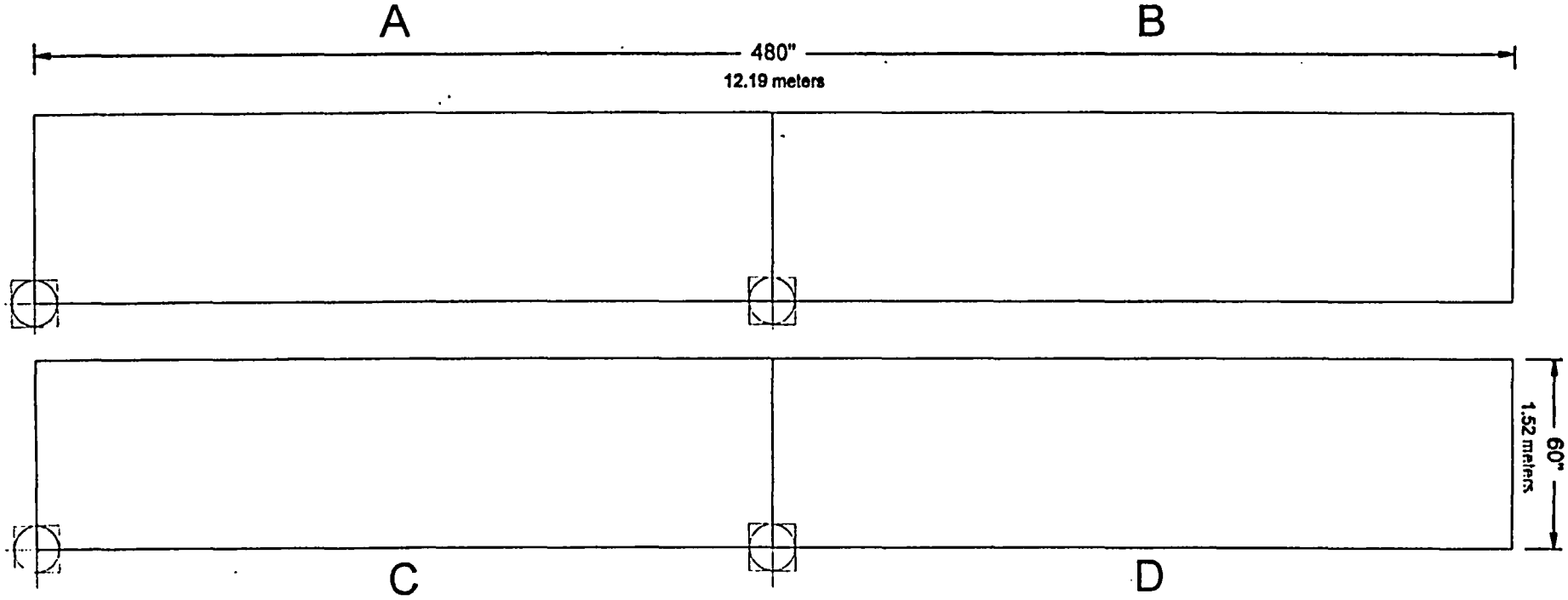
SOIL LIFTS



Total Area = 300 Square Meters

ATTACHMENT 1 1

BOULDER LIFTS



Total Area = 37.2 Square Meters

ATTACHMENT 1.2

Nal Scan MDC Calculation

$b := 200$ $p := 0.5$ $\overline{HS}_d := 56.42$ $SR := 25$ $d := 1.38$

$Conv := 208.705$ $MS_{output} := 2.115 \cdot 10^{-4}$

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

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

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

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

$MDCR_i = 100.629$ *net counts per minute*

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

$MDCR_{surveyor} = 142.311$ *net counts per minute*

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

$MDER = 0.682$ µR/h

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

$MDC_{scan} = 3.224$ pCi/g

ATTACHMENT 2.1

where:

b = *background in counts per minute*

b_i = *background counts in observation interval*

Conv = NaI 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 = *obervation Interval (seconds)*

p = *human performance factor*

SR = scan rate in centimeters per second

ATTACHMENT 2.2

ORIGINAL

SNEC RADIOLOGICAL SURVEY	Survey Unit #	N/A	Survey #	900-04-0335

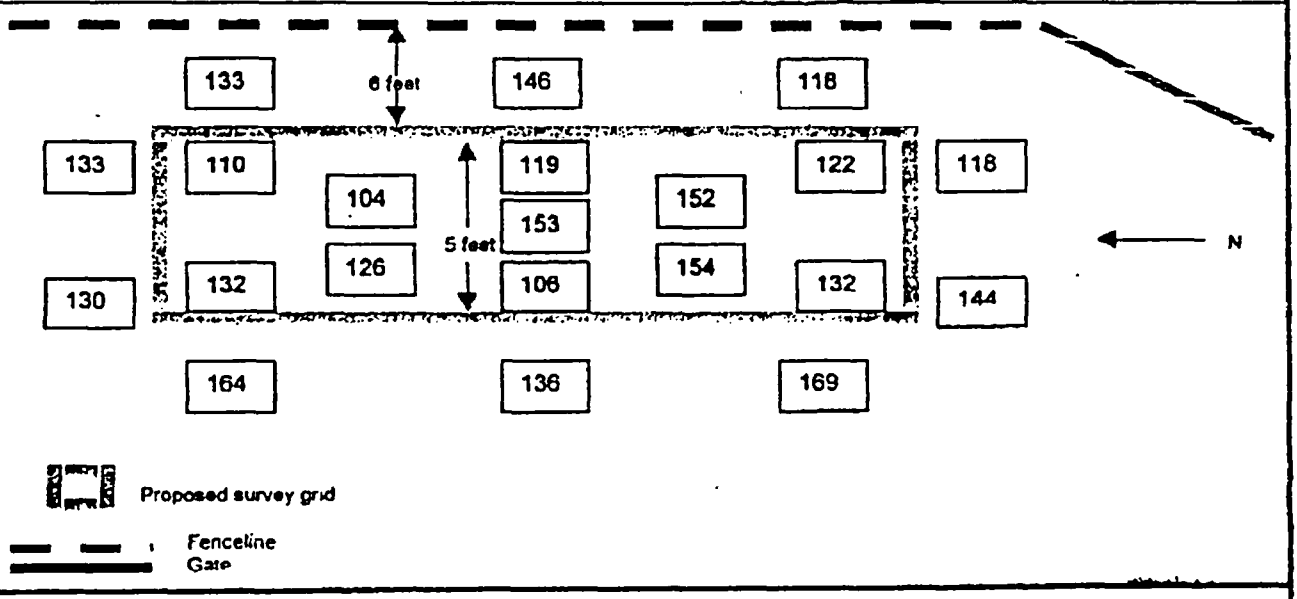
Location	EAST YARD AT STONE STORAGE AREA					
Grid #	N/A	Area Classification	N/A	SR #	N/A	
Reason For Survey	Background study	Date of Survey	3/18/04	Time of Survey	0859	
Technician	R. Reheard	Technician	N/A	Technician	N/A	
GRCS Review	R Marquoge			Date Of Review	3/18/04	

Radiological Instrument Data			Radiological Instrument Data			Radiological Instrument Data		
Inst./Probe Type	2350 / 4410		Inst./Probe Type	N/A		Inst./Probe Type	N/A	
Serial Number(s)	129429 / 206766 Pk		Serial Number(s)			Serial Number(s)		
Cal. Due Date(s)	11/03/04 / 12/12/04		Cal. Due Date(s)			Cal. Due Date(s)		
Efficiency (%)	N/A		Efficiency (%)			Efficiency (%)		
ABCR (cpm)	N/A		Background			ABCR (cpm)		
BRA Average	N/A		BRA Average			BRA Average		
BRA Location	N/A		BRA Location			BRA Location		
Source Checks	Sat. ☒	Unsat. ☐	Source Checks	Sat. ☒	Unsat. ☐	Source Checks	Sat. ☐	Unsat. ☐

Comments

Ambient air temperature at survey location was 36 degrees Fahrenheit.
This survey was completed to provide background information prior to the evolution of free releasing the accumulated stones.
Stones will be placed inside the proposed survey grid area and technicians will walk on the timbers while using a 2350 / 4410 instrument
The background readings outside the survey grid area were taken at random locations with an average reading of 146 counts / minute
The survey grid was 100% scanned at the rate of .5 meters per second with the detector held ≤ 4 inches above the surface.
The readings inside the survey grid were obtained as representative of the total area and the average reading was 128 counts / minute

Survey Map



ATTACHMENT 3 . 1

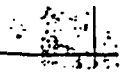
Site Report

Site Summary

Site Name: Soil Lift

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	4.30	No	10.000	1
					1

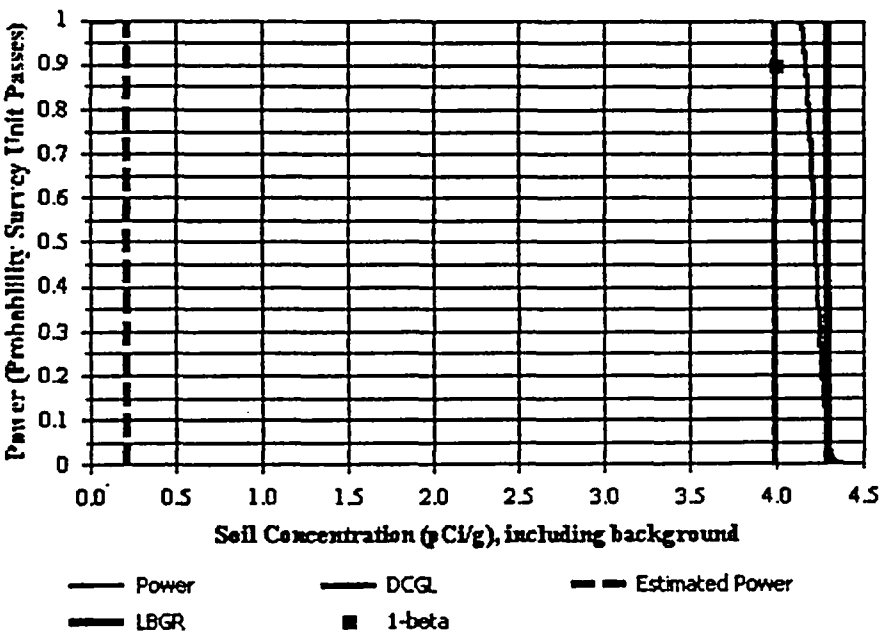
ATTACHMENT 4-1

Surface Soil Survey Plan

Survey Plan Summary

Site:	Soil Lift		
Planner(s):			
Survey Unit Name:	Soil Pile Lifts		
Comments:			
Area (m²):	300	Classification:	1
Selected Test:	Sign	Estimated Sigma (pCi/g):	0.10963
DCGL (pCi/g):	4.30	Sample Size (N):	11
LBGR (pCi/g):	4	Estimated Conc. (pCi/g):	0.2
Alpha:	0.050	Estimated Power:	1
Beta:	0.100	EMC Sample Size (N):	11
Scanning Instrumentation:	2" by 2" NaI Detector-W		

Prospective Power Curve



ATTACHMENT 4.2

Surface Soil Survey Plan

Contaminant Summary

Contaminant	DCGLw (pCi/g)	Inferred Contaminant	Ratio	Modified DCGLw (pCi/g)	Scan MDC (pCi/g)
Cs-137	4.30	N/A	N/A	N/A	3.224

Contaminant	Survey Unit Estimate (Mean ± 1-Sigma) (pCi/g)	Reference Area Estimate (Mean ± 1-Sigma) (pCi/g)
Cs-137	0.22 ± 0.10963	0.28 ± 0.39

ATTACHMENT 4.3

Elevated Measurement Comparison (EMC)

Enter in a description for the scanning instrumentation used. Then enter a scan MDC for each measured contaminant. Click the CALCULATE button to view the integrated survey design results. All entered and calculated scan MDC and DCGL units are in pCi/g.

Scanning Instrumentation Description: 2" by 2" NaI Detector-W

Contaminant	Scan MDC
Cs-137	3.224

Enter Scan MDC

NUREG-1507

CALCULATE

Statistical Design

N:	11
Bounded Area (m²):	27.3
Area Factor:	1
DCGLw:	4.30
Scan MDC Required:	N/A

Hot Spot Design

Actual Scan MDC:	3.224
Area Factor:	N/A
Bounded Area (m²):	N/A
Post-EMC N:	11

Enable Training

COMPASS

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

OK

LV Yard Boulder and ...

ATTACHMENT 4.4

Site Report

Site Summary

Site Name: Boulder Lift

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	4.30	No	10,000	1
				1	1

ATTACHMENT 4.5

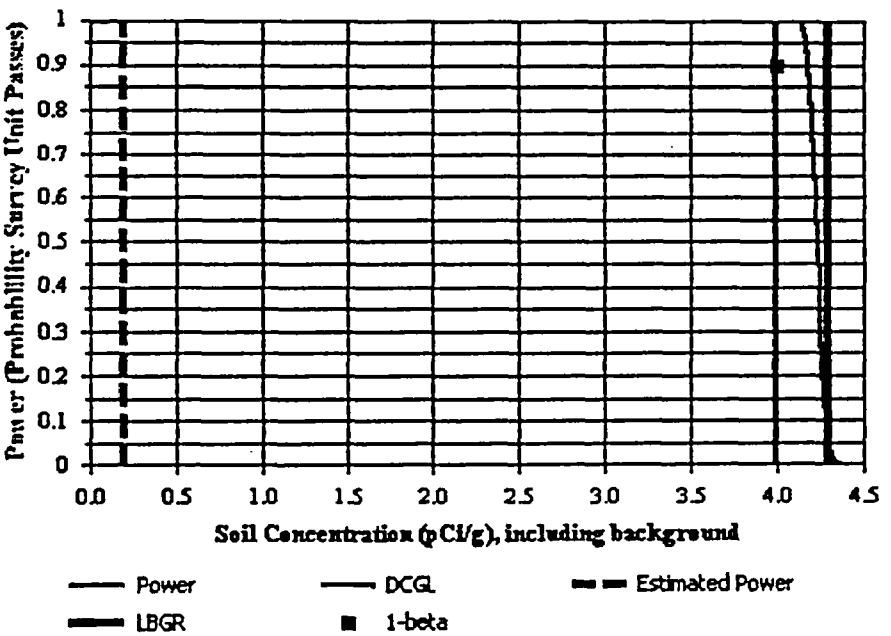
Surface Soil Survey Plan

Survey Plan Summary

	Boulder Lift		
Planner(s):	BHB		
Survey Unit Name:	Boulder Lift Area		
Comments:			
Area (m²):	37	Classification:	
Selected Test:	Sign	Estimated Sigma (pCi/g):	0.102354
DCGL (pCi/g):	4.30	Sample Size (N):	11
LBGR (pCi/g):	4	Estimated Conc. (pCi/g):	0.2
	0.050	Estimated Power:	1
	0.100	EMC Sample Size (N):	11

Scanning Instrumentation: 2" by 2" NaI Detector-W

Prospective Power Curve



ATTACHMENT 4.6

Surface Soil Survey Plan

Contaminant Summary

Contaminant	DCGLw (pCi/g)	Inferred Contaminant	Ratio	Modified DCGLw (pCi/g)	Scan MDC (pCi/g)
Cs-137	4.30	N/A	N/A	N/A	3.224

Contaminant	Survey Unit Estimate (Mean ± 1-Sigma) (pCi/g)	Reference Area Estimate (Mean ± 1-Sigma) (pCi/g)
Cs-137	0.192 ± 0.102354	0.28 ± 0.39

ATTACHMENT 4 : 7

Elevated Measurement Comparison (EMC)

Enter in a description for the scanning instrumentation used. Then enter a scan MDC for each measured contaminant. Click the CALCULATE button to view the integrated survey design results. All entered and calculated scan MDC and DCGL units are in pCi/g.

Scanning Instrumentation Description: 2" by 2" NaI Detector-W

Contaminant	Scan MDC
Cs-137	3.224

Enter Scan MDC

NUREG-1507

CALCULATE

Statistical Design		Hot Spot Design	
N:	11	Actual Scan MDC:	3.224
Bounded Area (m²):	3.4	Area Factor:	N/A
Area Factor:	1	Bounded Area (m²):	N/A
DCGLw:	4.30	Post-EMC N:	11
Scan MDC Required:	N/A		

Enable Training

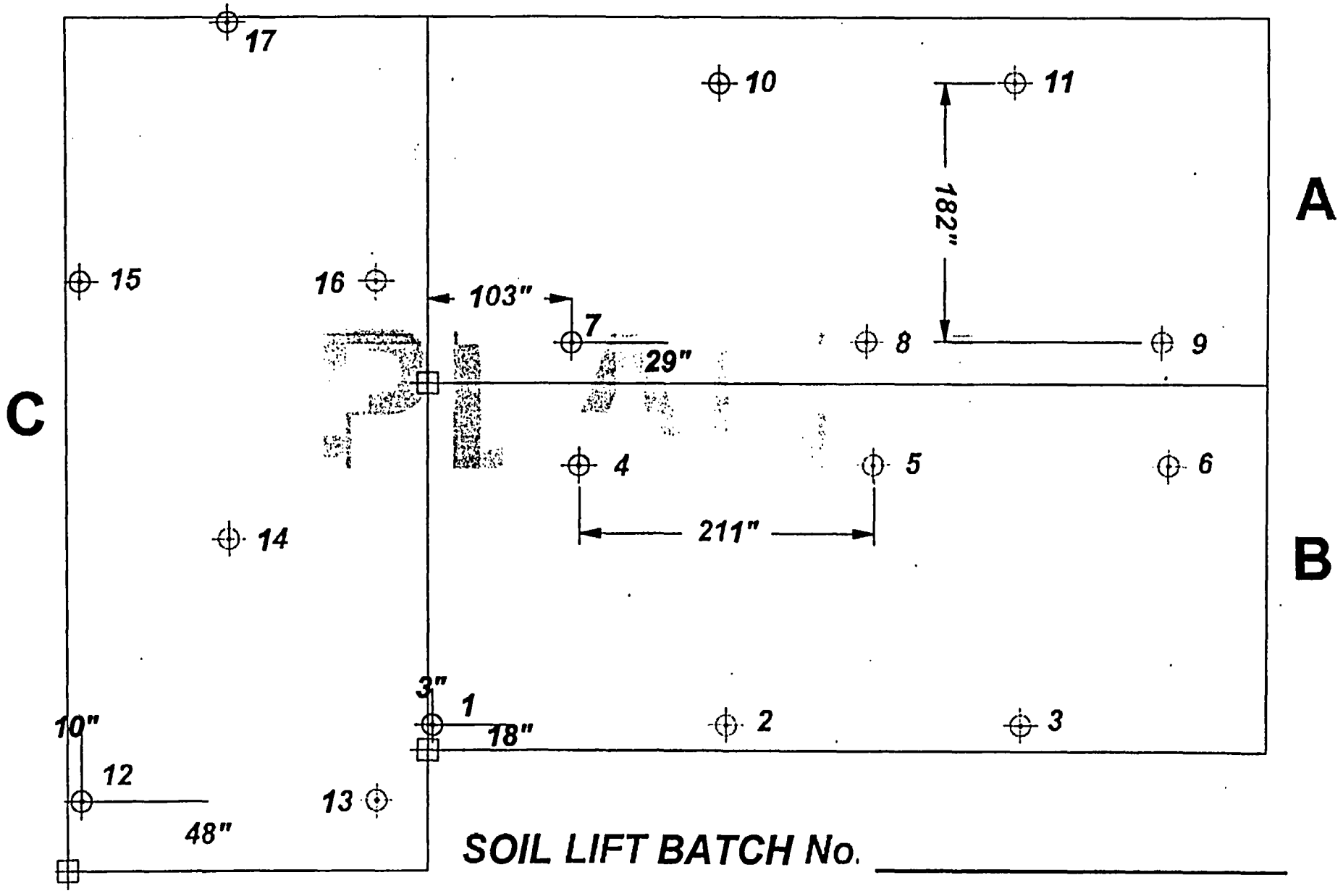
COMPASS

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

OK

ATTACHMENT 4-8

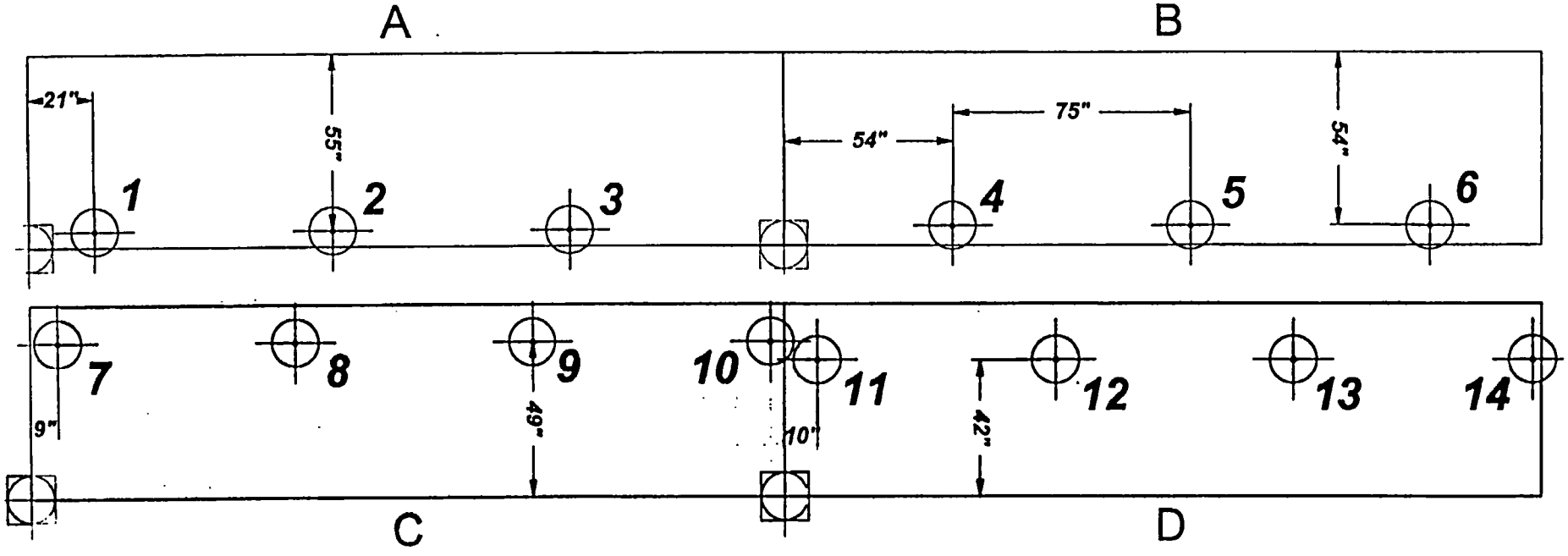
TYP CAL



SOIL LIFT BATCH No. _____

ATTACHMENT 5 1

TYPICAL
BOULDER LIFTS



BOULDER LIFT BATCH No. _____

ATTACHMENT 6 . 1

Soil Pile Samples

Location	Sample No.	Cs-137
Pile 1	1-15385	5.72E-02
Pile 1	2-15386	2.50E-01
Pile 1	1-15387	2.23E-01
Pile 1	2-15388	2.58E-01
Pile 1	1-15389	2.73E-01
Pile 2	1-15406	3.84E-01
Pile 2	2-15407	2.70E-01
Pile 2	1-15408	3.78E-01
Pile 2	2-15409	2.64E-01
Pile 2	1-15410	3.04E-01
Pile 2	2-15411	3.83E-01
S. CV Yard, Pile 3, Sample 1	5-15474	0.09
S. CV Yard, Pile 3, Sample 2	2-15473	0.17
S. CV Yard, Pile 3, Sample 3	1-15476	0.15
S. CV Yard, Pile 3, Sample 4	5-15472	0.12
S. CV Yard, Pile 3, Sample 5	2-15477	0.08
S. CV Yard, Pile 3, Sample 6	2-15471	0.09
	Mean=>	2.20E-01
	Standard Deviation=>	0.10963

Stone Pile Samples

Location	Sample No.	Cs-137
CV Yard Stone Pile, F-1	2-15480	4.50E-01
CV Yard Stone Pile, D-1	5-15479	1.70E-01
CV Yard Stone Pile, B-1	1-15478	7.00E-02
CV Yard Stone Pile, A-1	1-15481	2.50E-01
CV Yard Stone Pile, C-1	5-15482	2.00E-01
CV Yard Stone Pile, E-1	2-15483	7.00E-02
CV Yard Stone Pile, I-1	1-15484	1.70E-01
CV Yard Stone Pile, G-1	5-15487	1.30E-01
CV Yard Stone Pile, J-1	2-15486	2.00E-01
CV Yard Stone Pile, K-1	1-15490	2.00E-01
CV Yard Stone Pile, H-1	1-15485	2.00E-01
	Mean=>	1.92E-01
	Standard Deviation=>	0.102354

ATTACHMENT 7.1

DCGL Calculation Logic-CV Yard Soil & Boulders

I. **Survey Unit:** SNEC Containment Vessel (CV) Yard Soil and Boulders

II. **Description:** The purpose of this calculation is to determine a representative isotopic mix for the CV Yard Soil and associated Boulders from available sample analyses. The effective volumetric $DCGL_w$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 six (6) tables. These tables were developed using Microsoft Excel. Table explanation is as follows.

Table 1: Data Listing – This table, which has been extracted from a larger database, provides a list of the most representative sample analyses. Results are from scoping, characterization, and pre/post remediation surveys. The samples consist of soil media that was taken in support of the aforementioned surveys. As applicable, a sample number, sample location/description, radionuclide concentration, 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: Decayed Listing – This table decays the data from Table 1. Half-life values (days) are listed above each respective nuclide column. Samples are decayed from the respective analysis date to January 15, 2004. Positive results are denoted in a yellow background field while MDA values are noted in the gray shaded fields.

Table 3: Decayed Listing of Positive Nuclides & MDAs Removed – This table provides the best overall representation of the data. Non-positive nuclide columns have been removed as well as all the MDA values. Therefore, 11 nuclides have been reduced to four (4).

Table 4: Ratio to Cs-137 for Positive Nuclides – This table provides the calculation methodology for determining the surrogate ratio to Cs-137 for each radionuclide. From this information the mean, sigma, and mean % of total are calculated. The mean % of total values is used to calculate the volumetric $DCGL_w$ 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 value in the mean result field. This results in higher "mean percent of total" values in the mix, which are conservative.

Note: From Table 4 only the "mean % of total" values are used as input to the "Effective DCGL Calculation Spreadsheet" as illustrated in Table 5.

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

IV. **Summary** – Since the CV Yard and Boulders are volumes of soil or rock material, existing in place or in a pile, the release limit is primarily based on the volumetric $DCGL_w$. Using the above data selection logic tables the calculated Cs-137 volumetric $DCGL_w$ is 5.73 pCi/g. This value will be reduced by 25% as part of SNEC's requirement to apply an administrative limit as discussed in the License Termination Plan (LTP).

ATTACHMENT 8 - 1

TABLE 1 - Data Listing (pCi/g)

	SNEC Sample No	Location/Description	H-3	Sr-90	Co-60	Cs-137	Am-241	Pu-238	Pu-239	Pu-241	C-14	Ni-63	Eu-152
1	CV Tunnel	CV Tunnel Sediment Composite, OL1	9.40E+00	9.67E+00	1.26E+00	1.25E+03	1.80E-01	5.50E-01	2.20E-01	4.47E+01	9.34E+00	4.02E+00	1.30E-01
2	SX9SL99219	Subsuface Sample #29 (0-5'), AY-128, OL1			7.00E-02	5.90E-01							
3	SXSL1063	North CV Yard Soil BA-127, 812' El, Sample # 5, OL2	4.58E+00	5.31E-02	1.92E-02	8.86E-01	9.61E-02	4.68E-02	3.27E-02	3.77E+00	2.10E-01	1.09E+01	5.25E-02
4	SXSL1089	North CV Yard Soil AY-127, 810' El, Sample # 3, OL1	3.03E+00	6.95E-02	3.32E-02	1.29E+00	9.93E-02	1.28E-01	5.00E-02	4.97E+00	2.10E-01	7.54E+00	8.28E-02
5	SXSL1115	North CV Yard Soil AY-128, 804' El, Sample # 2, OL1	4.88E+00	5.36E-02	2.43E-02	1.80E+00	2.40E-01	1.38E-01	4.07E-02	4.21E+00	2.10E-01	7.60E+00	5.71E-02
6	SXSL1122	North CV Yard Soil AY-129, 798' El, Sample # 2, OL1	3.44E+00	5.29E-02	2.79E-02	4.77E+00	1.83E-01	8.94E-02	4.00E-02	3.68E+00	2.06E-01	8.75E+00	8.62E-02
7	SXSL1130	North CV Yard Soil AX-129, 803' El, Sample # 4, OL1	4.99E+00	6.48E-02	2.98E-02	2.26E+01	1.49E-01	8.56E-02	1.21E-02	3.55E+00	2.31E-01	1.34E+01	9.89E-02
8	SXSL1132	North CV Yard Soil AZ-130, Sample # 5, OL1	2.98E+00	7.15E-02	3.50E-02	2.59E+00	1.64E-01	7.46E-02	6.46E-02	5.27E+00	2.15E-01	1.26E+01	7.34E-02
9	SXSL1270	AX-128, 3-3, Soil, CV SE Side 5' From CV, 800' El., OL1	1.13E+01	2.00E-02	1.00E-02	2.31E+01	3.70E-02	7.00E-03	7.00E-03	2.10E+00	3.93E+00	8.68E+00	7.00E-02
10	SXSL1281	AX-128, 3-1, Soil, CV Tunnel East 5' From CV, 800' El, OL1	1.15E+01	3.00E-02	1.00E-02	4.38E+00	3.10E-02	1.60E-02	7.00E-03	1.91E+00	4.00E+00	7.78E+00	4.00E-02
11	SXSL2849	Anulus Well, A-2, 5 to 10' Depth, OL1	2.00E+00	3.14E-02	1.00E-01	6.00E-01	9.78E-03	1.33E-02	1.10E-02	1.87E+00	1.83E-01	1.75E+00	
13	SXSL2871	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, OL1		3.00E-02	7.00E-02	5.60E-01							
14	SXSL2872	CV Area - East Yard Dirt Pile - Bottom (also top center), OL1		3.00E-02	6.00E-02	1.00E-01							
15	SXSL3140	East CV Yard, Soil Pile @ 8' on West Side (6" Depth), OL1	1.89E+00	1.20E-02	1.40E-02	8.25E-01	7.00E-03	5.00E-03	5.00E-03	3.69E-01	8.60E-02	3.41E+00	3.00E-02
16	SXSL3142	Soil Pile, CV Yard, Three Feet on East Side, SR-37, OL1		2.95E-02	7.00E-02	6.00E-01							
17	SXSL3145	East CV Yard, Soil Pile @ 3' on East Side (6" Depth), OL1	1.90E+00	1.70E-02	1.30E-02	1.26E+00	4.00E-03	5.00E-03	5.00E-03	3.76E-01	8.30E-02	3.69E+00	3.80E-02
18	SXSL3149	Soil Pile, CV Yard, Six Feet on East Side, SR-37, OL1		2.97E-02	8.00E-02	3.00E-01							
19	SXSL3153	East CV Yard, Soil Pile @ Top (6" Depth), OL1	1.94E+00	4.30E-02	2.30E-02	3.00E-01	3.00E-03	5.00E-03	5.00E-03	3.43E-01	8.70E-02	4.18E+00	5.10E-02
21	SXSL4142	CV Yard Soil - West Side, AP1-7, OL1	2.22E+00	3.25E-02	5.00E-02	9.00E-01	1.76E-02	6.71E-02	2.02E-02				
22	SXSL4143	CV Yard Soil - West Side, AP1-7, OL1	2.23E+00	3.16E-02	5.00E-02	5.00E-01	2.21E-02	6.31E-02	3.64E-02				
23	SXSL4149	CV Yard Soil - West Side, AP1-7, OL1	2.24E+00	2.77E-02	7.00E-02	3.90E+00	2.77E-02	4.30E-02	3.04E-02				

TABLE 2 - Decayed Listing (pCi/g)

			T 1/2	T 1/2	T 1/2	T 1/2	T 1/2	T 1/2	T 1/2	T 1/2	T 1/2	T 1/2	T 1/2	Decay Date	
			4485.27	10446.15	1925.23275	11019.5925	157861.05	32050.6875	8813847.75	5259.6	2092882.5	36561.525	4967.4	January 15, 2004	
	SNEC Sample No	Location/Description	H-3	Sr-90	Co-60	Cs-137	Am-241	Pu-238	Pu-239	Pu-241	C-14	Ni-63	Eu-152	Analysis Date	ET (d)
1	CV Tunnel	CV Tunnel Sediment Composite, OL1	7.97E+00	9.01E+00	8.59E-01	1.17E+03	1.79E-01	5.37E-01	2.20E-01	3.88E+01	9.34E+00	3.94E+00	1.12E-01	February 14, 2001	1065
2	SX9SL99219	Subsuface Sample #29 (0-5'), AY-128, OL1			4.05E-02	5.36E-01								November 17, 1999	1520
3	SXSL1063	North CV Yard Soil BA-127, 812' El, Sample # 5, OL2	4.20E+00	5.11E-02	1.57E-02	8.55E-01	9.59E-02	4.62E-02	3.27E-02	3.50E+00	2.10E-01	1.08E+01	4.85E-02	June 27, 2002	567
4	SXSL1089	North CV Yard Soil AY-127, 810' El, Sample # 3, OL1	2.78E+00	6.69E-02	2.71E-02	1.24E+00	9.91E-02	1.26E-01	5.00E-02	4.61E+00	2.10E-01	7.46E+00	7.65E-02	June 28, 2002	566
5	SXSL1115	North CV Yard Soil AY-128, 804' El, Sample # 2, OL1	4.47E+00	5.16E-02	1.98E-02	1.74E+00	2.39E-01	1.36E-01	4.07E-02	3.91E+00	2.10E-01	7.52E+00	5.28E-02	June 28, 2002	565
6	SXSL1122	North CV Yard Soil AY-129, 798' El, Sample # 2, OL1	3.15E+00	5.10E-02	2.28E-02	4.60E+00	1.83E-01	8.83E-02	4.00E-02	3.42E+00	2.06E-01	8.66E+00	7.97E-02	June 28, 2002	565
7	SXSL1130	North CV Yard Soil AX-128, 803' El, Sample # 4, OL1	4.58E+00	6.24E-02	2.44E-02	2.18E+01	1.49E-01	8.46E-02	1.21E-02	3.30E+00	2.31E-01	1.33E+01	9.15E-02	July 3, 2002	561
8	SXSL1132	North CV Yard Soil AZ-130, Sample # 5, OL1	2.73E+00	6.89E-02	2.86E-02	2.50E+00	1.64E-01	7.37E-02	6.46E-02	4.89E+00	2.15E-01	1.25E+01	6.79E-02	July 3, 2002	561
9	SXSL1270	AX-129, 3-3, Soil, CV SE Side 5' From CV, 800' El., OL1	9.84E+00	1.88E-02	7.22E-03	2.18E+01	3.69E-02	6.86E-03	7.00E-03	1.87E+00	3.93E+00	8.53E+00	6.17E-02	July 28, 2001	903
10	SXSL1281	AX-128, 3-1, Soil, CV Tunnel East 5' From CV, 800' El, OL1	1.00E+01	2.83E-02	7.22E-03	4.14E+00	3.09E-02	1.57E-02	7.00E-03	1.69E+00	4.00E+00	7.65E+00	3.53E-02	July 26, 2001	903
11	SXSL2849	Anulus Well, A-2, 5 to 10' Depth, OL1	1.79E+00	3.00E-02	7.77E-02	5.74E-01	9.75E-03	1.31E-02	1.10E-02	1.71E+00	1.83E-01	1.73E+00		February 13, 2002	701
13	SXSL2871	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, OL1		2.87E-02	5.48E-02	5.37E-01								March 6, 2002	680
14	SXSL2872	CV Area - East Yard Dirt Pile - Bottom (also top center), OL1		2.87E-02	4.70E-02	9.58E-02								March 6, 2002	680
15	SXSL3140	East CV Yard, Soil Pile @ 8' on West Side (6" Depth), OL1	1.75E+00	1.16E-02	1.17E-02	7.99E-01	6.98E-03	4.95E-03	5.00E-03	3.45E-01	8.60E-02	3.37E+00	2.80E-02	August 30, 2002	503
16	SXSL3142	Soil Pile, CV Yard, Three Feet on East Side, SR-37, OL1		2.85E-02	5.81E-02	5.81E-01								August 13, 2002	520
17	SXSL3145	East CV Yard, Soil Pile @ 3' on East Side (6" Depth), OL1	1.76E+00	1.64E-02	1.08E-02	1.22E+00	3.99E-03	4.95E-03	5.00E-03	3.52E-01	8.30E-02	3.65E+00	3.54E-02	August 30, 2002	503
18	SXSL3149	Soil Pile, CV Yard, Six Feet on East Side, SR-37, OL1		2.87E-02	6.63E-02	2.90E-01								August 13, 2002	520
19	SXSL3153	East CV Yard, Soil Pile @ Top (6" Depth), OL1	1.79E+00	4.16E-02	1.92E-02	2.91E-01	2.99E-03	4.95E-03	5.00E-03	3.21E-01	8.70E-02	4.14E+00	4.75E-02	August 30, 2002	503
21	SXSL4142	CV Yard Soil - West Side, AP1-7, OL1	2.18E+00	3.23E-02	4.81E-02	8.94E-01	1.76E-02	6.69E-02	2.02E-02					October 2, 2003	105
22	SXSL4143	CV Yard Soil - West Side, AP1-7, OL1	2.19E+00	3.14E-02	4.81E-02	4.97E-01	2.21E-02	6.30E-02	3.64E-02					October 2, 2003	105
23	SXSL4149	CV Yard Soil - West Side, AP1-7, OL1	2.20E+00	2.75E-02	6.74E-02	3.87E+00	2.77E-02	4.29E-02	3.04E-02					October 2, 2003	105

KEY	
	Yellow Shaded Background = Positive Result
	Gray Shaded Background = MDA

Attachment 8-2

C01

TABLE 3 - Decayed Listing of Positive Nuclides & MDAs Removed (pCi/g)

	SNEC Sample No	Location/Description	H-3	Sr-90	Co-60	Cs-137	Total pCi/g
1	CV Tunnel	CV Tunnel Sediment Composite, OL1		9.01E+00	8.59E-01	1.17E+03	1178.89
2	SX9SL99219	Subsuface Sample #29 (0-5'), AY-128, OL1				5.36E-01	0.54
3	SXSL1063	North CV Yard Soil BA-127, 812' El, Sample # 5, OL2	4.20E+00			8.55E-01	5.05
4	SXSL1089	North CV Yard Soil AY-127, 810' El, Sample # 3, OL1	2.78E+00			1.24E+00	4.02
5	SXSL1115	North CV Yard Soil AY-128, 804' El, Sample # 2, OL1	4.47E+00			1.74E+00	6.21
6	SXSL1122	North CV Yard Soil AY-129, 798' El, Sample # 2, OL1	3.15E+00			4.60E+00	7.76
7	SXSL1130	North CV Yard Soil AX-129, 803' El, Sample # 4, OL1	4.58E+00		2.44E-02	2.18E+01	26.42
8	SXSL1132	North CV Yard Soil AZ-130, Sample # 5, OL1	2.73E+00			2.50E+00	5.23
9	SXSL1270	AX-129, 3-3, Soil, CV SE Side 5' From CV, 800' El., OL1				2.18E+01	21.82
10	SXSL1281	AX-128, 3-1, Soil, CV Tunnel East 5' From CV, 800' El, OL1				4.14E+00	4.14
11	SXSL2649	Anulus Well, A-2, 5 to 10' Depth, OL1				5.74E-01	0.57
13	SXSL2871	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, OL1				5.37E-01	0.54
14	SXSL2872	CV Area - East Yard Dirt Pile - Bottom (also top center), OL1				9.58E-02	0.10
15	SXSL3140	East CV Yard, Soil Pile @ 6' on West Side (6" Depth), OL1				7.99E-01	0.80
16	SXSL3142	Soil Pile, CV Yard, Three Feet on East Side, SR-37, OL1				5.81E-01	0.58
17	SXSL3145	East CV Yard, Soil Pile @ 3' on East Side (6" Depth), OL1				1.22E+00	1.22
18	SXSL3149	Soil Pile, CV Yard, Six Feet on East Side, SR-37, OL1				2.90E-01	0.29
19	SXSL3153	East CV Yard, Soil Pile @ Top (6" Depth), OL1				2.91E-01	0.29
21	SXSL4142	CV Yard Soil - West Side, AP1-7, OL1				8.94E-01	0.89
22	SXSL4143	CV Yard Soil - West Side, AP1-7, OL1				4.97E-01	0.50
23	SXSL4149	CV Yard Soil - West Side, AP1-7, OL1			6.74E-02	3.87E+00	3.94

TABLE 4 - Ratio To Cs-137 for Positive Nuclides

	SNEC Sample No	Location/Description	H-3	Sr-90	Co-60	Cs-137	Total
1	CV Tunnel	CV Tunnel Sediment Composite, OL1		7.71E-03	7.35E-04	1.00E+00	1.01
2	SX9SL99219	Subsuface Sample #29 (0-5'), AY-128, OL1				1.00E+00	1.00
3	SXSL1063	North CV Yard Soil BA-127, 812' El, Sample # 5, OL2	4.91E+00			1.00E+00	5.91
4	SXSL1089	North CV Yard Soil AY-127, 810' El, Sample # 3, OL1	2.23E+00			1.00E+00	3.23
5	SXSL1115	North CV Yard Soil AY-128, 804' El, Sample # 2, OL1	2.57E+00			1.00E+00	3.57
6	SXSL1122	North CV Yard Soil AY-129, 798' El, Sample # 2, OL1	6.85E-01			1.00E+00	1.68
7	SXSL1130	North CV Yard Soil AX-129, 803' El, Sample # 4, OL1	2.10E-01		1.12E-03	1.00E+00	1.21
8	SXSL1132	North CV Yard Soil AZ-130, Sample # 5, OL1	1.09E+00			1.00E+00	2.09
9	SXSL1270	AX-129, 3-3, Soil, CV SE Side 5' From CV, 800' El., OL1				1.00E+00	1.00
10	SXSL1281	AX-128, 3-1, Soil, CV Tunnel East 5' From CV, 800' El, OL1				1.00E+00	1.00
11	SXSL2649	Anulus Well, A-2, 5 to 10' Depth, OL1				1.00E+00	1.00
13	SXSL2871	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, OL1				1.00E+00	1.00
14	SXSL2872	CV Area - East Yard Dirt Pile - Bottom (also top center), OL1				1.00E+00	1.00
15	SXSL3140	East CV Yard, Soil Pile @ 6' on West Side (6" Depth), OL1				1.00E+00	1.00
16	SXSL3142	Soil Pile, CV Yard, Three Feet on East Side, SR-37, OL1				1.00E+00	1.00
17	SXSL3145	East CV Yard, Soil Pile @ 3' on East Side (6" Depth), OL1				1.00E+00	1.00
18	SXSL3149	Soil Pile, CV Yard, Six Feet on East Side, SR-37, OL1				1.00E+00	1.00
19	SXSL3153	East CV Yard, Soil Pile @ Top (6" Depth), OL1				1.00E+00	1.00
21	SXSL4142	CV Yard Soil - West Side, AP1-7, OL1				1.00E+00	1.00
22	SXSL4143	CV Yard Soil - West Side, AP1-7, OL1				1.00E+00	1.00
23	SXSL4149	CV Yard Soil - West Side, AP1-7, OL1			1.74E-02	1.00E+00	1.02
		Mean⇒	1.95E+00	7.71E-03	6.42E-03	1	2.96
		Sigma⇒	1.708		0.010	0.000	
		Mean % of Total⇒	65.79%	0.26%	0.22%	33.74%	100.00%

Attachment 8-3

C02

Table 5

Effective DCGL Calculator for Cs-137 (in pCi/g)

SNEC AL	75%	Total Activity Limit DCGLw		Administrative Limit	
		16.98	pCi/g	12.74	pCi/g

SAMPLE NUMBER(s)⇒ CV YARD SOIL & BOULDER SAMPLES

Cs-137 Limit		Cs-137 Administrative Limit	
5.73	pCi/g	4.30	pCi/g

17.45%	25.0	mrem/y TEDE Limit	
7.79%	4.0	mrem/y Drinking Water (DW) Limit	☑ Check for 25 mrem/y

	Isotope	Sample Input (pCi/g, uCi, % of Total, 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	This Sample mrem/y TEDE	This Sample mrem/y DW	
1	Am-241		0.000%	9.9	2.3	0.00	0.00	0.00	0.00	0.00	Am-241
2	C-14		0.000%	2.0	5.4	0.00	0.00	0.00	0.00	0.00	C-14
3	Co-60	0.0064	0.216%	3.5	67.0	0.04	0.08	0.04	0.05	0.00	Co-60
4	Cs-137	1.0000	33.738%	6.6	397	5.73	12.83	5.73	3.79	0.01	Cs-137
5	Eu-152		0.000%	10.1	1440	0.00	0.00	0.00	0.00	0.00	Eu-152
6	H-3	1.9499	65.786%	132	31.1	11.17	25.02	11.17	0.37	0.25	H-3
7	Ni-63		0.000%	747	19000	0.00	0.00	0.00	0.00	0.00	Ni-63
8	Pu-238		0.000%	1.8	0.41	0.00	0.00	0.00	0.00	0.00	Pu-238
9	Pu-239		0.000%	1.6	0.37	0.00	0.00	0.00	0.00	0.00	Pu-239
10	Pu-241		0.000%	86	19.8	0.00	0.00	0.00	0.00	0.00	Pu-241
11	Sr-90	0.0077	0.260%	1.2	0.61	0.04	0.10	0.04	0.16	0.05	Sr-90
		2.96E+00	100.000%			16.98	38.03	16.98	4.364	0.312	
						Maximum Permissible pCi/g (25 mrem/y)	Maximum Permissible pCi/g (4 mrem/y)		To Use This Information, Sample Input Units Must Be In pCi/g *not % of Total.*		

Attachment 8-4

C03

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-116	AREA/LOCATION	CV Yard – Northwest SIDE of CV
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

ORIGINAL

RESULTS SUMMARY FOR SR-116

SR-116 was issued to perform FFS of the survey unit designated as OL1-2. The total soil surface area for this Class 1 area is approx. 309 square meters. The grids covered under this SR are AY-130, AY-129, AZ-130, AZ-129. The SR required the following radiological measurements:

- Surface Scan Measurements for Gamma Activity Using a NaI Detector – perform a 100% scan survey of the grids listed above Survey shall be performed in a serpentine pattern approx 0.5 meters wide at a rate not exceeding 25 cm/s. The detector shall be held within 10.16 cm. The surface scan action level is 200 ncpm.

- Surface Soil Sampling – obtain one surface soil sample at each of the 39 locations listed on page 5 of this SR. The effective $DCGL_w$ is 4.3 pCi/g, Cs-137.

- Additional sampling/surveying may be performed as requested by the SR Coordinator.

- QC Repeat Measurements – A minimum of 5% of all measurements and sampling will be re-performed using identical methodology.

1. Summary of Results

A. Surface Scan Measurements Using a NaI Detector

100% scan was performed of survey unit OL1-2. Action level was 200 ncpm.

Results: all areas indicated activity <action level except for 1 area (designated AP1). This area encompassed approx. 3 ft^2 and was located below the train support structure. A static measurement of this area indicated activity of 1945 ncpm and a sample was obtained. (See Section C).

B. Surface Soil Sampling

Thirty-nine samples were obtained covering the locations listed on page 5 of the SR.

Results: Thirty-five samples indicated positive Cs137 activity ranging from 0.06 to 1.6 pCi/g. The average Cs-137 MDA achieved for the non-positive samples was 0.08 pCi/g. Co-60 was not identified in the samples, typical achieved MDA was 0.07 pCi/g.

C. Biased Sample Results

One sample, obtained for AP1, indicated activity of 120 pCi/g, Cs-137 and 1.0 pCi/g, Co-60.

Note: A verification scan was performed covering 12 ft^2 of this same area. All areas indicated activity below action level. A verification sample was obtained which indicated activity of 3.6 pCi/g, Cs-137 and <0.06 pCi/g, Co-60.

APPENDIX F

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-116	AREA/LOCATION	CV Yard – Northwest SIDE of CV
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

D. Quality Control (QC) Measurements and Comparisons

Scans and samples were obtained. This percentage meets the 5% requirement. Note: A static measurement was not performed on AP1. Per the QAO, a static measurement was not to be taken since the post-sampling scan indicated activity <action level. The static measurement result comparison would not have met the acceptance criteria established in Section 4.6 of E900-IMP-4520.04.

2. Discrepancies and Exceptions

A QC static measurement was not performed to comply with Section 4.6 of E900-IMP-4520.04. Per the QAO, this measurement was not necessary since the post-sampling scan indicated activity <action level. The static measurement result comparison would not have met the acceptance criteria (20%) established in Section 4.6 of E900-IMP-4520.04.

3. Special Note:

Two Quality Checking Inspections were performed during the performance of the SR. Inspections focused primarily on two areas: instrumentation calibration/source checking and the Rad Con technicians' scanning/sampling performance to ensure site procedural and SR requirements. No deficiencies were identified.

4. Final Summary:

Based on the results of the surveys/sampling performed for this SR and the results of the verification scanning/sampling of AP1, survey unit OL1-2 meets the site LTP release criteria.

David Sarge (GRCS) _____ Date 5.22.09

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-117	AREA/LOCATION	North West Side of CV – Concrete Structures
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

RESULTS SUMMARY FOR SR-117

SR-117 was issued to perform FFS of the survey unit designated as MA8-1 that covers three concrete structures: Ventilation Pad, Concrete Spoils Pad, and the Old Railroad Pad to SwitchGear Yard. The total surface area for this Class 1 area is approx. 48 square meters. The SR required the following radiological measurements:

- Surface Scan Measurements for Gamma Activity Using a GFPC Detector – perform a 100% surface scan survey of the structures listed above. Survey shall be performed at a rate not to exceed 2.2 cm/sec and the detector shall remain on contact to the surface unless not possible (i.e., gouges, cavities, etc.). The surface scan action level is 500 ncpm.

- Non-biased Static Measurements – perform 1-minute static measurements at each of the locations listed on pages 5 through 7 on the SR. Measurements shall be obtained on contact with the surface. The action level ($DCGL_w$) for this survey unit is 1260 ncpm.

- Additional sampling/surveying may be performed as requested by the SR Coordinator.

- QC Repeat Measurements – A minimum of 5% of all measurements and sampling will be re-performed using identical methodology.

1. Summary of Results

A. Surface Scan Measurements Using a GFPC Detector

100% scan was performed of all three concrete structures. Action level was 500 ncpm.

Results: all areas indicated activity below action level.

B. Non-Biased Static Measurements

Twenty measurement pairs were obtained covering the three concrete structures.

Results: All measurement pairs indicated activity below the action level. The following table lists the measurement results:

APPENDIX G

SURVEY REQUEST CONTINUATION SHEET

SR NUMBER	SR-117	AREA/LOCATION	North West Side of CV – Concrete Structures
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

Concrete Structure	Fixed Point	Shielded Reading (cpm)	Unshielded Reading (cpm)	Net Difference (ncpm)
Concrete A - Ventilation Pad	1	231	366	135
	2	250	333	83
	3	247	349	102
	4	262	309	47
	5	295	355	60
	6	255	362	107
	7	224	341	117
	8	254	403	149
	Mean	252.3	352.3	
	Standard Deviation	21.4	27.4	
	Max	295	403	
	Min	224	309	
	Median	252	352	
Concrete B – Old Railroad Pad	1	216	307	91
	2	210	274	64
	3	176	202	26
	4	231	323	92
	5	234	304	70
	6	242	358	116
	Mean	218.2	294.7	
	Standard Deviation	23.8	53.0	
	Max	242	358	
	Min	176	202	
	Median	223.5	305.5	
Concrete Spoils	1	341	410	69
	2	307	445	138
	3	384	411	27
	4	355	432	77
	5	356	417	61
	6	355	418	63
	Mean	349.7	422.2	
	Standard Deviation	25.2	13.7	
	Max	384	445	
	Min	307	410	
	Median	355	417.5	

C. Quality Control (QC) Measurements and Comparisons

- **Repeat Scan/Static measurements** were performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04.

2. Discrepancies and Exceptions:

none.

3. Special Note:

A Quality Checking Inspection was performed during the performance of the SR. Inspection focused primarily on two areas: instrumentation calibration/source checking and the Rad Con technicians' scanning/sampling performance to ensure site procedural and SR requirements. No deficiencies were identified.

4. Final Summary:

Based on the results of the surveys/sampling performed for this SR, survey unit MA8-1 meets the site LTP release criteria.

David Sarge (GRCS) _____ **Date** 8.9.04

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0140	AREA/LOCATION	Southside of CV – Steel liner, solid concrete structures, concrete block wall, open land areas
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

RESULTS SUMMARY FOR SR-0140

SR-0140 was issued to perform a Final Status Survey of the areas surrounding the south side of the remaining CV shell which includes soil, rock, concrete block, solid concrete structures and the outer shell of the CV. The survey includes scans, static readings, and applicable soil samples. The survey unit for this SR is OL1-3, MA8-2. CV4-2, CV5-1 (grids AX-127 through 130 and AY-130).

The SR required the following radiological measurements:

- Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) of the 5 solid concrete structures listed on pages 7 of the SR – 100% surface scan is required of these areas (in a serpentine pattern) at a rate not exceeding 1.2 inches/ sec at a distance within 2 inches. The action level is 300 gross cpm.

- Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) of open land areas (including the concrete block wall – 100% surface scan is required of these areas (in a serpentine pattern) at a rate not exceeding 10 inches/ second at a distance within 4 inches. The action level is either 300 gross cpm or 300 ncpm (ABCR).

- Surface Scan Measurements Using a GFPC Detector – 100% surface scan is required of the CV shell and the 5 solid concrete structures at a rate not exceeding 2.2 cm/second on contact unless not physically possible. The action levels are 2,500 gross cpm (CV Liner) and 1,200 gross cpm (solid concrete structures).

- Static Measurements Using a GFPC Detector – obtain static measurement pairs at the locations listed on pages 6 and 7 of the SR (CV Liner, 5 solid concrete structures).

- Non-biased soil samples – obtain samples in the locations listed on page 8 of the SR.

- QC Repeat Measurements – A minimum of 5% of all surface scan measurements and sampling will be re-performed using identical methodology.

- Additional sampling/surveys may be performed at the request of the SR Coordinator.

1. Summary of Results

A. Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) of solid concrete structures

100% scan of the exposed surfaces of the 5 concrete structures is required.

Results: Scan results indicate activity below the action level with one exception. An area (approx. 1 ft^2) of structure #2 indicated 309 cpm on a 1-minute static measurement. A concrete sample was obtained in this location with results indicating 1.0 ± 0.1 pCi/g, Cs-137, <0.05 pCi/g, Co-60.

APPENDIX H

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0140	AREA/LOCATION	Southside of CV – Steel liner, solid concrete structures, concrete block wall, open land areas
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

B. Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) of open land areas (including the concrete block wall)

100% surface scan is required.

Results: 100% of the open land areas was scanned. All areas indicated activity below action level except for fourteen locations. These areas were bounded, static measurements were obtained in the areas indicating the highest activity, and samples were obtained. The following table lists the results:

Static Measurement Location	Total Effected Area (ft^2)	Result (gross cpm)	Sample Number	Sample Results (pCi/g) Cs-137, Co-60.
AP-1	1	310	SX-OT-5797	0.19 ± 0.04, <0.05
AP-2	30	316	SX-OT-5798	<0.09, <0.08
AP-3	100	386	SX-SL-5796	<0.06, <0.06
AP-4	1	358	SX-SL-5799	<0.1, <0.1
AP-5	12	360	SX-OT-5812	<0.14, <0.14
AP-6	6	380	SX-OT-5813	0.25 ± 0.07, <0.1
AP-7	2	345	SX-OT-5814	0.17 ± 0.08, <0.1
AP-8	15	312	SX-OT-5815	<0.08, <0.1
AP-9	6	320	SX-SL-5816	2.0 ± 0.2, <0.1
AP-10	2	345	SX-SL-5817	1.7 ± 0.2, <0.1
AP-11	9	300	SX-SL-5818	0.2 ± 0.07, <0.1
AP-12	33	308	SX-SL-5819	0.2 ± 0.07, <0.1
AP-13	74	306	SX-SL-5820	0.3 ± 0.1, <0.1
AP-14	18	321	SX-SL-5821	<0.1, <0.1

C. Surface Scan Measurements Using a GFPC Detector of the CV shell and the solid concrete structures

100% surface scan is required.

Results: 100% scan of the remaining section of CV shell and the 5 concrete structures was performed. Both indicated activity below the respective action levels.

D. Biased Static Measurements Using a GFPC Detector of the CV Shell and Concrete Structures

The required sets of measurement pairs were obtained for both areas. The following table lists the results:

SURVEY REQUEST CONTINUATION SHEET

SR NUMBER	SR-0140	AREA/LOCATION	Southside of CV – Steel liner, solid concrete structures, concrete block wall, open land areas
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

Static Location Number	Shielded Reading(cpm)	Unshielded Reading(cpm)	Net Difference (ncpm)
CV4-2 - 1	327	304	-23
2	288	383	95
3	295	357	62
4	301	380	79
5	280	297	17
6	343	346	3
7	288	328	40
8	327	298	-29
9	332	334	2
10	288	367	79
11	343	328	-15
12	353	333	-20
13	330	391	61
14	405	351	-54
15	323	354	31
16	314	376	62
17	243	268	25
18	244	261	17
MEAN	312.4	336.4	
2 ST. DEV.	78.4	77.0	
MAX	405	391	
MIN	243	261	
MEDIAN	318.5	340	
MA8-2 - 1	333	369	36
2	289	345	56
3	313	371	58
4	322	399	77
5	276	414	138
6	283	409	126
7	303	389	86
8	340	482	142
9	344	430	86
10	312	357	45
11	287	369	82
MEAN	309.3	394.0	
2 ST. DEV.	47.5	78.1	
MAX	344	482	
MIN	276	345	
MEDIAN	312	389	

Static Location Number	Shielded Reading(cpm)	Unshielded Reading(cpm)	Net Difference (ncpm)
CV5-1 - 1	312	336	24
2	310	291	-19
3	306	374	68
4	318	408	90
5	308	335	27
6	278	320	42
7	264	317	53
8	277	335	58
9	325	307	-18
10	313	351	38
11	311	356	45
12	315	317	2
13	244	271	27
MEAN	298.5	332.2	
2 ST. DEV.	49.1	71.0	
MAX	325	408	
MIN	244	271	
MEDIAN	310	335	

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0140	AREA/LOCATION	Southside of CV – Steel liner, solid concrete structures, concrete block wall, open land areas
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

E. Unbiased Soil Sampling

Eighteen soil samples were obtained in the locations in survey unit OL1-3 listed in the SR. The highest activity was indicated on sample SX-SL-5839 (Sample Point #16) with 0.4 ± 0.1 pCi/g, Cs-137, <0.1 pCi/g, Co-60. Positive Cs-137 results ranged from 0.07 to 0.4 pCi/g. Non-positive results achieved a typical MDA of 0.07 pCi/g, Cs-137. No Co-60 was identified (typical achieved MDA was 0.09 pCi/g).

2. Quality Control (QC) Measurements and Comparisons

- **Repeat Scan/Static measurements and Soil samples** were performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04.

3. Exceptions and Discrepancies: none

David Sarge (GRCS) _____ **Date** 6/16/04

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0147	AREA/LOCATION	CV Yard – Northeast Side of CV and CV Concrete Cap
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

ORIGINAL

RESULTS SUMMARY FOR SR-0147

SR-0147 was issued to perform a Final Status Survey of the remaining Northeast segment of the area surrounding the CV (Class 1) and the concrete cap over the CV shell (Class 3). The survey includes scans, static readings, and applicable soil/core bore samples. The survey unit for this SR is OL1-4 and MA8-3, (grids AX-127 to 130, AY-127 to 130 and AZ-127 to 128).

The SR required the following radiological measurements:

- Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) – 100% scan of OL1-4 (in a serpentine pattern) at a rate not exceeding 10 inches/sec at a distance within 4 inches. The action level is 300 gross cpm.
- Surface Scan Measurements Using a GFPC Detector – 100% surface scan is required of the CV concrete cap in the (36) 1-square meter areas listed on page 6 of the SR. The rate shall not exceed 2.2 cm/sec on contact with the concrete. The action level is 3,000 gross cpm.
- Static Measurements Using a 2" x 2" Sodium Iodide Detector (set to identified Cs-137) – Perform 1-minute static measurements of the 30 locations listed on page 8 of the SR.
- Static Measurements Using a GFPC Detector – Perform 1-minute static measurement pairs of the 10 locations in MA8-3 listed on page 7 of the SR.
- Surface Soil Samples – obtain samples in the 30 locations listed on page 8 of the SR.
- Concrete Core Bore Samples - Obtain samples of areas of MA8-3 when static measurements with a 44-10 detector exceeds the action level.
- QC Repeat Measurements – A minimum of 5% of all surface scan/static measurements and sampling will be re-performed using identical methodology.
- Additional sampling/surveys may be performed at the request of the SR Coordinator.

1. Summary of Results

A. Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137)

100% scan of OL1-4 is required.

Results: 100% scan was performed. Results indicate activity below the action level with five exceptions. The size of each area was 1 square foot and the activities ranged from 314 to 350 cpm.

APPENDIX I

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0147	AREA/LOCATION	CV Yard – Northeast Side of CV and CV Concrete Cap
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

B. Surface Scan Measurements Using a GFPC Detector of the CV Concrete Cap (MA8-3)

~~100% surface scan is required.~~ per s/l/05 Thirty. six $1m^2$ grids were required to be scanned. of slab 5

Results: 100% of the required 36 areas were scanned with a few exceptions due to configuration of CV outline. All areas indicated activity below action level. A total of $7.41 m^2$ was not scanned of slab 5

C. Static Measurements Using a 2" x 2" Sodium Iodide Detector of the Open Land Area (OL1-4)

1-minute static measurements were required in 30 locations.

Results: All locations indicated activity below the action level. The following table lists the results:

Static Measurement Location	Results (gross cpm)	Statistical Results		Sample Number	Sample Results (pCi/g) Cs-137, Co-60.
1	193			SX-SL-6259	<0.1 , <0.12
2	185			SX-SL-6260	0.1 ± 0.05 , <0.09
3	176			SX-SL-6261	<0.09 , <0.1
4	160			SX-SL-6262	0.13 ± 0.06 , <0.1
5	177			SX-SL-6263	<0.12 , <0.08
6	185			SX-SL-6264	0.07 ± 0.05 , <0.09
7	192			SX-SL-6265	<0.15 , <0.14
8	218			SX-SL-6266	1.0 ± 0.14 , <0.1
9	185			SX-SL-6267	0.19 ± 0.07 , <0.12
10	163			SX-SL-6268	0.13 ± 0.06 , <0.07
11	186			SX-SL-6269	<0.14 , <0.1
12	166			SX-SL-6270	<0.1 , <0.1
13	293			SX-OT-6271	<0.1 , <0.1
14	122			SX-OT-6273	<0.09 , <0.09
15	190			SX-SL-6274	0.13 ± 0.06 , <0.1
16	214			SX-SL-6275	<0.13 , <0.09
17	264			SX-OT-6276	<0.1 , <0.1
18	189			SX-SL-6277	0.15 ± 0.06 , <0.09
19	197			SX-SL-6278	0.1 ± 0.05 , <0.1
20	181			SX-SL-6279	0.1 ± 0.08 , <0.12
21	175			SX-SL-6280	0.1 ± 0.06 , <0.09
22	207			SX-SL-6281	0.66 ± 0.15 , <0.13
23	239			SX-SL-6282	0.3 ± 0.09 , <0.14
24	249			SX-SL-6283	0.45 ± 0.1 , <0.1
25	189			SX-SL-6284	<0.07 , <0.09
26	149	MEAN	190.1	SX-SL-6285	0.13 ± 0.06 , <0.07
27	167	2 ST. DEV.	76.7	SX-SL-6286	<0.13 , <0.1
28	232	MAX	293	SX-SL-6287	<0.08 , <0.1
29	122	MIN	122.0	SX-SL-6288	0.12 ± 0.07 , <0.12
30	137	MEDIAN	185.5	SX-SL-6289	0.26 ± 0.08 , <0.1

D. Static Measurements Using a GFPC Detector

Static measurement pairs of 10 locations within MA8-3 is required.

Results: 10 pairs were obtained. The highest unshielded reading indicated 555 cpm.

The following table lists the results:

Static Location Number	Shielded Reading(cpm)	Unshielded Reading(cpm)	Net Difference (ncpm)
MA8-3-1	398	410	12
2	391	555	164
3	344	366	22
4	364	376	12
5	399	410	11
6	345	469	124
7	388	454	66
8	436	456	20
9	447	538	91
10	452	453	1
MEAN	396.4	448.7	
2 ST. DEV.	78.2	124.6	
MAX	452	555	
MIN	344	366	
MEDIAN	394.5	453.5	

E. Surface Soil Samples

Samples were obtained in the 30 static measurement locations in survey unit OL1-4 listed in the SR.

Results: The highest activity was indicated on sample SX-SL-6266 (Sample Point #8) with 1.0 ± 0.14 pCi/g, Cs-137, <0.1 pCi/g, Co-60. Positive Cs-137 results ranged from 0.07 to 1.0 pCi/g. Non-positive results achieved a typical MDA of 0.1 pCi/g, Cs-137. No Co-60 was identified (typical achieved MDA was 0.1 pCi/g).

Five additional samples were obtained of areas indicating activity above the action level via NaI Detector. Two samples indicated positive Cs-137. Results ranged from 0.07 to 0.2 pCi/g. Non-positive results achieved a typical MDA of 0.1 pCi/g, Cs-137. No Co-60 activity was indicated (typical achieved MDA was 0.1 pCi/g).

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0147	AREA/LOCATION	CV Yard – Northeast Side of CV and CV Concrete Cap
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

F. Concrete Core Bore Samples

No samples were necessary due to static measurement results.

2. Quality Control (QC) Measurements and Comparisons

- **Repeat Scan/Static measurements and Soil samples** were performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04 with one exception. The 44-10 scan of the northeast yard indicated all areas scanned < action level except for four areas indicated activity above the action level. These areas were not identified on the initial scan survey. Therefore this comparison does not meet the acceptance criteria. An investigation was performed to establish an explanation for the failure.

  Explanation: Although three areas indicated activity above the action level, the samples obtained of these areas indicated a maximum of 0.07 pCi/g, Cs-137. This indicates activity well below the $DCGL_w$ of 3.4 pCi/g. A review of the gamma spectroscopy reports for these samples indicate up to 1.1 pCi/g, Bi-214. One of the energy lines for this isotope is very close to the Cs-137 661 KeV peak and may be contributing significantly to the response during the 44-10 scan surveys. In addition, this soil type (shale) has historically indicated a substantial presence of Bi-214 isotope with no or very low Cs-137 component.

  Conclusion: Based upon the findings of the investigation, the 44-10 scan results are concluded to the valid.

3. Special Notes:

R. Shepherd performed a quality checking inspection. Observed were the pre-job briefing and the performance of the SR. Two problems were identified and the responsible individual was notified. Both problems were properly addressed and resolved.

4. Exceptions and Discrepancies:

Eight grids of MA8-3 had portions that fell outside the surface boundary of the CV concrete cap. A total of 5.0 m^2 was scan surveyed. The survey designer was notified.

David Sarge (GRCS) _____ Date 8·16·24

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0185	AREA/LOCATION	Phase 4 – Southwest CV Yard Area – solid concrete structures and open land areas
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

RESULTS SUMMARY FOR SR-0185

SR-0185 was issued to perform the FSS of the remaining below-grade Class 1 area in the Southwest segment of the CV Yard, including scans, static measurements, and applicable soil samples. The survey units for this SR are OL1-5 and MA8-4 (grids AW-130, AW-131, AX-130, and AX-131).

The SR required the following radiological measurements:

- Surface Scan Measurements of Solid Structural Concrete - Using a GFPC Detector - scan 100% of the remaining exposed concrete walls similar to an open land survey (a serpentine pattern) at a rate not exceeding 2.2 cm/sec held on contact with the surface (unless not physically possible). The action level is 1500 ncpm. If this level is exceeded and a 1-minute static measurement indicates activity above 2515 ncpm, bound the area and document the estimated area on a survey.

- Surface Scan Measurements of Open Land Areas - Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) – obtain an ABCR by collecting a minimum of three measurements of the fill material adjacent to the survey unit. If the ABCR exceeds 550 cpm, discontinue the survey and contact the SR Coordinator for guidance. Scan 100% of all land areas (in a serpentine pattern) at a rate not exceeding 10 inches/second at a distance within 4 inches. The action level is either 200 ncpm.

- Biased Static Measurements Using a GFPC Detector – Obtain the twelve static measurement pairs at the locations specified in Calculation E900-04-024.

- Soil sampling – Obtain the twelve (12) surface soil samples at all locations specified in Calc. E900-04-024.

- QC Repeat Measurements – A minimum of 5% of all sampling and surveying performed under this SR will be re-performed using identical methodology.

1. Summary of Results

A. Surface Scan Measurements of Solid Concrete Structures using a GFPC Detector

100% scan of the exposed surfaces of the concrete structures is required. The action level was 1500 ncpm.

Results: 100% scan was performed. Scan results indicate activity below the action level.

APPENDIX J

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0185	AREA/LOCATION	Phase 4 – Southwest CV Yard Area – solid concrete structures and open land areas
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

B. Surface Scan Measurements of Open Land Areas using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137

100% surface scan is required. The action level was 200 ncpm.

Results: 100% of the open land areas was scanned. Scan results indicate activity below action level.

C. Static Measurements Using a GFPC Detector of the Solid Concrete Structures

The required sets of measurement pairs were obtained for the concrete structures. The following table lists the results:

Location	Shielded Reading (cpm)	Unshielded Reading (cpm)	Net Difference (ncpm)
FP# 1	235	341	106
FP# 2	209	275	66
FP# 3	284	369	85
FP# 4	225	312	87
FP# 5	206	257	51
FP# 6	237	270	33
FP# 7	228	291	63
FP# 8	319	452	133
FP# 9	311	392	81
FP# 10	312	410	98
FP# 11	263	414	151
FP#12	287	539	252
Mean	260	360	
2 Standard Deviations	83.2	171.0	
Max	319	539	
Min	206	257	
Median	250	355	

E. Soil Sampling

Twelve (12) soil samples were obtained.

Results: The highest activity was indicated on sample SX-SL-8251 (Sample Point #4) with 0.46 ± 0.13 pCi/g, Cs-137, <0.19 pCi/g, Co-60. Positive Cs-137 results ranged from 0.06 to 0.46 pCi/g. Non-positive results achieved a typical MDA of 0.16 pCi/g, Cs-137. No Co-60 was identified (typical achieved MDA was 0.14 pCi/g).

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0185	AREA/LOCATION	Phase 4 – Southwest CV Yard Area – solid concrete structures and open land areas
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

2. Quality Control (QC) Measurements and Comparisons

- **Repeat Scan/Static measurements and Soil sampling** was performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04.

3. Exceptions and Discrepancies: none

David Sarge (GRCS) _____ Date 11-24-04

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0121	AREA/LOCATION	SNEC Yard – Boulders Removed From the East Soil Pile
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

ORIGINAL

RESULTS SUMMARY FOR SR-0121

SR-0121 was issued to perform FSS of the boulders (river rock and bedrock) that was previously removed the East Soil Pile during Shonka surveys. The survey unit for this SR is OL1-Misc-B.

The SR required the following radiological measurements:

- Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) – 100% surface scan is required of each boulder lift segment. Scan measurements shall be performed in a serpentine pattern (0.5 meters wide) at a rate not exceeding 10 inches/second at a distance within 4 inches. The action level is 304 gross cpm.

- Rock Sampling - Obtain samples from each lift segment according to the sampling plan within the SR. Samples indicating activity above 4.3 pCi/g, Cs-137 must be segregated from clean fill.

- QC Repeat Measurements – A minimum of 5% of all surface scan measurements and sampling will be re-performed using identical methodology.

- Additional sampling/surveys may be performed at the request of the SR Coordinator.

1. Summary of Results

A. Surface Scan Measurements (2"x 2" Sodium Iodide Detector)

Surface scanning was performed on four batches, each with 4 subgroups. Action level was 304 gross cpm.

Results: Scans of all batches indicated activity below action level.

B. Rock Sampling

Fifty-six (56) rock samples were obtained according to the sampling plan.

Results: The highest Cs-137 activity indicated on the samples was 0.34 ± 0.07 pCi/g, <0.08 pCi/g Co-60. This sample, SX-OT-5420 was obtained from batch #3, sample #12. Positive Cs-137 samples ranged from 0.05 to 0.34 pCi/g with a typical achieved Co-60 MDA of <0.06 pCi/g.

APPENDIX K

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0121	AREA/LOCATION	SNEC Yard – Boulders Removed From the East Soil Pile
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

ORIGINAL

2. Quality Control (QC) Measurements and Comparisons

- **Repeat Scan measurements and Rock samples** were performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04.

3. Exceptions and Discrepancies: none

4. Special Note:

R. Shepherd performed two quality checking inspections during the performance of this SR. Observations of rock crushing operations and performance of scan surveys were observed. Additionally, survey instrumentation inspection and operability documentation inspection was conducted. No deficiencies were identified.

David Sarge (GRCS) _____ Date 8.25.04

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0122	AREA/LOCATION	SNEC Yard – Soil From the East CV Yard
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

RESULTS SUMMARY FOR SR-0122

SR-0122 was issued to perform FSS of the soil that was previously removed the East CV Yard area during Shonka Surveys. The survey unit for this SR is OL1-Misc-S.

The SR required the following radiological measurements:

- Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) – 100% surface scan is required of each soil lift segment. Scan measurements shall be performed in a serpentine pattern (0.5 meters wide) at a rate not exceeding 10 inches/second at a distance within 4 inches. The action level is 289 gross cpm.

- Surface Soil Sampling - Obtain samples from each lift segment according to the sampling plan within the SR. Samples indicating activity above 4.3 pCi/g, Cs-137 must be segregated from clean fill.

- QC Repeat Measurements – A minimum of 5% of all surface scan measurements and sampling will be re-performed using identical methodology.

- Additional sampling/surveys may be performed at the request of the SR Coordinator.

1. Summary of Results

A. Surface Scan Measurements (2"x 2" Sodium Iodide Detector)

Surface scanning was performed on four batches, each with 3 subgroups. Action level was 200 ncpm.

Results: Scans of all batches indicated activity below action level.

B. Rock Sampling

Sixty-nine (69) soil samples were obtained according to the sampling plan.

Results: The highest Cs-137 activity indicated on the samples was 2.4 ± 0.2 pCi/g, <0.08 pCi/g Co-60. This sample, SX-SL-5190 was obtained from batch #1, sample #11. Positive Cs-137 samples ranged from 0.08 to 2.4 pCi/g with a typical achieved Co-60 MDA of <0.07 pCi/g.

APPENDIX L

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0122	AREA/LOCATION	SNEC Yard – Soil From the East CV Yard
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

2. Quality Control (QC) Measurements and Comparisons

- **Repeat Scan measurements and Rock samples** were performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04.

3. Exceptions and Discrepancies:

Technicians failed to perform an initial surface scan (prior to first filling) of each lift section as required by the SR. This was due to an oversight of the technicians. Since all soil scan survey results indicated activity below action level, this requirement (100% pre-load scan) was not necessary. The RSO was notified.

David Sarge (GRCS) _____ **Date** 8.26.04

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0156	AREA/LOCATION	SNEC Yard – Remaining Boulder Piles
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

ORIGINAL

RESULTS SUMMARY FOR SR-0156

SR-0156 was issued to perform a Final Status Survey of the remaining boulder piles (river rock and bedrock) located in the East Yard. The survey unit was this SR is OL-Misc-B. The survey includes scans and sampling.

The SR required the following radiological measurements:

- Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) –Collect material from piles 3 and 4 to areas and fill the lifts to a depth of 6 inches (remove any plant debris). Perform a 100% scan (in a serpentine pattern) of material at a rate not exceeding 10 inches/sec at a distance within 4 inches. The action level is 304 gross cpm.

- Surface Scan Measurements Using a GFPC Detector – 100% scan is required of all boulders > 6 inches in size in plies 1,2,5, and 6. Additionally, 100% scan is required of six of the largest boulders from piles 3 and 4. Scan rate is not to exceed 2.2 cm/sec on contact with the surface. The action level is 1,200 gross cpm.

- Rock Samples – Obtain samples of rocks < 2 inches in size from the sampling locations identified on pages 8 and 9 in the SR. If activity above 4.3 pCi/g, Cs-137 is identified, contact the SR Coordinator.

- QC Repeat Measurements – A minimum of 5% of all scan/static measurements and sampling will be re-performed using identical methodology.

- Additional sampling/surveys may be performed at the request of the SR Coordinator.

1. Summary of Results

A. Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137)

100% scan (in a serpentine pattern) of material is required.

Results: Scan results indicate all material has activity below the action level.

B. Surface Scan Measurements Using a GFPC Detector

100% scan is required of all boulders > 6 inches in size in plies 1, 2, 5, and 6. Additionally, 100% scan is required of six of the largest boulders from piles 3 and 4.

Results: Scans performed on material from the areas listed above indicated activity below the action level. The material from piles 3 and 4 were sub-grouped into 4 separate lifts (5, 6, 7, and 8).

APPENDIX M

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0156	AREA/LOCATION	SNEC Yard – Remaining Boulder Piles
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

C. **Rock Samples**

Fifty-six (56) samples were obtained (14 from each of the four lifts).

Results: The highest Cs-137 activity, indicated on sample SX-OT-6747, was 0.36 ± 0.08 pCi/g, <0.08 pCi/g Co-60. This sample was obtained from Lift #5. Positive Cs-137 samples ranged from 0.08 to 0.36 pCi/g. Typical achieved Co-60 MDA was 0.1 pCi/g.

2. Quality Control (QC) Measurements and Comparisons

- **Repeat Scan measurements and Soil samples** were performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04.

3. Exceptions and Discrepancies: none

4. Special Notes:

R. Shepherd performed a quality checking inspection on 8/17/04. Primarily observed technicians performing surveys. No discrepancies were identified.

David Sarge (GRCS) _____ Date 9-16-04

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0170	AREA/LOCATION	SNEC Yard – Soil From the East CV Yard
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

ORIGINAL

RESULTS SUMMARY FOR SR-0170

SR-0170 was issued to perform FSS of the soil removed the East CV Yard area during remediation activities. The survey unit for this SR is OL1-Misc-S. Eight soil lifts are included in this SR, (15.24 m by 6.55 m).

The SR required the following radiological measurements:

- Surface Scan Measurements Using a 2" x 2" Sodium Iodide Detector (set to identify Cs-137) – 100% surface scan is required of each soil lift segment. Scan measurements shall be performed in a serpentine pattern (0.5 meters wide) at a rate not exceeding 10 inches/second at a distance within 4 inches. The action level is 289 gross cpm.

- Surface Soil Sampling - Obtain samples from each lift segment according to the sampling plan within the SR. Samples indicating activity above 4.3 pCi/g, Cs-137 must be segregated for disposal.

- QC Repeat Measurements – A minimum of 5% of all surface scan measurements and sampling will be re-performed using identical methodology.

- Additional sampling/surveys may be performed at the request of the SR Coordinator.

1. Summary of Results

A. Surface Scan Measurements (2"x 2" Sodium Iodide Detector)

Surface scanning was performed on two batches. Action level was 289 gross cpm.

Results: Scans of all batches indicated activity below action level.

B. Surface Soil Sampling

Thirty-five (35) soil samples were obtained according to sampling plans 1A and 1B..

Results: The highest Cs-137 activity indicated on the samples was 2.0 ± 0.27 pCi/g, <0.16 pCi/g Co-60. This sample, SX-SL-7752 was obtained from lift plan 1A, SP18. Positive Cs-137 samples ranged from 0.18 to 2.0 pCi/g with a typical achieved Co-60 MDA of 0.15 pCi/g.

APPENDIX N

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-0170	AREA/LOCATION	SNEC Yard – Soil From the East CV Yard
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

2. Quality Control (QC) Measurements and Comparisons

- **Repeat Scan measurements and Soil samples** were performed and met the applicable acceptance criteria established in Section 4.6 of E900-IMP-4520.04.

3. Special Note:

Due to a change in decommissioning plans, the soil lift areas were disassembled on 10/18/04 and the remaining volume of remediation effort soils will be scanned via SRA.

David Sarge (GRCS) _____ **Date** 12-9-04