FirstEnergy Corp.

SNEC CALCULATION COVER SHEET

CALCULATION DESCRIPTION

Calculation Number	Revision Number	Effective Date	Page Number
E900-04-013	0	7/15/04	1 of 10

Subject

CV Yard Survey Design – North East Side of CV

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	7/15/04
Technical Reviewer	**P. Donnachie/** P. Donnachie	Date	7/15/04
Additional Review	**A. Paynter/**	Date	16 July 04
Additional Review	N/A	Date	
SNEC Management Approval		Date	

1.0 PURPOSE

1.1 The purpose of this calculation is to develop a survey design for one (1) CV Yard open land area (OL1-4), and a concrete cap poured over the cut-off CV Dome area. These are below grade, Class 1 and Class 3 survey units to be surveyed IAW **Reference 3.1** and **3.2**.

2.0 SUMMARY OF RESULTS

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

2.1 The open land area begins at the ~804' El (the cut-off elevation of the CV shell), and extends to about grade level at ~811' El. This survey unit is bounded on the eastern side by the remaining CV yard area at grade level, and on the southern edge by a wing wall extension from the CV support structure. A line from a well in the north extending to the center of the CV bounds this area on the western side. These landmarks are shown in **Attachment 1-1**. This survey area is located in site area OL1 and the open land survey unit is designated ***OL1-4***.

2.2 The poured concrete cap over the CV area is designated ***MA8-3***.

2.3 These survey units are to be classified and scanned as follows:

2.3.1 The open land area is a Class 1 survey unit of ***~441 m^2*** (***OL1-4***) (100% scan coverage).

2.3.2 Concrete cap over CV is a Class 3 survey unit of ***~182 m^2*** (***MA8-3***) (scan randomly chosen 1 m^2 grids as shown on **Attachment 2-1**, (~31 m^2 = ~17% scan coverage).

2.4 The open land area survey unit should be scanned using a NaI detector. A Gas Flow Proportional Counter (GFPC) beta radiation detection system should be used to survey the concrete cap over the CV. Scanning parameters for these two areas are listed below.

SUMMARY OF SCANNING PARAMETERS

Area or Structure	Instrument Type Used	Scan Speed	Surface to Detector Face	Calculated MDCscan Values
OL1-4 (soil)	NaI (2" by 2" Cs-137 Window)	9.8" per sec (25 cm/sec)	4" (10.2 cm)	2.2 to 4.4 pCi/g (100 – 400 cpm bkgnd)
MA8-3 (concrete cap)	GFPC (beta)	0.9" per sec (2.2 cm/sec)	Contact	929 dpm/100 cm^2

Soil survey parameters taken from Reference 3.3. Concrete cap survey parameters taken from Attachment 3-1.

2.5 NaI Scanning Criteria

2.5.1 A ***2" D by 2" L NaI detector*** with a Cs-137 window setting shall be used. The window will straddle the Cs-137 662 keV full energy peak width.

2.5.2 The NaI instrument conversion factor/efficiency shall not be less than ***208 cpm/uR/h*** (used for planning purposes). See **Reference 3.3** for site listing of typical instrument efficiency factors (Cs-137).

2.5.3 Scan in a serpentine pattern that is ~0.5 meters wide (soil and fill materials).

2.6 The effective DCGLw values for the CV Yard area are listed below. The US NRC has reviewed and concurred with the derivation logic for applicable DCGL determination. See **Attachment 4-1** to **4-6**.

DCGLw Table

Volumetric DCGLw (pCi/g – Cs-137)	Surface Gross Activity DCGLw (dpm/100 cm²)
5.73 (4.3 A.L.)	44,434 (33,325 A.L.)

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

2.7 GFPC Scanning of Concrete Cap over CV

A Gas Flow Proportional Counter (GFPC) shall be used to scan the MA8-3 structure in one square meter blocks designated 1 through 36 on **Attachment 2-1**. The following parameters were used to develop this survey design.

GFPC Detection Efficiency Results Used for Planning

Material Type	ε_i*	ε_s	ε_t (as %)	% Cs-137	Resulting counts/disintegration
Concrete	0.478	0.5	23.9%	0.5952	0.142

*See **Reference 3.3** for examples of typical detector efficiency factors (as of 6/1/04).

NOTE 1: Total efficiency should not be less than ε_t value for any instrument used during this survey effort.
NOTE 2: No efficiency correction factor (for rough surfaces) is applied for the CV concrete cap area.

2.8 Alarm Set-Points

Based on the expected minimum detection efficiency, the following are the alarm set-points for these survey units.

Alarm Set-Points

Area or Structure	Instrument Type Used	Alarm Set (gross cpm)	DCGL (in ncpm)
OL1-4 (soil)	NaI (2" by 2" Cs-137 Window)*	300	~200*
MA8-3 (concrete cap)	GFPC (gross beta)	3,000	5,879

* See **Reference 3.3** for information used to establish this factor.

2.8.1 All survey personnel shall be trained to identify count rates at or above these alarm set-points.

2.8.2 If an alarm set point is reached during any 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 tools.

2.9 Sample elevated areas(s) IAW SNEC Procedure E900-IMP-4520.04 **(Reference 3.2)** and the following.

2.9.1 Clearly mark, identify and document all sample locations

2.11.2 Sample any location that is above the action level cited is Section 2.8 above.

2.11.3 For concrete, a 4" long core bore sample is preferred so that the depth of penetration can be identified. However, when a core bore cannot be taken because of the lack of volume, quality of concrete, or because of limited access in the area, sampling should remove the first 1" of material and yield a volume of at least 200 cc to ensure an adequate counting MDA for Cs-137 (a 4" diameter area by 1" deep = ~200 cc).

2.10 The minimum number of sampling points indicated for these survey units by the Compass computer program (**Reference 3.5**) are listed in the following Table. See **Attachments 5-1** to **5-4** for Compass results for OL1-4 area, and **Attachment 6-1** to **6-2** for Compass results for the MA8-3 area. Diagrams of measurement or sampling points are provided in **Attachment 7-1** to **7-2** for OL1-4, and **Attachment 8-1** to **8-2** for MA8-3.

Minimum Number of Samples or Fixed Point Measurements per Area

Survey Unit No.	Classification	No. of Points
OL1-4 (soil)	Class 1	26
MA8-3 (solid concrete cap)	Class 3	8

2.11 VSP (**Reference 3.6**) is used to plot all sampling and measurement points on the included diagrams. In some cases, the actual number of random start systematically spaced sample/measurement points may be greater than that required by the Compass computer code because of:

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

2.11.1 The starting points for physically locating sites in the excavation area (OL1-4) are based on measurements from the CV outer shell and an angle center within the CV Pad. All key measurement points are marked on **Attachment 7-2**. Once the key points are located in the survey unit, a triangular grid system of sampling points must be laid out over the contour of each survey unit.

NOTE

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

2.11.2 When an obstruction is encountered that will not allow collection of a sample or placement of a measurement point, ***contact the cognizant SR coordinator for permission to delete or move the point. Document any adjustments made.***

NOTE

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

3.0 REFERENCES

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

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

3.3 SNEC Calculation E900-04-009, "CV Yard Survey Design – South Side of CV".

3.4 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.

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

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

3.7 SNEC Procedure E900-IMP-4520.06, "Survey Unit Inspection in Support of FSS Design".

3.8 SNEC Calculation No. E900-04-005, "CV Yard Survey Design – North West Side of CV".

3.9 Plan SNEC Facility License Termination Plan.

3.10 ISO 7503-1, Evaluation of Surface Contamination, Part 1: Beta-emitters (maximum beta energy greater than 0.15 MeV) and alpha-emitters, 1988.

3.11 SNEC Facility Historical Site Assessment, Rev 0, March, 2000.

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

3.13 NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual", August, 2000.

3.14 Microsoft Excel 97, Microsoft Corporation Inc., SR-2, 1985-1997.

4.0 ASSUMPTIONS AND BASIC DATA

4.1 Remediation History

A review of the survey history of this open land area (OL1-4) adjacent to the CV shell, was conducted in support of this survey design. Surface and subsurface sample data collected in conjunction with installation of the anchor bolts, grout curtain, and various wells within this area, and previously scanned back-fill materials make up the sample data base for this general area. However, only a few soil samples were taken from this area during the recent post remediation survey effort (SR-0136). Therefore, it is assumed that this area has a similar variability as the North West sector (**Reference 3.8**). The few samples that do exist suggest that the use of North West sector sample results will be a conservative choice for use as a variability estimate. Earlier remediation history in this area is reported in the SNEC facility Historical Site Assessment document (**Reference 3.11**) and the 1994 Soil Remediation Project Report.

The concrete cap over the cut-off CV Dome area (MA8-3) was added by the SNEC site to prevent groundwater from entering the below grade dome area that was previously surveyed. Therefore, the only source of contamination for this structure is cross contamination from soil or structures in the CV yard. Since the surrounding area has been

remediated there is little chance cross contamination could have occurred. Thus the concrete cap is probably free of any surface contamination.

4.2 Remediation has impacted radionuclide concentration levels in this survey unit. Remediation efforts have been shown to be effective in lowering the average concentration of Cs-137 in this area. Therefore, the impact of remediation must be considered in determining the effective Cs-137 DCGLw surrogate value. Remediation of this survey unit was largely complete by about July of 2001. Samples collected prior to this date have been disqualified in the final listing which was decayed to January 15th, 2004. In all, about twenty three (23) sample results were used to determine the best representative mix for this survey unit.

4.3 The Compass computer program is used to calculate the required number of random start systematically spaced samples (or measurements) to be taken in each survey unit (**Reference 3.5**). An off-site soil background from **Reference 3.9** is used to estimate background for input to the Compass program (see **Attachment 5-3**), and Williamsburg concrete GFPC measurements were used to estimate a background value for concrete (see **Attachment 9-1**).

4.4 Soil samples from **Reference 3.8** are used as the initial estimate of variability for this survey area. These results are shown on **Attachment 10-1.**

4.5 Concrete variability measurements were performed at the start of this work under SR-0143 and are reported in **Attachment 11-1.**

4.6 The MARSSIM WRS Test criteria will be used for work in this area.

4.7 This survey design uses Cs-137 as a surrogate to bound the average volumetric concentration for all SNEC facility related radionuclides in the survey unit. The effective DCGLw (in pCi/g) 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.

4.8 The sample data base used to determine the effective radionuclide mix for the CV Yard area has been drawn from samples assayed at off-site laboratories. This list is shown in **Attachment 4-2**, 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-41. The data shows Cs-137 and H-3 (99%) to be the predominant radioactive contaminants found in this area. Sr-90 and Co-60 on the other hand, were also positively identified, but constitute less than 1% of the mix. The gross activity DCGLw considers all beta emitting radionuclides above the energy required to enter the detectors active volume. However, Cs-137 remains the primary beta radiation producer.

The decayed sample results were input to the spreadsheet titled "Effective DCGL Calculator for Cs-137" (**Reference 3-12**) to determine the effective volumetric and surface DCGLw values for the OL1-3 area. The output of this spreadsheet is shown on **Attachment 4-4** and **4-6.**

4.9 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 range of background values in the CV Yard area varies from about 100 cpm to ~400 cpm (see **Reference 3.4**).

4.10 These survey units were inspected after remediation efforts were shown effective. A copy of portions of the SNEC facility post-remediation inspection report is included as **Attachment 12-1**.

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

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

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

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

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

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

4.17 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 1 for both a 10,000 square meter area as well as for a 1 square meter area (see **Attachment 5-1**).

4.18 Area factors for structural surfaces are not appropriate for Class 3 areas (MA8-3).

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**, is a diagram of survey unit OL1-4 and MA8 –3.

6.2 **Attachment 2-1**, is diagram of survey unit MA8-3 showing randomly placed scanning areas 1 through 36.

6.3 **Attachment 3-1** and **3-2** are the calculations used to determine the scan MDC for the MA8-3 area.

6.4 **Attachment 4-1** to **4-6**, are the DCGL calculation logic for the CV Yard area showing the samples used in the mix ratios.

6.5 **Attachment 5-1** to **5-4**, are Compass output for the OL1-4 area.

6.6 **Attachment 6-1 to 6-2**, are Compass output for the MA8-3 area

6.7 **Attachment 7-1** to **7-2**, are diagrams of area OL1-4 showing the VSP selected sample locations for this survey unit.

6.8 **Attachment 8-1** to **8-2**, are diagrams of area MA8-3 showing the VSP selected fixed point locations for this survey unit.

6.9 **Attachment 9-1**, are background concrete GFPC measurements from Williamsburg (FSS-001).

6.10 **Attachment 10-1**, is the soil variability results for soil samples from the OL1-2 area collected IAW **Reference 3.8** requirements.

6.11 **Attachment 11-1**, is the concrete surface variability measurements from MA8-3.

6.12 **Attachment 12-1**, is a copy of the inspection report for the OL1-4 and MA8-3 areas.

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).

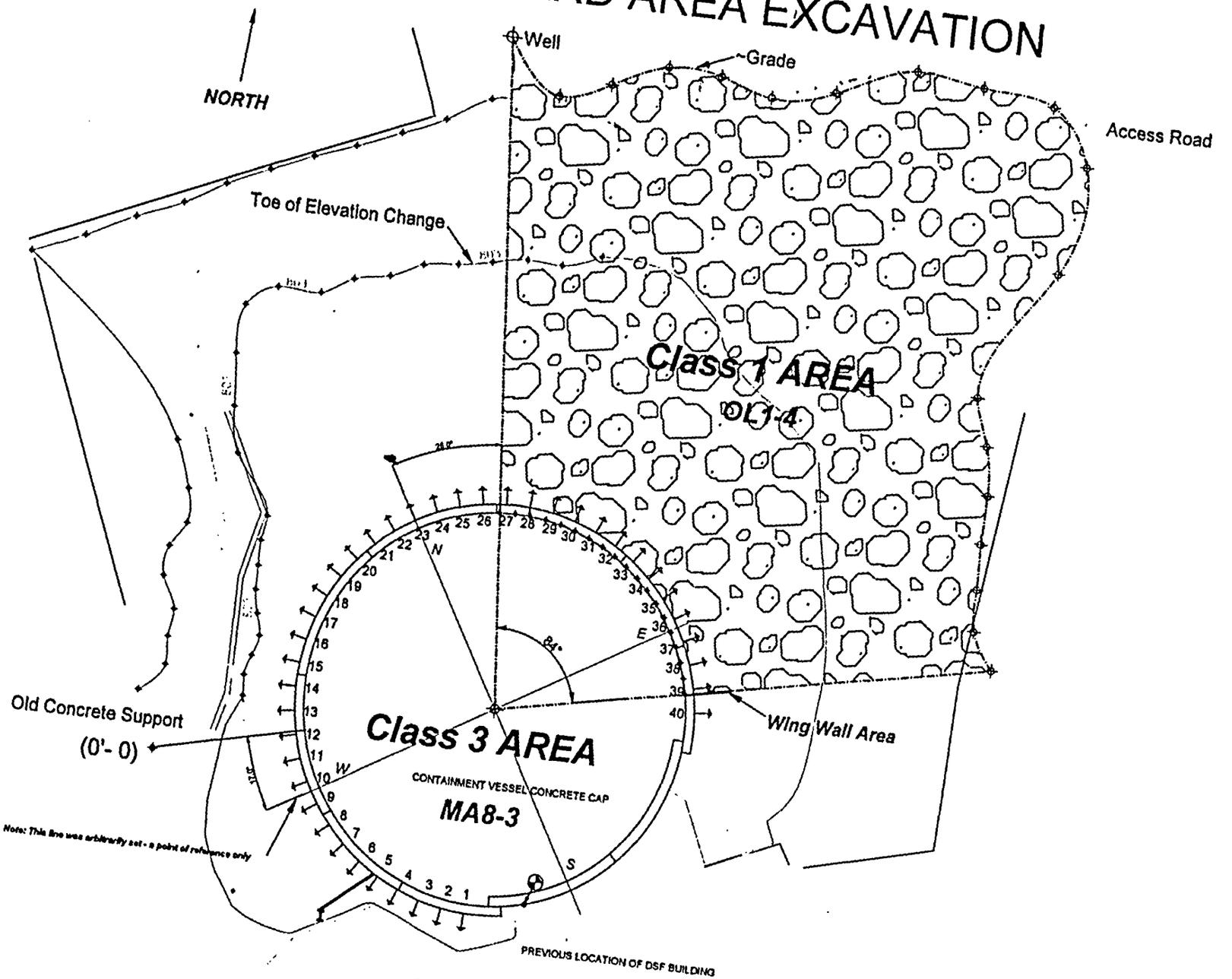
Exhibit 2

Survey Design Checklist

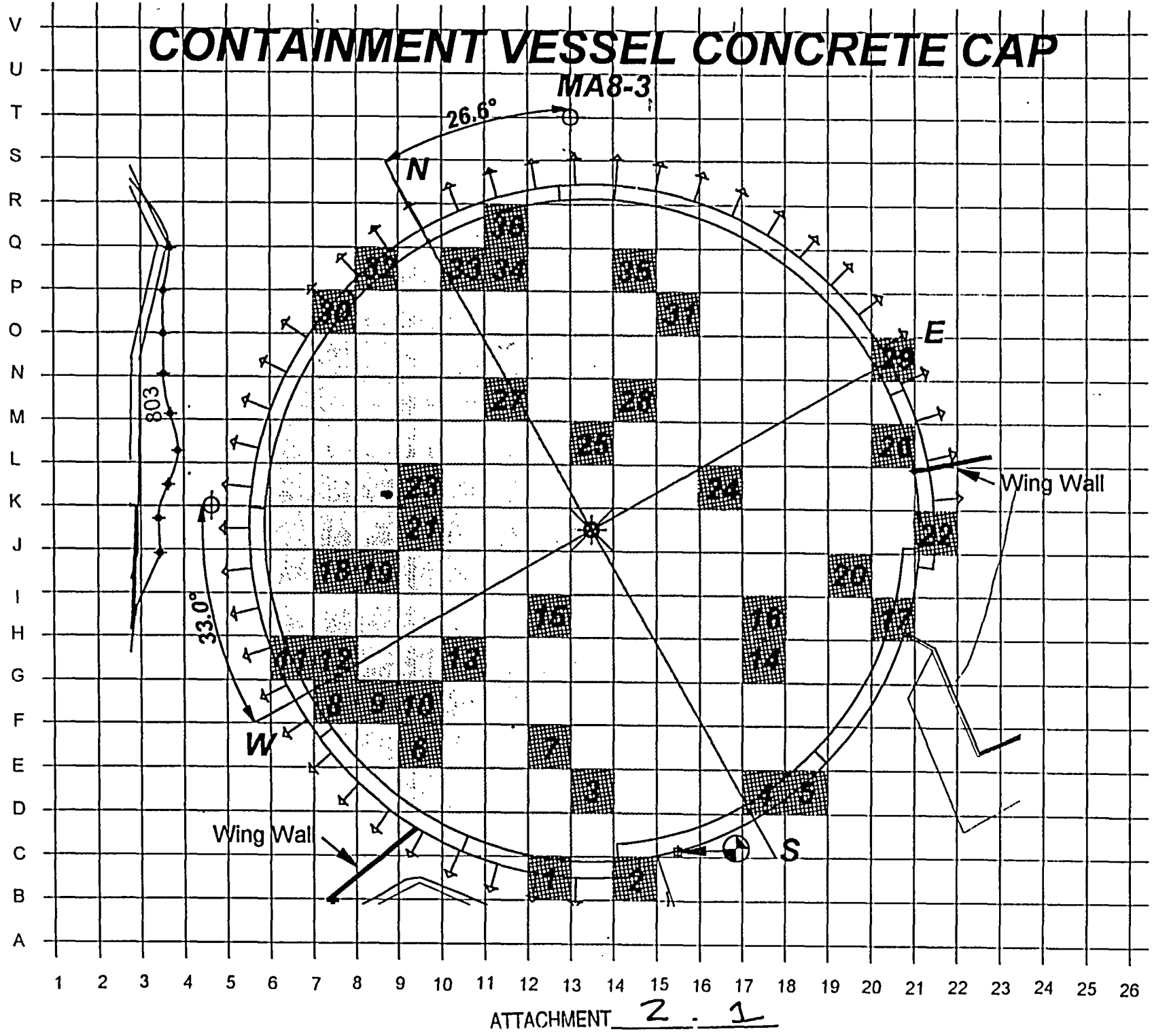
Calculation No. E900-04-013	Location Codes OL1-4 & MA8-3		
ITEM	**REVIEW FOCUS**	**Status (Circle One)**	**Reviewer Initials & Date**
1	Has a survey design calculation number been assigned and is a survey design summary description provided?	(Yes) N/A	AD 7/15/04
2	Are drawings/diagrams adequate for the subject area (drawings should have compass headings)?	(Yes) N/A	AD 7/15/04
3	Are boundaries properly identified and is the survey area classification clearly indicated?	(Yes) N/A	AD 7/15/04
4	Has the survey area(s) been properly divided into survey units IAW EXHIBIT 10	(Yes) N/A	AD 7/15/04
5	Are physical characteristics of the area/location or system documented?	(Yes) N/A	AD 7/15/04
6	Is a remediation effectiveness discussion included?	(Yes) N/A	AD 7/15/04
7	Have characterization survey and/or sampling results been converted to units that are comparable to applicable DCGL values?	(Yes) N/A	AD 7/15/04
8	Is survey and/or sampling data that was used for determining survey unit variance included?	(Yes) N/A	AD 7/15/04
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	AD 7/15/04
10	Are applicable survey and/or sampling data that was used to determine variability included?	(Yes) N/A	AD 7/15/04
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)	AD 7/15/04
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)	AD 7/15/04
13	Are all necessary supporting calculations and/or site procedures referenced or included?	(Yes) N/A	AD 7/15/04
14	Has an effective DCGLw been identified for the survey unit(s)?	(Yes) N/A	AD 7/15/04
15	Was the appropriate $DCGL_{EMC}$ included in the survey design calculation?	(Yes) N/A	AD 7/15/04
16	Has the statistical tests that will be used to evaluate the data been identified?	(Yes) N/A	AD 7/15/04
17	Has an elevated measurement comparison been performed (Class 1 Area)?	(Yes) N/A	AD 7/15/04
18	Has the decision error levels been identified and are the necessary justifications provided?	(Yes) N/A	AD 7/15/04
19	Has scan instrumentation been identified along with the assigned scanning methodology?	(Yes) N/A	AD 7/15/04
20	Has the scan rate been identified, and is the MDCscan adequate for the survey design?	(Yes) N/A	AD 7/15/04
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)	AD 7/15/04
22	Is survey instrumentation calibration data included and are detection sensitivities adequate?	(Yes) N/A	AD 7/15/04
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	AD 7/15/04
24	Are investigation levels and administrative limits adequate, and are any associated actions clearly indicated?	(Yes) N/A	AD 7/15/04
25	For sample analysis, have the required MDA values been determined.?	Yes, (N/A)	AD 7/15/04
26	Has any special sampling methodology been identified other than provided in Reference 6.3?	Yes, (N/A)	AD 7/15/04

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

NORTH EAST CV YARD AREA EXCAVATION



ATTACHMENT 1 - 1



ATTACHMENT 2.1

Beta Scan Measurement MDC Calculation

MA8-3, Concrete Cap-Over CV Dome

$\varepsilon_i := .478$ $\varepsilon_s := .5 \cdot .5952$ $b := 306$ $p := 0.5$ $W_d := 8.8$ $S_r := 2.2$ $d := 1.38$ $A := 100$

$\frac{W_d}{S_r} = 4$ *Observation Interval (seconds)* $O_i := \frac{W_d}{S_r}$ *Observation Interval (seconds)*

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

$\varepsilon_t := \varepsilon_i \cdot \varepsilon_s$

$\varepsilon_t = 0.1423$

$b_i = 20.4$ *Counts in observation Interval*

$C := \frac{1}{\left(\varepsilon_i \cdot \varepsilon_s \cdot \frac{A}{100}\right) \cdot \sqrt{p}}$

$C = 9.942$

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

$MDCR_i = 93.5$ *net counts per minute*

$MDCR_i + b = 399.494$ *gross counts per minute*

$\frac{MDCR_i}{O_i} = 23.4$ *net counts per minute in observation interval*

$MDC_{scan} := C \cdot MDCR_i$

$MDC_{scan} = 929.479$ *dpm per 100 cm^2*

where:

b = *background counts per minute*

b_i = *background counts in observation interval*

p = *human performance factor*

W_d = *detector width in centimeters*

S_r = *scan rate in centimeters per second*

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

MDC_{scan} = *Minimum Detectable Concentration for scanning (dpm/100 square centimeters)*

C = *constant used to convert MDCR to MDC*

ε_i = *instrument efficiency (counts/emission)*

ε_s = *source efficiency (emissions/disintegration)*

A = *instrument physical probe area (in square centimeters)*

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 4.1

Attachment 4-2

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-128, 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	SXSL2649	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 @ 6' 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-128, 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	6.66E+00	7.97E-02	June 29, 2002	565
7	SXSL1130	North CV Yard Soil AX-129, 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-128, 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 26, 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	SXSL2649	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 @ 6' 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

C01

Attachment 4-3

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%

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 4-4

C03

BWB 7/15/04

TABLE 3 - REDUCED LISTING - DECAYED - MDA's REMOVED (Except Cs-137)

	SNBC Sample No	LAB No.	Location/Description	H-3	Sr-90	Co-60	Cs-137	Total pCi/g
1	CV Tunnel	SWXT, 0100806-01	CV Tunnel Sediment Composite, OL1		9.01E+00	8.69E-01	1.17E+00	1179.69
2	SXB6L88719	111074	Subsurface Sample #28 (0-6'), AY-128, OL1				8.36E-01	9.84
3	SXBL1083	Teledyne-80918; L19184-1	North CV Yard Soil BA-127, 817' E, Sample # 5, OL2	4.20E+00			8.68E-01	9.05
4	SXBL1089	Teledyne-80919; L19184-2	North CV Yard Soil AY-127, 810' E, Sample # 3, OL1	2.78E+00			1.24E+00	4.02
5	SXBL1115	Teledyne-80920; L19184-3	North CV Yard Soil AY-128, 804' E, Sample # 2, OL1	4.47E+00			1.74E+00	9.21
6	SXBL1122	Teledyne-80921; L19184-4	North CV Yard Soil AY-128, 799' E, Sample # 3, OL1	3.18E+00			4.80E+00	7.76
7	SXBL1130	Teledyne-80922; L19184-5	North CV Yard Soil AX-128, 803' E, Sample # 4, OL1	4.84E+00		2.44E-02	2.19E+01	26.42
8	SXBL1132	Teledyne-80923; L19184-6	North CV Yard Soil AZ-130, Sample # 6, OL1	2.77E+00			2.80E+00	9.23
9	SXBL1270	SWXT, 0100806-02	AX-128, 2-3, Soil, CV Pit Side @ Face CV, 802' E, OL1				2.19E+01	21.82
10	SXBL1281	SWXT, 0100806-01	AX-128, 3-1, Soil, CV Tunnel East @ Face CV, 800' E, OL1				4.14E+00	4.14
11	SXBL2648	Teledyne-73220; L19977-3	Arabia Well, A-3, 8 to 10' Depth, OL1				8.74E-01	0.87
12	SXBL2671	Teledyne-71949; L17838-11	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, OL1				8.37E-01	0.84
13	SXBL2672	Teledyne-71948; L17838-10	CV Area - East Yard Dirt Pile - Bottom (deep log section), OL1				8.68E-02	0.10
14	SXBL3140	SWXT, 1030-003-10-01	East CV Yard, Soil Pits @ 8' on West Side (8' Depth), OL1				7.90E-01	0.80
15	SXBL3142	Teledyne; L20230-3	Soil Pits, CV Yard, Three Feet on East Side, BR-37, OL1				8.81E-01	0.89
16	SXBL3145	SWXT, 1030-003-10-01	East CV Yard, Soil Pits @ 3' on East Side (8' Depth), OL1				1.32E+00	1.22
17	SXBL3149	Teledyne; L20230-4	Soil Pits, CV Yard, Six Feet on East Side, BR-37, OL1				2.90E-01	0.29
18	SXBL3153	SWXT, 1030-003-10-01	East CV Yard, Soil Pits @ Top (8' Depth), OL1				2.91E-01	0.29
19	SXBL4142	Teledyne; L22187-2	CV Yard Soil - West Side, AP1-7, OL1				8.94E-01	0.89
20	SXBL4143	Teledyne; L22187-3	CV Yard Soil - West Side, AP1-7, OL1				4.07E-01	0.90
21	SXBL4148	Teledyne; L22187-4	CV Yard Soil - West Side, AP1-7, OL1			6.74E-02	3.37E+00	3.94

BWB 7/15/04

TABLE 4 - % OF TOTAL CALCULATION

	SNBC Sample No	LAB No.	Location/Description	H-3	Sr-90	Co-60	Cs-137	Total
1	CV Tunnel	SWXT, 0100806-01	CV Tunnel Sediment Composite, OL1		0.79%	0.07%	99.15%	100.0%
2	SXB6L88719	111074	Subsurface Sample #28 (0-6'), AY-128, OL1				100.00%	100.0%
3	SXBL1083	Teledyne-80918; L19184-1	North CV Yard Soil BA-127, 817' E, Sample # 5, OL2	46.07%			95.95%	100.0%
4	SXBL1089	Teledyne-80919; L19184-2	North CV Yard Soil AY-127, 810' E, Sample # 3, OL1	69.04%			99.99%	100.0%
5	SXBL1115	Teledyne-80920; L19184-3	North CV Yard Soil AY-128, 804' E, Sample # 2, OL1	72.04%			97.99%	100.0%
6	SXBL1122	Teledyne-80921; L19184-4	North CV Yard Soil AY-128, 799' E, Sample # 3, OL1	40.98%			99.34%	100.0%
7	SXBL1130	Teledyne-80922; L19184-5	North CV Yard Soil AX-128, 803' E, Sample # 4, OL1	17.33%		0.09%	82.58%	100.0%
8	SXBL1132	Teledyne-80923; L19184-6	North CV Yard Soil AZ-130, Sample # 6, OL1	69.23%			97.77%	100.0%
9	SXBL1270	SWXT, 0100806-02	AX-128, 2-3, Soil, CV Pit Side @ Face CV, 802' E, OL1				100.00%	100.0%
10	SXBL1281	SWXT, 0100806-01	AX-128, 3-1, Soil, CV Tunnel East @ Face CV, 800' E, OL1				100.00%	100.0%
11	SXBL2648	Teledyne-73220; L19977-3	Arabia Well, A-3, 8 to 10' Depth, OL1				100.00%	100.0%
12	SXBL2671	Teledyne-71949; L17838-11	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, OL1				100.00%	100.0%
13	SXBL2672	Teledyne-71948; L17838-10	CV Area - East Yard Dirt Pile - Bottom (deep log section), OL1				100.00%	100.0%
14	SXBL3140	SWXT, 1030-003-10-01	East CV Yard, Soil Pits @ 8' on West Side (8' Depth), OL1				100.00%	100.0%
15	SXBL3142	Teledyne; L20230-3	Soil Pits, CV Yard, Three Feet on East Side, BR-37, OL1				100.00%	100.0%
16	SXBL3145	SWXT, 1030-003-10-01	East CV Yard, Soil Pits @ 3' on East Side (8' Depth), OL1				100.00%	100.0%
17	SXBL3149	Teledyne; L20230-4	Soil Pits, CV Yard, Six Feet on East Side, BR-37, OL1				100.00%	100.0%
18	SXBL3153	SWXT, 1030-003-10-01	East CV Yard, Soil Pits @ Top (8' Depth), OL1				100.00%	100.0%
19	SXBL4142	Teledyne; L22187-2	CV Yard Soil - West Side, AP1-7, OL1				100.00%	100.0%
20	SXBL4143	Teledyne; L22187-3	CV Yard Soil - West Side, AP1-7, OL1				100.00%	100.0%
21	SXBL4148	Teledyne; L22187-4	CV Yard Soil - West Side, AP1-7, OL1			1.71%	98.29%	100.0%
			Means	0.557209972	0.007843045	0.000625001	0.839541181	1.41
			Sigmas	0.241		0.009	0.284	
			Mean % of Totals	39.50%	0.64%	0.44%	59.51%	100.00%
			2 Sigma + Means	1.04E+00	7.84E-03	2.50E-02	1.41E+00	2.48
			% of Totals	41.91%	0.31%	1.01%	56.77%	100.00%

Effective DCGL Calculator for Cs-137 (dpm/100 cm^2)

Gross Activity DCGLw		Gross Activity Administrative Limit	
44434	dpm/100 cm^2	33325	dpm/100 cm^2

25.0 mrem/y TEDE Limit

SAMPLE NO(s)⇒ CV YARD SOIL & BOULDER SAMPLES

Cs-137 Limit		Cs-137 Administrative Limit	
26445	dpm/100 cm^2	19834	dpm/100 cm^2

SNEC AL	75%

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	Individual Limits (dpm/100 cm^2)	Allowed dpm/100 cm^2	mrem/y TEDE	Beta dpm/100 cm^2	Alpha dpm/100 cm^2	
1	Am-241		0.000%	27	0.00	0.00	N/A	0.00	Am-241
2	C-14		0.000%	3,700,000	0.00	0.00	0.00	N/A	C-14
3	Co-60	6.25E-03	0.443%	7,100	196.87	0.69	196.87	N/A	Co-60
4	Cs-137	2.65E-01	59.515%	28,000	26444.68	23.61	26444.7	N/A	Cs-137
5	Eu-152		0.000%	13,000	0.00	0.00	0.00	N/A	Eu-152
6	H-3	5.57E-01	39.500%	120,000,000	17551.45	0.00	Not Detectable	N/A	H-3
7	Ni-63		0.000%	1,800,000	0.00	0.00	Not Detectable	N/A	Ni-63
8	Pu-238		0.000%	30	0.00	0.00	N/A	0.00	Pu-238
9	Pu-239		0.000%	28	0.00	0.00	N/A	0.00	Pu-239
10	Pu-241		0.000%	880	0.00	0.00	Not Detectable	N/A	Pu-241
11	Sr-90	7.64E-03	0.542%	8,700	240.75	0.69	240.75	N/A	Sr-90
			100.000%		44434	25.0	26882	0	
					Maximum Permissible dpm/100 cm^2				

ATTACHMENT 4 - 6

Site Report

Site Summary

Site Name: CV Yard Area (OL1-4)

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

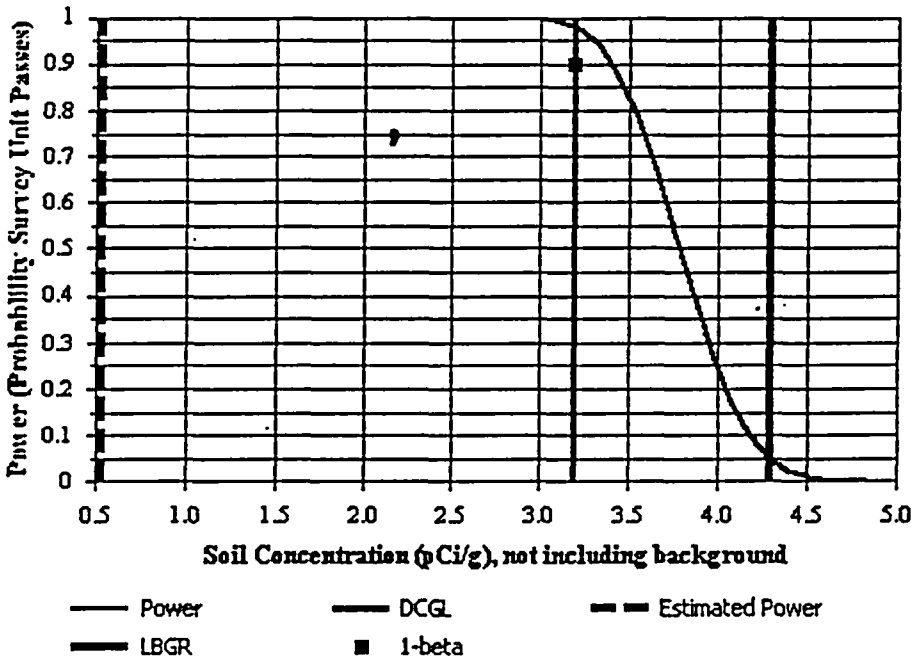
ATTACHMENT 5.1

Surface Soil Survey Plan

Survey Plan Summary

Site:	CV Yard Area (OL1-4)		
Planner(s):	BHB		
Survey Unit Name:	CV Yard Area (OL1-4)		
Comments:	North East Area		
Area (m²):	441	Classification:	1
Selected Test:	WRS	Estimated Sigma (pCi/g):	1.06
DCGL (pCi/g):	4.30	Sample Size (N/2):	26
LBGR (pCi/g):	3.2	Estimated Conc. (pCi/g):	0.5
Alpha:	0.050	Estimated Power:	1
Beta:	0.100	EMC Sample Size (N):	26
Scanning Instrumentation:	NaI 2" by 2" (W)		

Prospective Power Curve



ATTACHMENT 5.2

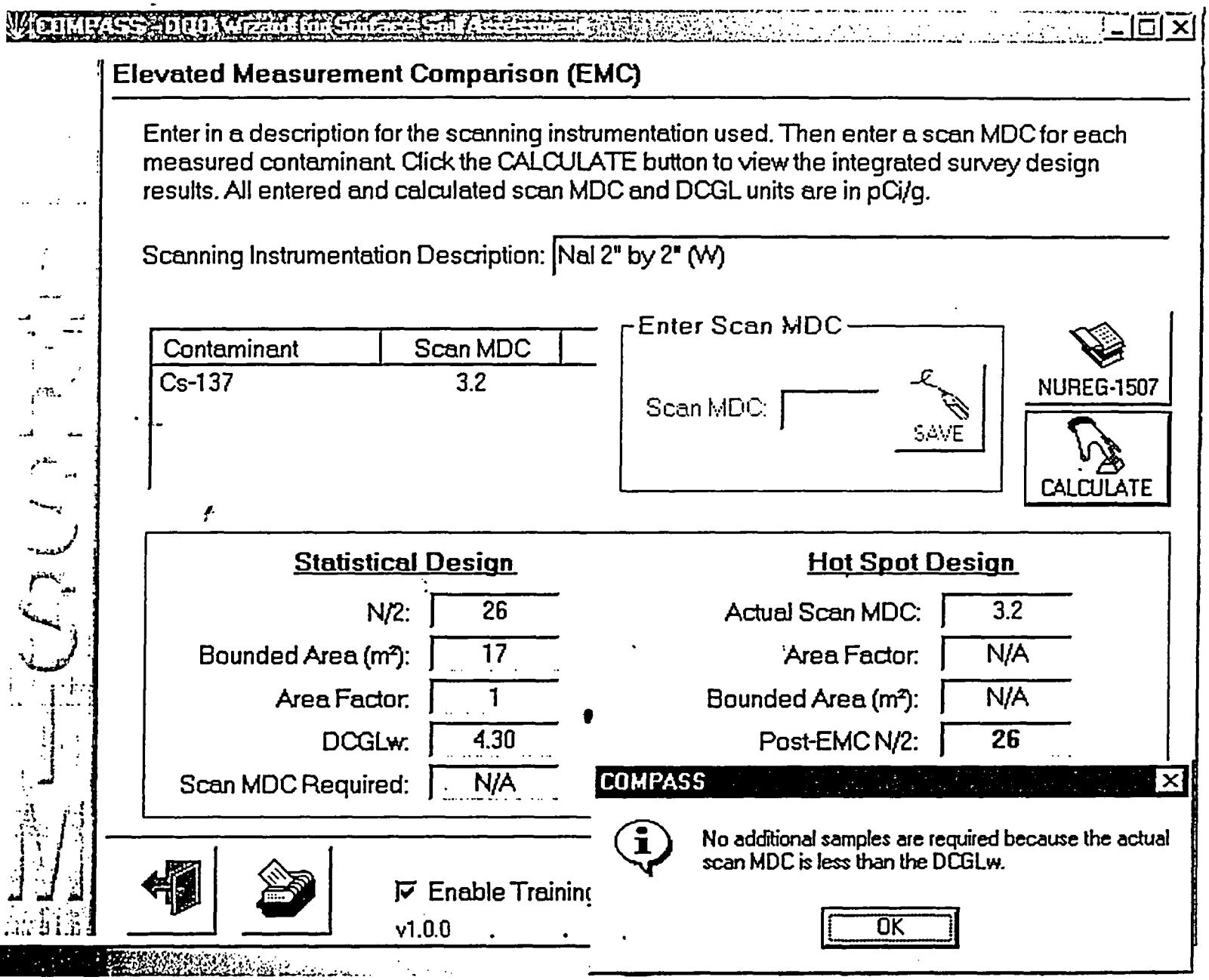
Surface Soil Survey Plan

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	3.2

Contaminant	Survey Unit Estimate (Mean ± 1-Sigma) (pCi/g)	Reference Area Estimate (Mean ± 1-Sigma) (pCi/g)
Cs-137	0.82 ± 1.06	0.28 ± 0.39

ATTACHMENT 5.3



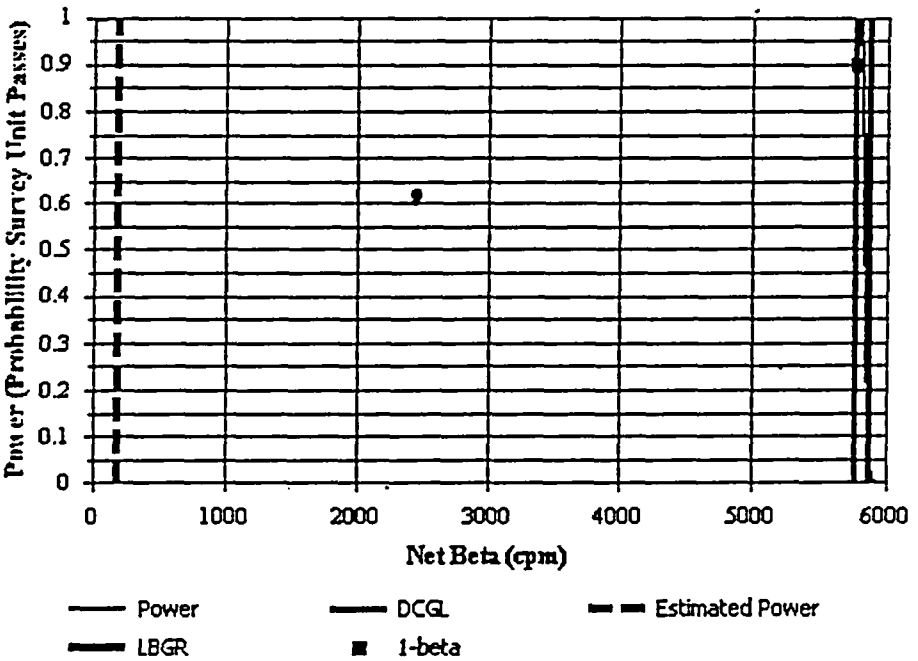
ATTACHMENT 5.4

Building Surface Survey Plan

Survey Plan Summary

Site:	Concrete Cap Over CV dome		
Planner(s):	BHB		
Survey Unit Name:	CV Dome Cap - MA8-3		
Comments:			
Area (m^2):	182	Classification:	3
Selected Test:	WRS	Estimated Sigma (cpm):	38.7
DCGL (cpm):	5,879	Sample Size (N/2):	8
LBGR (cpm):	5,770	Estimated Conc. (cpm):	187
Alpha:	0.050	Estimated Power:	1.00
Beta:	0.100		

Prospective Power Curve



ATTACHMENT 6 - 1

Building Surface Survey Plan

Contaminant Summary

Contaminant	DCGLw (dpm/100 cm²)
Gross Activity	33,325

Beta Instrumentation Summary

Gross Beta DCGLw (dpm/100 cm²): 33,325
Total Efficiency: 0.14
Gross Beta DCGLw (cpm): 5,879

ID	Type	Mode	Area (cm²)
23	GFPC	Beta	126

Contaminant	Energy[1]	Fraction[2]	Inst. Eff.	Surf. Eff.	Total Eff.
Gross Activity	187.87	1.0000	0.48	0.30	0.1423

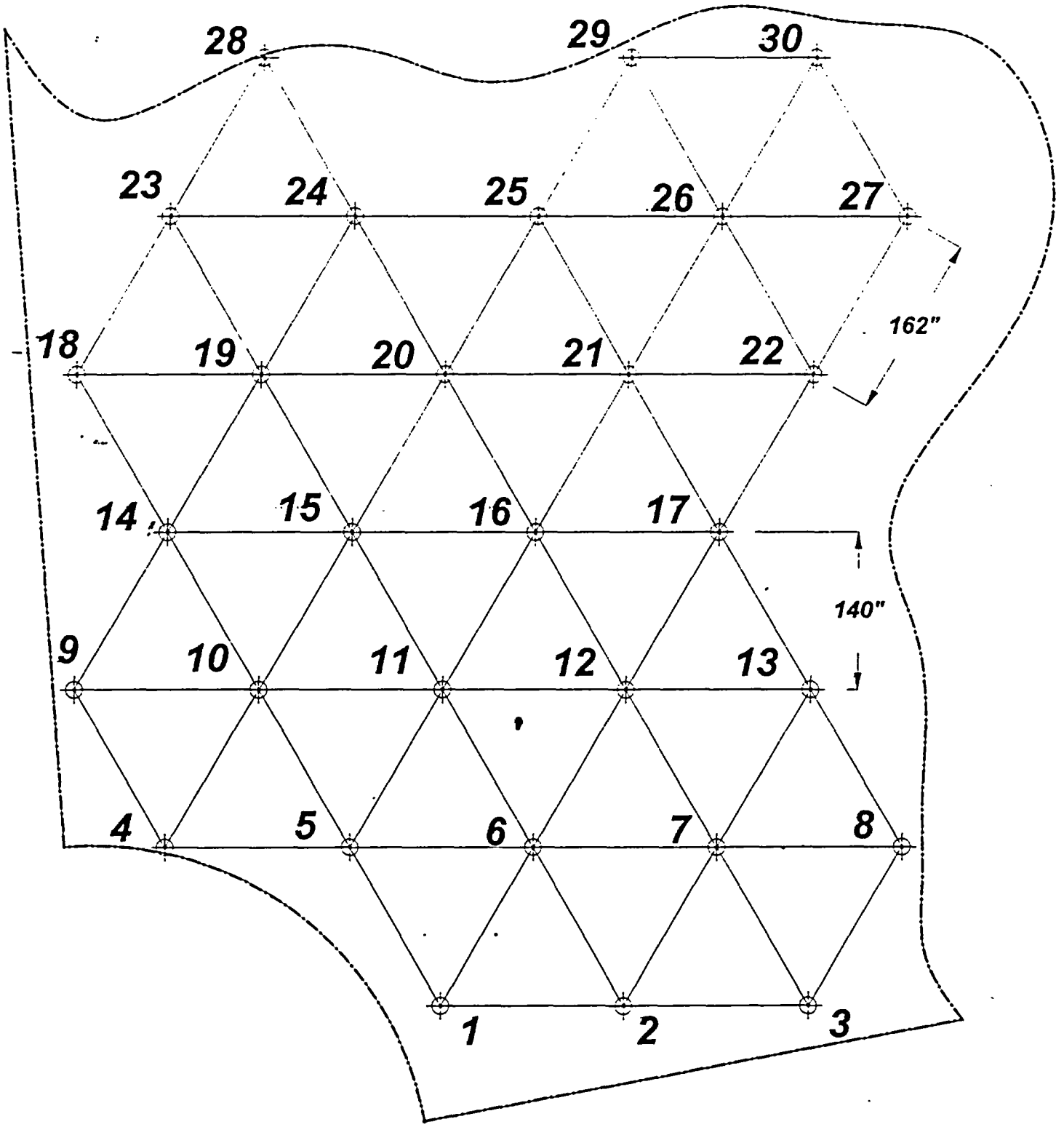
[1] Average beta energy (keV) [N/A indicates alpha emission]
[2] Activity fraction

Gross Survey Unit Mean (cpm): 493 ± 39 (1-sigma)
Count Time (min): 1

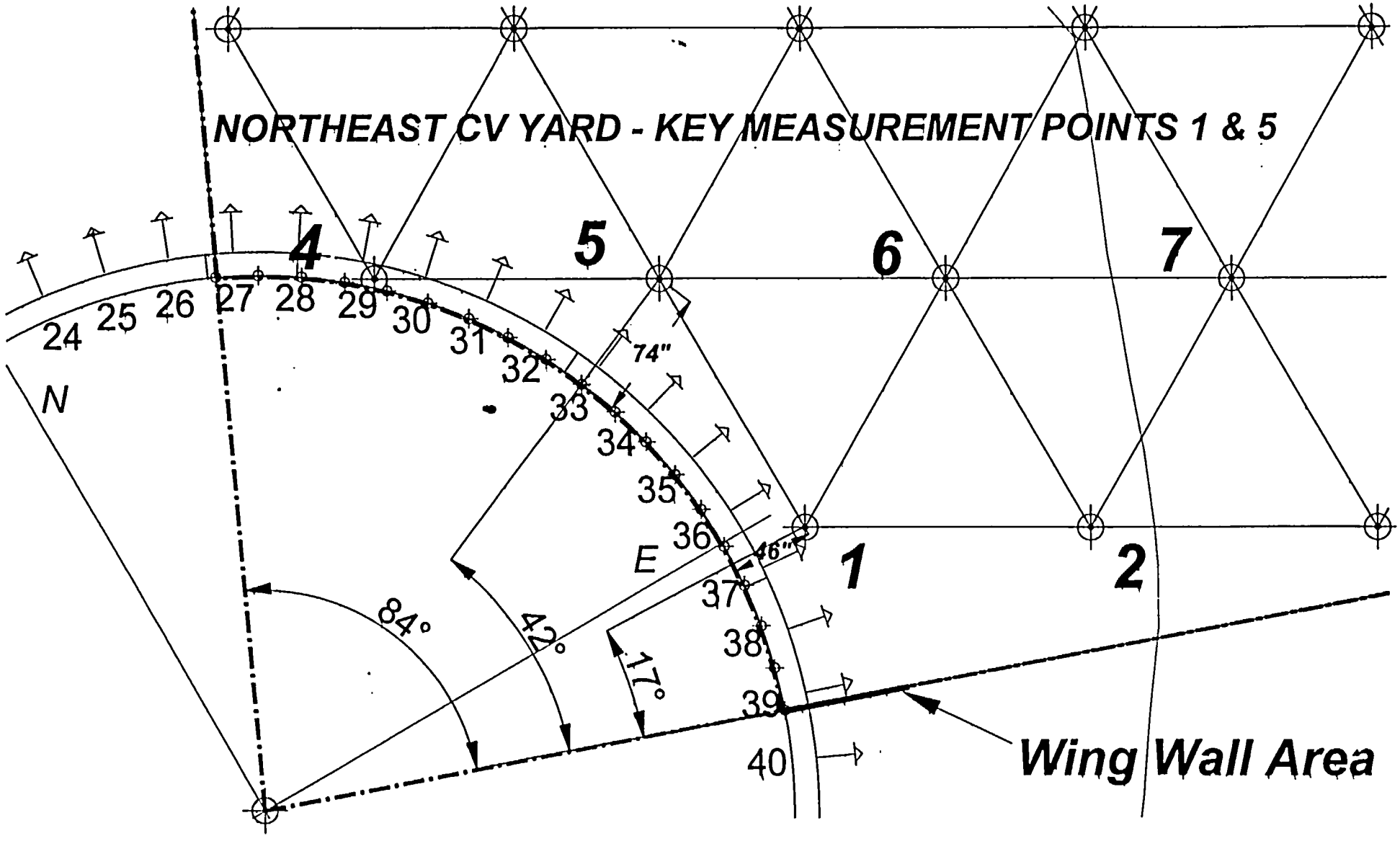
Material	Number of BKG Counts	Average (cpm)	Standard Deviation (cpm)	MDC (dpm/100 cm²)
Concrete	31	306	34.5	478

ATTACHMENT 6 - 2

North East CV Yard Area
OL1-4

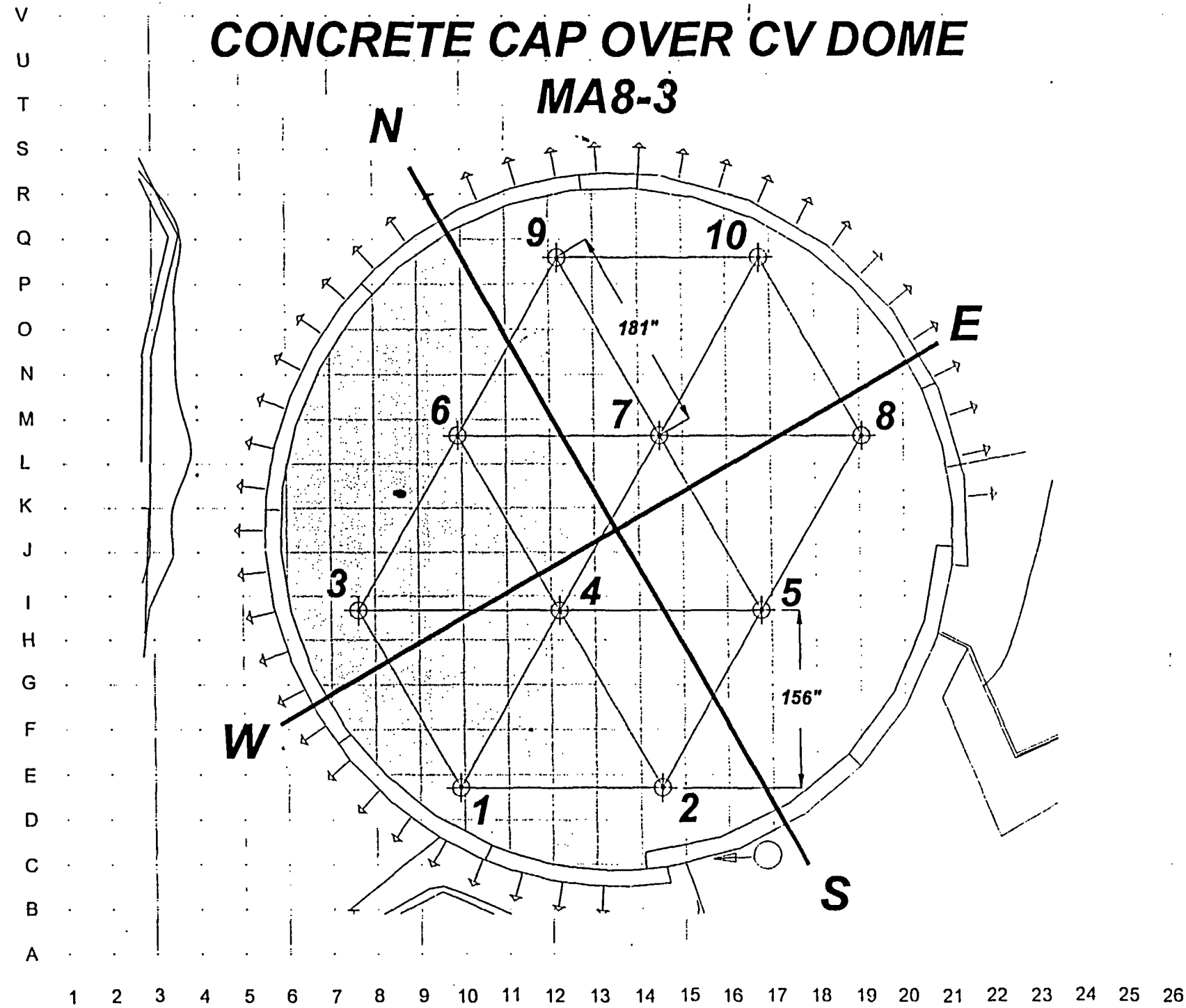


ATTACHMENT 7.1



ATTACHMENT 7.2

ATTACHMENT 8-1



MA8-3 Concrete Cap Over CV Dome

Sample No.	Grid No.	X-Coordinate	Y-Coordinate
1	D9	36"	28"
2	D14	19"	28"
3	H7	25"	26"
4	H12	8"	26"
5	H16	30"	26"
6	L9	36"	25"
7	L14	19"	25"
8	L19	2"	25"
9	P12	8"	23"
10	P6	31"	23"

ATTACHMENT 8.2

Williamsburg Concrete Background Measurements

37122N21	Instrument 95348	RLM6220	Time	Detector	Counts	Count Time (sec)	Mode	Designator		FSS-001	BHB
0	BKGND	1/4/2002	8:52	1	7.26E+03	1800	SCL	Inital Background	β		
1	Source Check	1/4/2002	9:07	1	1.79E+05	60	SCL	Source	β		
2	BKGND	1/4/2002	10:05	2	4.40E+01	1800	SCL	Inital Background	α	Concrete CF(conv) ⇒	0
14	Source Check	1/4/2002	10:39	2	1.51E+05	60	SCL	Source	α	Shielded	Unshielded
15	CON A1S	1/4/2002	13:00	1	2.78E+02	60	SCL	Shielded	β	2.78E+02	
16	CON A1U	1/4/2002	13:02	1	3.88E+02	60	SCL	Unshielded	β		3.88E+02
17	CON A2S	1/4/2002	13:20	1	2.39E+02	60	SCL	Shielded	β	2.39E+02	
18	CON A2U	1/4/2002	13:21	1	2.22E+02	60	SCL	Unshielded	β		2.22E+02
19	CON A3S	1/4/2002	13:28	1	2.39E+02	60	SCL	Shielded	β	2.39E+02	
20	CON A3U	1/4/2002	13:30	1	2.62E+02	60	SCL	Unshielded	β		2.62E+02
21	CON A4S	1/4/2002	13:36	1	2.45E+02	60	SCL	Shielded	β	2.45E+02	
22	CON A4U	1/4/2002	13:38	1	2.71E+02	60	SCL	Unshielded	β		2.71E+02
23	CON A5S	1/4/2002	13:58	1	2.00E+02	60	SCL	Shielded	β	2.00E+02	
24	CON A5U	1/4/2002	14:00	1	2.82E+02	60	SCL	Unshielded	β		2.82E+02
25	CON A6S	1/4/2002	14:03	1	1.84E+02	60	SCL	Shielded	β	1.84E+02	
26	CON A6U	1/4/2002	14:05	1	3.10E+02	60	SCL	Unshielded	β		3.10E+02
27	CON A7S	1/4/2002	14:09	1	1.98E+02	60	SCL	Shielded	β	1.98E+02	
28	CON A7U	1/4/2002	14:10	1	3.15E+02	60	SCL	Unshielded	β		3.15E+02
29	CON A8S	1/4/2002	14:19	1	2.34E+02	60	SCL	Shielded	β	2.34E+02	
30	CON A8S	1/4/2002	14:22	1	2.31E+02	60	SCL	Shielded	β	2.31E+02	
31	CON A8U	1/4/2002	14:24	1	2.88E+02	60	SCL	Unshielded	β		2.88E+02
32	CON A9S	1/4/2002	14:31	1	2.65E+02	60	SCL	Shielded	β	2.65E+02	
33	CON A9U	1/4/2002	14:33	1	2.89E+02	60	SCL	Unshielded	β		2.89E+02
34	CON A10S	1/4/2002	14:42	1	2.46E+02	60	SCL	Shielded	β	2.46E+02	
35	CON A10U	1/4/2002	14:43	1	3.16E+02	60	SCL	Unshielded	β		3.16E+02
36	CON A11S	1/4/2002	15:10	1	1.95E+02	60	SCL	Shielded	β	1.95E+02	
37	CON A11U	1/4/2002	15:12	1	2.94E+02	60	SCL	Unshielded	β		2.94E+02
38	CON A12S	1/4/2002	15:13	1	2.21E+02	60	SCL	Shielded	β	2.21E+02	
39	CON A12U	1/4/2002	15:14	1	2.84E+02	60	SCL	Unshielded	β		2.84E+02
40	CON A13S	1/4/2002	15:23	1	1.74E+02	60	SCL	Shielded	β	1.74E+02	
41	CON A13U	1/4/2002	15:24	1	2.94E+02	60	SCL	Unshielded	β		2.94E+02
42	CON A14S	1/4/2002	15:25	1	1.96E+02	60	SCL	Shielded	β	1.96E+02	
43	CON A14U	1/4/2002	15:26	1	3.33E+02	60	SCL	Unshielded	β		3.33E+02
44	CON A15S	1/4/2002	15:28	1	2.16E+02	60	SCL	Shielded	β	2.16E+02	
45	CON A15U	1/4/2002	15:29	1	3.45E+02	60	SCL	Unshielded	β		3.45E+02
46	CON A16S	1/4/2002	15:30	1	1.83E+02	60	SCL	Shielded	β	1.83E+02	
47	CON A16U	1/4/2002	15:31	1	3.13E+02	60	SCL	Unshielded	β		3.13E+02
48	CON A17S	1/4/2002	15:33	1	1.82E+02	60	SCL	Shielded	β	1.82E+02	
49	CON A17U	1/4/2002	15:34	1	3.22E+02	60	SCL	Unshielded	β		3.22E+02
50	CON A18S	1/4/2002	15:35	1	1.84E+02	60	SCL	Shielded	β	1.84E+02	
51	CON A18U	1/4/2002	15:36	1	3.24E+02	60	SCL	Unshielded	β		3.24E+02
52	CON A19S	1/4/2002	15:37	1	1.91E+02	60	SCL	Shielded	β	1.91E+02	
53	CON A19U	1/4/2002	15:39	1	3.07E+02	60	SCL	Unshielded	β		3.07E+02
54	CON A20S	1/4/2002	15:40	1	1.94E+02	60	SCL	Shielded	β	1.94E+02	
55	CON A20U	1/4/2002	15:41	1	3.33E+02	60	SCL	Unshielded	β		3.33E+02
56	CON A21S	1/4/2002	15:57	1	2.23E+02	60	SCL	Shielded	β	2.23E+02	
57	CON A21U	1/4/2002	15:58	1	2.92E+02	60	SCL	Unshielded	β		2.92E+02
58	CON A22S	1/4/2002	15:59	1	1.72E+02	60	SCL	Shielded	β	1.72E+02	
59	CON A22U	1/4/2002	16:00	1	2.80E+02	60	SCL	Unshielded	β		2.80E+02
60	CON A23S	1/4/2002	16:01	1	1.94E+02	60	SCL	Shielded	β	1.94E+02	
61	CON A23U	1/4/2002	16:02	1	3.29E+02	60	SCL	Unshielded	β		3.29E+02
62	CON A24S	1/4/2002	16:04	1	1.87E+02	60	SCL	Shielded	β	1.87E+02	
63	CON A24U	1/4/2002	16:05	1	3.48E+02	60	SCL	Unshielded	β		3.48E+02
64	CON A25S	1/4/2002	16:06	1	2.07E+02	60	SCL	Shielded	β	2.07E+02	
65	CON A25U	1/4/2002	16:07	1	3.72E+02	60	SCL	Unshielded	β		3.72E+02
66	CON A26S	1/4/2002	16:09	1	2.09E+02	60	SCL	Shielded	β	2.09E+02	
67	CON A26U	1/4/2002	16:10	1	3.26E+02	60	SCL	Unshielded	β		3.26E+02
68	CON A27S	1/4/2002	16:11	1	2.07E+02	60	SCL	Shielded	β	2.07E+02	
69	CON A27U	1/4/2002	16:12	1	3.30E+02	60	SCL	Unshielded	β		3.30E+02
70	CON A28S	1/4/2002	16:14	1	2.30E+02	60	SCL	Shielded	β	2.30E+02	
71	CON A28U	1/4/2002	16:15	1	3.06E+02	60	SCL	Unshielded	β		3.06E+02
72	CON A29S	1/4/2002	16:20	1	2.13E+02	60	SCL	Shielded	β	2.13E+02	
73	CON A29U	1/4/2002	16:21	1	2.58E+02	60	SCL	Unshielded	β		2.58E+02
74	CON A30S	1/4/2002	16:24	1	2.33E+02	60	SCL	Shielded	β	2.33E+02	
75	CON A30U	1/4/2002	16:25	1	2.89E+02	60	SCL	Unshielded	β		2.89E+02
76	CON A31S	1/4/2002	16:28	1	1.84E+02	60	SCL	Shielded	β	1.84E+02	
77	CON A31U	1/4/2002	16:29	1	2.63E+02	60	SCL	Unshielded	β		2.63E+02
—	Source Check	1/4/2002	17:27	1	1.70E+05	60	SCL	—	β		

Minimum ⇒	1.72E+02	2.22E+02
Maximum ⇒	2.78E+02	3.88E+02
Mean ⇒	2.11E+02	3.06E+02
Sigma ⇒	2.69E+01	3.45E+01

ATTACHMENT 9-1

OL1-1 POST REMEDIATION SAMPLES Onsite analysis		
Sample Number	Grid	Cs-137 pCi/g
SX-SL-1281	AX-128	4.5
SX-SL-1282	AX-128	0.94
SX-SL-1283	AX-128	3
SX-SL-1284	AX-128	1.4
SX-SL-4076	AX-128	0.9
SX-SL-4073	AX-128	0.07
SX-SL-1285	AX-128	1.5
SX-SL-1228	AX-130	0.48
SX-SL-1229	AX-130	0.15
SX-SL-1230	AX-130	3.7
SX-SL-1231	AX-130	0.49
SX-SL-1232	AX-130	1.25
SX-SL-1126	AZ-130	0.36
SX-SL-1127	AZ-130	0.64
SX-SL-1128	AZ-130	0.22
SX-SL-1132	AZ-130	2
SX-SL-1104	AZ-129	0.08
SX-SL-1105	AZ-129	0.34
SX-SL-1106	AZ-129	0.78
SX-SL-1107	AZ-129	0.25
SX-SL-1108	AZ-129	0.28
SX-SL-1099	AZ-128	1.2
SX-SL-1100	AZ-128	0.12
SX-SL-1101	AZ-128	0.07
SX-SL-1102	AZ-128	0.2
SX-SL-1103	AZ-128	0.23
SX-SL-1075	AX-127	0.23
SX-SL-1076	AX-127	0.16
SX-SL-1077	AX-127	0.7
SX-SL-1078	AX-127	0.13
SX-SL-1079	AX-127	0.13
SX-SL-1087	AY-127	0.08
SX-SL-1088	AY-127	0.07
SX-SL-1089	AY-127	0.05
SX-SL-1090	AY-127	0.06
SX-SL-1091	AY-127	0.07
SX-SL-1027	AZ-127	0.35
SX-SL-1028	AZ-127	0.57
SX-SL-1029	AZ-127	0.5
SX-SL-1030	AZ-127	0.45
SX-SL-1031	AZ-127	0.7
SX-SL-1233	AY-130	0.14
SX-SL-1234	AY-130	0.6
SX-SL-1235	AY-130	1.3
SX-SL-1121	AY-129	0.035
SX-SL-1122	AY-129	4.3
SX-SL-1221	AY-128	0.17
SX-SL-1222	AY-128	1.1
SX-SL-1223	AY-128	2.1
SX-SL-1224	AY-128	2
SX-SL-1225	AY-128	1.75
SX-SL-4083	AX-129	0.3
SX-SL-4082	AX-129	0.14
	Max	4.50
	Avg	0.82
	STDEV	1.06
Denotes < MDA		

	OL1-1 POST REMEDIATION SAMPLES Onsite analysis, with additional samples		
	Sample Number	Grid	Cs-137 pCi/g
	SX-SL-1281	AX-128	4.5
	SX-SL-1282	AX-128	0.94
	SX-SL-1283	AX-128	3
	SX-SL-1284	AX-128	1.4
	SX-SL-4076	AX-128	0.9
1	SX-SL-4135	AP1-1	0.06
2	SX-SL-4136	AP1-2	0.1
3	SX-SL-4137	AP1-3	0.17
4	SX-SL-4138	AP1-4	0.16
5	SX-SL-4133	AP1-5	0.06
6	SX-SL-4134	AP1-6	0.05
7	SX-SL-4139	AP1-7	0.06
8	SX-SL-4140	AP1-8	0.05
9	SX-SL-4141	AP1-9	0.06
10	SX-SL-4142	AP1-10	0.9
11	SX-SL-4143	AP1-11	0.5
12	SX-SL-4149	AP1-12	3.9
13	SX-SL-4150	AP1-13	0.05
14	SX-SL-4152	AP1-14	0.06
	SX-SL-4073	AX-128	0.07
	SX-SL-1285	AX-128	1.5
	SX-SL-1228	AX-130	0.48
	SX-SL-1229	AX-130	0.15
	SX-SL-1230	AX-130	3.7
	SX-SL-1231	AX-130	0.49
	SX-SL-1232	AX-130	1.25
	SX-SL-1126	AZ-130	0.36
	SX-SL-1127	AZ-130	0.64
	SX-SL-1128	AZ-130	0.22
	SX-SL-1132	AZ-130	2
	SX-SL-1104	AZ-129	0.08
	SX-SL-1105	AZ-129	0.34
	SX-SL-1106	AZ-129	0.78
	SX-SL-1107	AZ-129	0.25
	SX-SL-1108	AZ-129	0.28
	SX-SL-1099	AZ-128	1.2
	SX-SL-1100	AZ-128	0.12
	SX-SL-1101	AZ-128	0.07
	SX-SL-1102	AZ-128	0.2
	SX-SL-1103	AZ-128	0.23
	SX-SL-1075	AX-127	0.23
	SX-SL-1076	AX-127	0.16
	SX-SL-1077	AX-127	0.7
	SX-SL-1078	AX-127	0.13
	SX-SL-1079	AX-127	0.13
	SX-SL-1087	AY-127	0.08
	SX-SL-1088	AY-127	0.07
	SX-SL-1089	AY-127	0.05
	SX-SL-1090	AY-127	0.06
	SX-SL-1091	AY-127	0.07
	SX-SL-1027	AZ-127	0.35
	SX-SL-1028	AZ-127	0.57
	SX-SL-1029	AZ-127	0.5
	SX-SL-1030	AZ-127	0.45
	SX-SL-1031	AZ-127	0.7
	SX-SL-1233	AY-130	0.14
	SX-SL-1234	AY-130	0.6
	SX-SL-1235	AY-130	1.3
	SX-SL-1121	AY-129	0.035
	SX-SL-1122	AY-129	4.3
	SX-SL-1221	AY-128	0.17
	SX-SL-1222	AY-128	1.1
	SX-SL-1223	AY-128	2.1
	SX-SL-1224	AY-128	2
	SX-SL-1225	AY-128	1.75
	SX-SL-4083	AX-129	0.3
	SX-SL-4082	AX-129	0.14
		Max	4.50
		Avg	0.74
		STDEV	1.05
	Denotes < MDA		

	OL1-1 POST REMEDIATION SAMPLES Onsite analysis, with even more samples		
	Sample Number	Grid	Cs-137 pCi/g
	SX-SL-1281	AX-128	4.5
	SX-SL-1282	AX-128	0.94
	SX-SL-1283	AX-128	3
	SX-SL-1284	AX-128	1.4
	SX-SL-4076	AX-128	0.9
	SX-SL-4135	AP1-1	0.06
	SX-SL-4136	AP1-2	0.1
	SX-SL-4137	AP1-3	0.17
	SX-SL-4138	AP1-4	0.16
	SX-SL-4133	AP1-5	0.06
	SX-SL-4134	AP1-6	0.05
	SX-SL-4139	AP1-7	0.06
	SX-SL-4140	AP1-8	0.05
	SX-SL-4141	AP1-9	0.06
	SX-SL-4142	AP1-10	0.9
	SX-SL-4143	AP1-11	0.5
	SX-SL-4149	AP1-12	3.9
	SX-SL-4150	AP1-13	0.05
	SX-SL-4152	AP1-14	0.06
1	SX-SL-4153		0.05
2	SX-SL-4154		0.05
3	SX-SL-4158		0.06
4	SX-SL-4156		0.14
5	SX-SL-4157		0.03
6	SX-SL-4160		0.06
7	SX-SL-4161		0.05
8	SX-SL-4162		0.05
9	SX-SL-4159		0.08
10	SX-SL-4164		0.07
11	SX-SL-4165		0.08
	SX-SL-4073	AX-128	0.07
	SX-SL-1285	AX-128	1.5
	SX-SL-1228	AX-130	0.48
	SX-SL-1229	AX-130	0.15
	SX-SL-1230	AX-130	3.7
	SX-SL-1231	AX-130	0.49
	SX-SL-1232	AX-130	1.25
	SX-SL-1126	AZ-130	0.36
	SX-SL-1127	AZ-130	0.64
	SX-SL-1128	AZ-130	0.22
	SX-SL-1132	AZ-130	2
	SX-SL-1104	AZ-129	0.08
	SX-SL-1105	AZ-129	0.34
	SX-SL-1106	AZ-129	0.78
	SX-SL-1107	AZ-129	0.25
	SX-SL-1108	AZ-129	0.28
	SX-SL-1099	AZ-128	1.2
	SX-SL-1100	AZ-128	0.12
	SX-SL-1101	AZ-128	0.07
	SX-SL-1102	AZ-128	0.2
	SX-SL-1103	AZ-128	0.23
	SX-SL-1075	AX-127	0.23
	SX-SL-1076	AX-127	0.16
	SX-SL-1077	AX-127	0.7
	SX-SL-1078	AX-127	0.13
	SX-SL-1079	AX-127	0.13
	SX-SL-1087	AY-127	0.08
	SX-SL-1088	AY-127	0.07
	SX-SL-1089	AY-127	0.05
	SX-SL-1090	AY-127	0.06
	SX-SL-1091	AY-127	0.07
	SX-SL-1027	AZ-127	0.35
	SX-SL-1028	AZ-127	0.57
	SX-SL-1029	AZ-127	0.5
	SX-SL-1030	AZ-127	0.45
	SX-SL-1031	AZ-127	0.7
	SX-SL-1233	AY-130	0.14
	SX-SL-1234	AY-130	0.6
	SX-SL-1235	AY-130	1.3
	SX-SL-1121	AY-129	0.035
	SX-SL-1122	AY-129	4.3
	SX-SL-1221	AY-128	0.17
	SX-SL-1222	AY-128	1.1
	SX-SL-1223	AY-128	2.1
	SX-SL-1224	AY-128	2
	SX-SL-1225	AY-128	1.75
	SX-SL-4083	AX-129	0.3
	SX-SL-4082	AX-129	0.14
		Max	4.50
		Avg	0.64
		STDEV	1.00
	Denotes < MDA		

ATTACHMENT 10.1

CV Pad Variability Measurements SR-0143

37122N21	126186	JF1995	Time	Detector	Counts	Count Time (sec)	Mode	Designator		FSS-753	BHB	
0	BKG CK	7/12/2004	5:54	1	2.65E+03	600	SCL	Inital Background	β	*Steel CF(cpm) ⇒*	*0*	
1	SCCK	7/12/2004	6:00	1	1.73E+05	60	SCL	Source	β	Shielded	Unshielded	NET cpm
2	MA8-3FP1S	7/12/2004	12:51	1	2.97E+02	60	SCL	Shielded	β	2.97E+02		
3	MA8-3FP1U	7/12/2004	12:53	1	4.62E+02	60	SCL	Unshielded	β		4.62E+02	1.65E+02
4	MA8-3FP2S	7/12/2004	12:54	1	3.56E+02	60	SCL	Shielded	β	3.56E+02		
5	MA8-3FP2U	7/12/2004	12:55	1	4.76E+02	60	SCL	Unshielded	β		4.76E+02	1.20E+02
6	MA8-3FP3S	7/12/2004	12:57	1	4.03E+02	60	SCL	Shielded	β	4.03E+02		
7	MA8-3FP3U	7/12/2004	12:58	1	4.28E+02	60	SCL	Unshielded	β		4.28E+02	2.50E+01
8	MA8-3FP4S	7/12/2004	13:00	1	3.61E+02	60	SCL	Shielded	β	3.61E+02		
9	MA8-3FP4U	7/12/2004	13:01	1	5.41E+02	60	SCL	Unshielded	β		5.41E+02	1.80E+02
10	MA8-3FP5S	7/12/2004	13:03	1	3.26E+02	60	SCL	Shielded	β	3.26E+02		
11	MA8-3FP5U	7/12/2004	13:04	1	5.09E+02	60	SCL	Unshielded	β		5.09E+02	1.83E+02
12	MA8-3FP6S	7/12/2004	13:06	1	3.89E+02	60	SCL	Shielded	β	3.89E+02		
13	MA8-3FP6U	7/12/2004	13:07	1	4.94E+02	60	SCL	Unshielded	β		4.94E+02	1.05E+02
14	MA8-3FP7S	7/12/2004	13:09	1	3.92E+02	60	SCL	Shielded	β	3.92E+02		
15	MA8-3FP7U	7/12/2004	13:10	1	5.46E+02	60	SCL	Unshielded	β		5.46E+02	1.54E+02
16	MA8-3FP8S	7/12/2004	13:11	1	3.63E+02	60	SCL	Shielded	β	3.63E+02		
17	MA8-3FP8U	7/12/2004	13:13	1	5.47E+02	60	SCL	Unshielded	β		5.47E+02	1.84E+02
18	MA8-3FP9S	7/12/2004	13:14	1	3.79E+02	60	SCL	Shielded	β	3.79E+02		
19	MA8-3FP9U	7/12/2004	13:16	1	4.52E+02	60	SCL	Unshielded	β		4.52E+02	7.30E+01
20	MA8-3FP10S	7/12/2004	13:17	1	3.57E+02	60	SCL	Shielded	β	3.57E+02		
21	MA8-3FP10U	7/12/2004	13:18	1	4.19E+02	60	SCL	Unshielded	β		4.19E+02	6.20E+01
22	MA8-3FP11S	7/12/2004	13:20	1	3.67E+02	60	SCL	Shielded	β	3.67E+02		
23	MA8-3FP11U	7/12/2004	13:21	1	5.00E+02	60	SCL	Unshielded	β		5.00E+02	1.33E+02
24	MA8-3FP12S	7/12/2004	13:23	1	3.69E+02	60	SCL	Shielded	β	3.69E+02		
25	MA8-3FP12U	7/12/2004	13:24	1	5.38E+02	60	SCL	Unshielded	β		5.38E+02	1.69E+02
26	MA8-3FP13S	7/12/2004	13:26	1	3.35E+02	60	SCL	Shielded	β	3.35E+02		
27	MA8-3FP13U	7/12/2004	13:27	1	4.69E+02	60	SCL	Unshielded	β		4.69E+02	1.34E+02
28	MA8-3FP14S	7/12/2004	13:28	1	3.75E+02	60	SCL	Shielded	β	3.75E+02		
29	MA8-3FP14U	7/12/2004	13:30	1	5.00E+02	60	SCL	Unshielded	β		5.00E+02	1.25E+02
30	MA8-3FP15S	7/12/2004	13:31	1	3.26E+02	60	SCL	Shielded	β	3.26E+02		
31	MA8-3FP15U	7/12/2004	13:32	1	5.50E+02	60	SCL	Unshielded	β		5.50E+02	2.24E+02
32	MA8-3FP16S	7/12/2004	13:34	1	4.16E+02	60	SCL	Shielded	β	4.16E+02		
33	MA8-3FP16U	7/12/2004	13:35	1	4.84E+02	60	SCL	Unshielded	β		4.84E+02	6.80E+01
34	MA8-3FP17S	7/12/2004	13:37	1	3.61E+02	60	SCL	Shielded	β	3.61E+02		
35	MA8-3FP17U	7/12/2004	13:38	1	5.14E+02	60	SCL	Unshielded	β		5.14E+02	1.53E+02
36	MA8-3FP18S	7/12/2004	13:40	1	3.90E+02	60	SCL	Shielded	β	3.90E+02		
37	MA8-3FP18U	7/12/2004	13:41	1	4.90E+02	60	SCL	Unshielded	β		4.90E+02	1.00E+02
38	MA8-3FP19S	7/12/2004	13:43	1	3.71E+02	60	SCL	Shielded	β	3.71E+02		
39	MA8-3FP19U	7/12/2004	13:44	1	4.76E+02	60	SCL	Unshielded	β		4.76E+02	1.05E+02
40	MA8-3FP20S	7/12/2004	13:46	1	3.58E+02	60	SCL	Shielded	β	3.58E+02		
41	MA8-3FP20U	7/12/2004	13:47	1	4.65E+02	60	SCL	Unshielded	β		4.65E+02	1.07E+02
									Minimum ⇒	2.97E+02	4.19E+02	2.50E+01
									Maximum ⇒	4.16E+02	5.50E+02	2.24E+02
									Mean ⇒	3.65E+02	4.93E+02	1.28E+02
									Sigma ⇒	2.82E+01	3.87E+01	4.94E+01

ATTACHMENT 11 - 1

INFORMATION ONLY

ORIGINAL

Exhibit 1
Survey Unit Inspection Check Sheet

SECTION 1 - SURVEY UNIT INSPECTION DESCRIPTION					
Survey Unit #	CV1-4 and MA8-3	Survey Unit Location	CV Excavation Northeast and CV Concrete Pad		
Date	7/13/04	Time	1200	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		

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.

Comments:

Response to Question 10: As mentioned on survey inspection performed on 6/30/04, access to east slope may require assistance via ladder/scaffolding. Discussed with L. Shamenek. He will have support personnel available to assist survey team.

Response to Question 12: As mentioned on survey inspection performed on 6/30/04, erosion is occurring on southeast side of CV1-4 (at wing wall). Erosion has occurred also on the east slope. This area needs to be evaluated by D and D Engineering prior to start of FSS. Discussed with L. Shamenek. He will examine the erosion at the time of FSS performance.

Survey Unit Inspector (print/sign)	D. Sarge /	Date	7/13/04
Survey Designer (print/sign)		Date	

ATTACHMENT 12.1

FirstEnergy Corp.

SNEC CALCULATION COVER SHEET

CALCULATION DESCRIPTION

Calculation Number	Revision Number	Effective Date	Page Number
E900-04-024	0	11-15-2004	1 of 9

Subject

CV Yard Phase 4 - 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/ B. Brosey	Date	11-15-04
Technical Reviewer	R. D. Holmes/ R D Holmes	Date	11/15/04
Additional Review	A. Paynter/	Date	11/29/04
Additional Review		Date	
Additional Review		Date	

1.0 PURPOSE

1.1 The purpose of this calculation is to develop a survey design for the phase 4 CV Yard area. This area is composed of one (1) soil survey unit and a collection of miscellaneous concrete surfaces considered one (1) additional survey unit. This is a below grade Class 1 survey area that is adjacent to remnants of the SNEC CV structure. It extends upward from about the 803' El to grade (at ~811' El), and is bounded by the eastern end of the CV Steam/Pipe Tunnel and in general, is located in the south west sector of the CV Yard. These landmarks are shown on **Attachment 1-1** through **1-3**.

1.2 The soil survey unit is designated ***OL1-5***. The miscellaneous concrete surfaces are collectively designated ***MA8-4***.

1.3 The total exposed soil surface area is ***~66 square meters*** and the concrete surfaces are collectively ***~7.8 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 values are listed below. The US NRC has concurred with the original mix and approach used to derive these values. See **Attachment 2-1** to **2-5**.

Volumetric DCGLw (pCi/g – Cs-137)	Surface Gross Activity DCGLw (dpm/100 cm^2)
5.74 (4.3 A.L.)	44,353 (33,265 A.L.)

NOTE: A.L. is the site Administrative Limit (75% of effective DCGLw), decayed to 9/15/04.

2.1 Soil and Fill Materials 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. The window will straddle the Cs-137 662 keV full energy peak width.

Soil Scanning Parameters

MDCscan (pCi/g) – Cs-137	Scan Speed (cm/sec)	Maximum Distance from Surface	% Coverage
3.3	25	4" (gap between)	100%

2.1.2 The instrument conversion factor/efficiency shall be not less than the value reported on **Attachment 3-1** (***205 cpm/uR/h***).

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

2.1.4 The MDCscan for soil is determined using a MicroShield model (**Attachment 4-1** & **4-2**). MDCscan Calculations are shown on **Attachments 5-1** and **5-2**.

2.1.5 Background has been measured in the area over similar background materials, and ranges from about 100 cpm to approximately 400 cpm (see **Reference 3.1**). 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 the elevated areas(s) IAW SNEC procedure E900-IMP-4520.04 (**Reference 3-2**).

NOTE

This survey design must be revised if it is shown that the true background count rate (from natural occurring materials) is greater than ~550 counts per minute.

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

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

2.1.8 Other instruments of the type specified in Section 2.1.1 above may be used during the FSS but they must demonstrate a detection efficiency at or above the value listed in Section 2.1.2 (~205 cpm/uR/h).

2.1.9 VSP (**Reference 3.3**) is used to plot all sampling points on included diagrams.

2.1.10 The minimum number of soil sampling points indicated for this survey unit by Compass (**Reference 3.4**) is ***11***. Sampling depth should be top 6 inches (15 cm) of soil (see **Attachment 6-1** through **6-5**). Distances between soil sample points are measured over the contour of the survey unit. Some starting 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 or to adjust survey point locations.

2.2 Survey Work for Concrete Surfaces

A Gas Flow Proportional Counter (GFPC) shall be used to survey concrete surfaces in this survey area. The following parameters should be used to develop a survey request.

Detection Efficiency Data

ε_i	ε_s	% Cs-137	Efficiency Loss Factor	counts/disintegration
0.478	0.5	0.598	0.421	0.06

2.2.1 The overall counting efficiency for this survey design assumes a mix ratio as shown on **Attachment 2-5**. For planning purposes, the instrument and source efficiency is assumed to be as shown in the previous Table. The detection efficiency is based on the instruments response to Cs-137. Radionuclides less than 1% of the total mix and are ignored. H-3 which is ~39% of the mix, has no detectable beta contribution.

2.2.2 A rough surface efficiency factor is employed to ensure that a conservative but representative efficiency is used for weathered concrete surfaces. From **Attachment 7-1** to **7-3** the assessment of the surface area of these rough concrete surfaces indicates that the mean surface gouge depth is ~1.6 inches deep. From **Reference 3-5** and **Attachment 8-1** this gap would reduce the overall efficiency by a factor of ~0.421. The resulting efficiency is then ***0.06 cts/dis***.

2.2.3 All GFPC instruments having a total efficiency (ε_t) less than 0.239 (23.9%) should not be used for this survey work.

2.2.4 These parameters were incorporated into the Compass computer program. The following is the Compass output for this survey design.

MDCstatic (dpm/100 cm²)*	MDCscan (dpm/100 cm²)*	Action Level Assigned During Phase 1 Scanning (ncpm)
1,116	2,204	1,500

*As calculated by the Compass computer program assuming a background value of 306 cpm.

2.2.5 The number of static measurement points on miscellaneous concrete surfaces were determined using the Compass computer program (see **Attachment 9-1** through **9-5**). The required number of static measurement points was determined to be as shown below. VSP was used to plot these locations.

- CV Yard Concrete Misc.(**Attachment 9-5**) – ***10 points***,

2.2.5 This survey design requires the detector be in ***contact with the surface*** during all measurement phases except in areas where this is not physically possible (gouges, cavities, etc.).

2.2.6 The action level during first phase scanning is ***1,500 cpm above background***. If this level is reached, the surveyor should stop and perform ***a count of at least 1/2 minute*** duration to identify the actual count rate.

2.2.7 Areas greater than the DCGLw (2,515 ncpm) must be identified, documented, marked, and bounded to include an area estimate.

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

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

3.6 SNEC Survey Request No. SR-173, Post-Remediation Results.

3.7 Plan SNEC Facility License Termination Plan.

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

3.9 Westinghouse Electric Corporation, Gilbert Associates, Inc., Drawing No. D-37798, Saxton Reactor Project, "Containment Vessel Penetration Access", 7/21/60.

3.10 GPU Nuclear, SNEC Facility, "Containment Vessel Survey", SNECRM-019, Rev 1, 1/18/02.

3.11 SNEC Facility Historical Site Assessment, Rev 0, March, 2000.

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

3.13 SNEC procedure E900-IMP-4520.06, "Survey Unit Inspection in Support of FSS Design".

3.14 ISO 7503-1, Evaluation of Surface Contamination, Part 1: Beta-emitters (maximum beta energy greater than 0.15 MeV) and alpha-emitters, 1988.

3.15 NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual", August, 2000.

3.16 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 Soil samples from the area used as the initial estimate of variability are shown in **Attachment 10-1.**

4.3 Concrete variability of the area structures was performed at the start of this work and are shown in **Attachment 11-1.** Background variability results are taken form the Williamsburg survey work of non-impacted background material (see **Attachment 11-2**).

4.4 The MARSSIM Sign Test will be applicable for the soil section of this survey design. No background subtraction will be performed under this criteria.

4.5 The MARSSIM WRS Test criteria is applicable for concrete survey work in this area.

4.6 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 3.3**).

4.7 VSP is used to plot 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 (key point measurement location).

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

The construction/assembly drawings used to determine the original physical extent of these areas are listed as **Reference 3.9** and **3.10.**

4.9 Remediation History

A review of survey request data pertaining to this open land area adjacent to the CV shell was conducted in support of this survey design. Analysis of soil samples taken after remediation of the area (from SR-0173), shows that the region has been reduced to an average of 0.26 pCi/g (Cs-137) with a maximum value of 0.51 pCi/g. Earlier remediation history in this area is reported in the SNEC facility Historical Site Assessment document (**Reference 3-11**) and the 1994 Soil Remediation Project Report.

4.10 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.

4.11 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 2-1** through **2-5**, 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-41. 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 this survey unit. Remediation efforts have been shown to be effective in lowering the average concentration of Cs-137 in this survey unit to less than 4.5 pCi/g (see **Attachment 8-1**). Therefore, the impact of remediation must be considered in determining the effective Cs-137 DCGLw surrogate value. Remediation of this survey unit was completed by about July of 2001. Samples collected prior to this date have been disqualified in the final listing which was decayed to September 15th, 2004. In all, about twenty three (23) sample results were used to determine the best representative mix for these survey units.

The decayed sample results were input to the spreadsheet titled "Effective DCGL Calculator for Cs-137" (**Reference 3-12**) to determine the effective volumetric and surface DCGLw values for the OL1 area. The output of this spreadsheet is shown on **Attachment 2-4** and **2-5**.

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 205 cpm/uR/h for Cs-137. Additionally, 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 ~400 cpm. The resulting MDCscan is ~3.3 pCi/g (see **Attachment 5-1** and **5-2**). This value is based on a nominal background value of 200 cpm.

4.12 The survey unit described in this survey design was inspected after remediation efforts were shown effective. A copy of portions of the SNEC facility post-remediation inspection report (**Reference 3.13**), is included as **Attachment 7-1** to **7-3**.

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 α value and 0.1 for the β value.

4.15 Special measurements including gamma-ray spectroscopy 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 The applicable 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 not applicable in subsurface soil volumes (below 1 meter). Therefore, the area factor input requirement for soil in the Compass computer program is 1 for both a 10,000 square meter area as well as for a 1 square meter area (see **Attachment 6-2**).

4.20 Area factors for concrete surface areas are shown on **Attachment 9-1**. These values are for Co-60 which is a constituent of the mix. However, Cs-137 and Co-60 area factors are very similar and therefore there is little impact from using the more conservative area factor.

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** to **1-2**, are photos of survey unit OL1-5 and MA8 –4.

6.1.1 **Attachment 1-3**, is a diagram of the OL1-5 open land area.

6.2 **Attachment 2-1** to **2-5** is the sample results from the OL1 area. In addition to the effective DCGL calculation sheets.

6.3 **Attachment 3-1**, is a copy of the calibration data from typical NaI and GFPC radiation detectors that will be used in this FSS process.

6.4 **Attachment 4-1** and **4-2**, is a MicroShield model of a soil volume used to determine the exposure rate from a 1 pCi/g Cs-137 source term.

6.5 **Attachment 5-1** and **5-2**, is the MDCscan calculation sheets for the soil model.

6.6 **Attachment 6-1**, is a diagram of the OL1-5 area showing the soil sampling points.

6.6.1 **Attachment 6-2** to **6-5**, are the Compass output data for the soil area OL1-5.

6.7 **Attachment 7-1** to **7-3**, is the results of the inspection report for the OL1-5 and MA8-4 areas.

6.8 **Attachment 8-1**, is the efficiency correction factor employed for a GFPC instrument.

6.9 **Attachment 9-1** to **9-4**, are Compass output data for the misc. concrete survey unit MA8-4.

6.9.1 **Attachment 9-5** is the fixed point survey locations for the MA8-4 misc. concrete surface.

6.10 **Attachment 10-1** is the variability measurements of soil samples from the OL1-5 area.

6.11 **Attachment 11-1**, is the GFPC MA8-4 misc. concrete variability measurement results.

6.11.1 **Attachment 11-2**, is the Williamsburg GFPC background measurement results.

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).

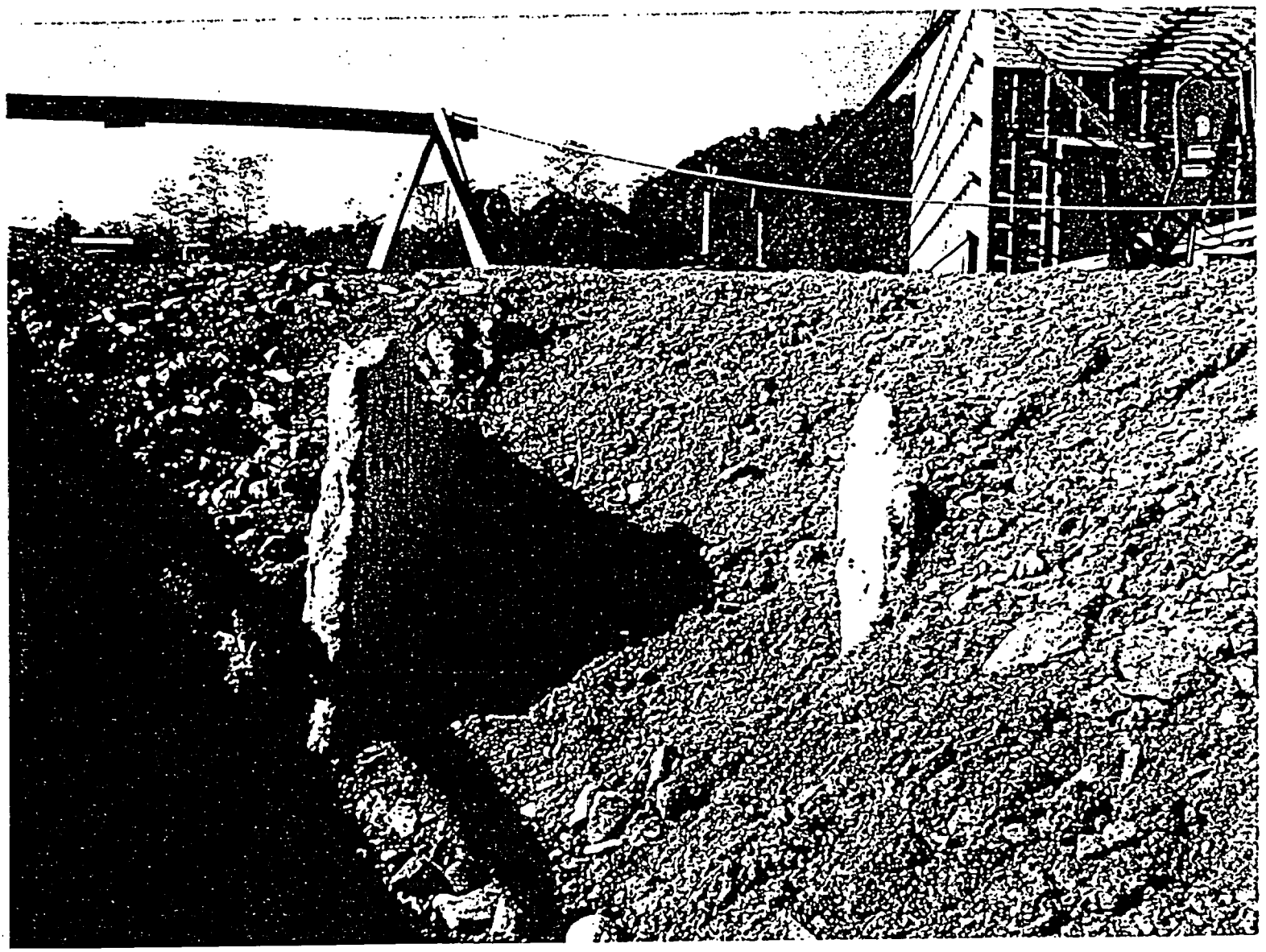
FirstEnergy	SNEC CALCULATION SHEET	
Calculation Number E900-04-024	Revision Number 0	Page Number Page 9 of 9
Subject CV Yard Phase 4 - Survey Design		

Exhibit 2
Survey Design Checklist

Calculation No. E900-04-024	Location Codes OL1-5 & MA8-4

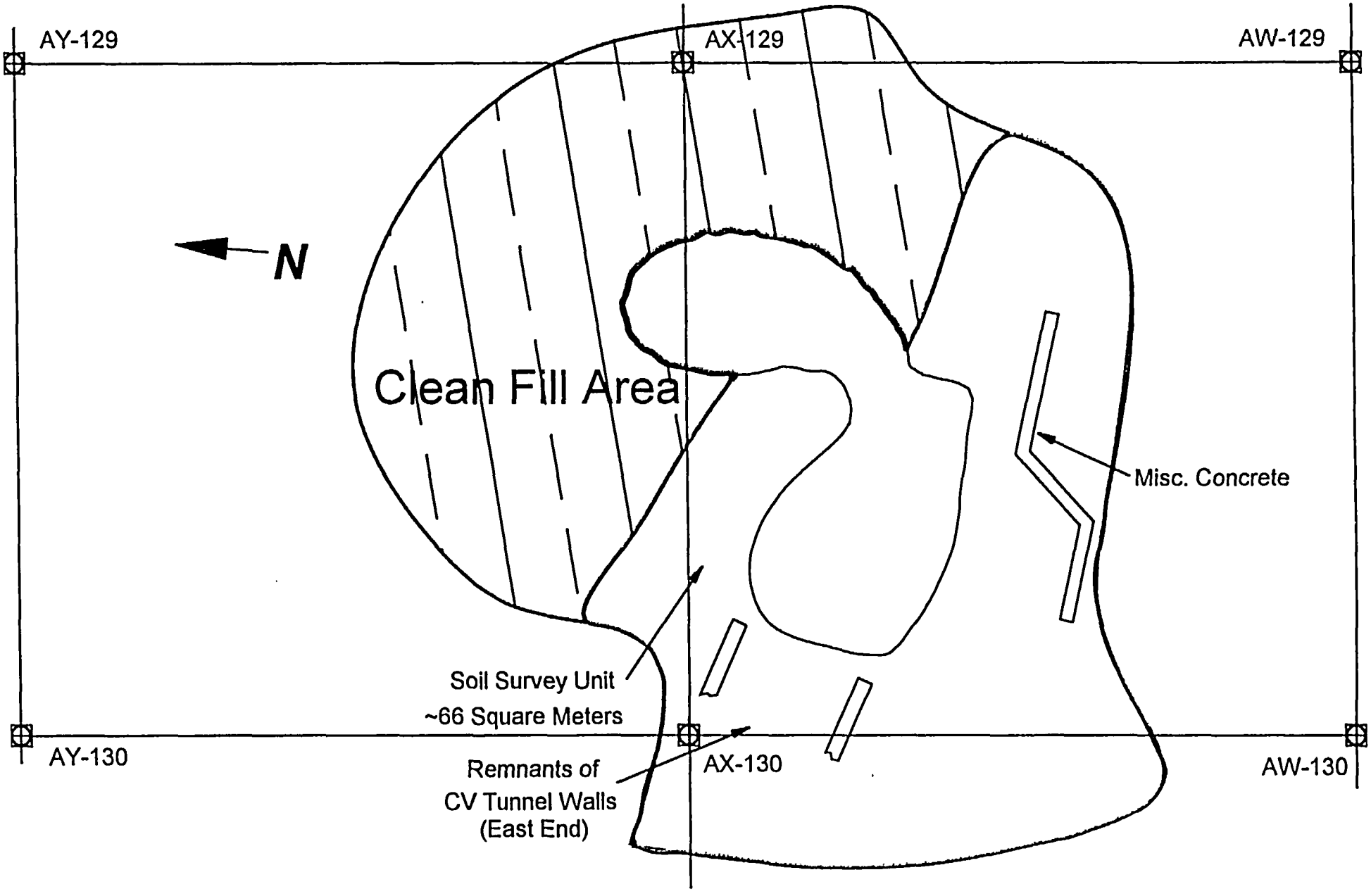
ITEM	REVIEW FOCUS	Status (Circle One)	Reviewer Initials & Date
1	Has a survey design calculation number been assigned and is a survey design summary description provided?	(Yes) N/A	3/7/05
2	Are drawings/diagrams adequate for the subject area (drawings should have compass headings)?	(Yes) N/A	3/7/05
3	Are boundaries properly identified and is the survey area classification clearly indicated?	(Yes) N/A	3/7/05
4	Has the survey area(s) been properly divided into survey units IAW EXHIBIT 10	(Yes) N/A	3/7/05
5	Are physical characteristics of the area/location or system documented?	(Yes) N/A	3/7/05
6	Is a remediation effectiveness discussion included?	(Yes) N/A	3/7/05
7	Have characterization survey and/or sampling results been converted to units that are comparable to applicable DCGL values?	(Yes) N/A	3/7/05
8	Is survey and/or sampling data that was used for determining survey unit variance included?	(Yes) N/A	3/7/05
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	3/7/05
10	Are applicable survey and/or sampling data that was used to determine variability included?	(Yes) N/A	3/7/05
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)	3/7/05
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)	3/7/05
13	Are all necessary supporting calculations and/or site procedures referenced or included?	(Yes) N/A	3/7/05
14	Has an effective DCGLw been identified for the survey unit(s)?	(Yes) N/A	3/7/05
15	Was the appropriate $DCGL_{EMC}$ included in the survey design calculation?	(Yes) N/A	3/7/05
16	Has the statistical tests that will be used to evaluate the data been identified?	(Yes) N/A	3/7/05
17	Has an elevated measurement comparison been performed (Class 1 Area)?	(Yes) N/A	3/7/05
18	Has the decision error levels been identified and are the necessary justifications provided?	(Yes) N/A	3/7/05
19	Has scan instrumentation been identified along with the assigned scanning methodology?	(Yes) N/A	3/7/05
20	Has the scan rate been identified, and is the MDCscan adequate for the survey design?	(Yes) N/A	3/7/05
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)	3/7/05
22	Is survey instrumentation calibration data included and are detection sensitivities adequate?	(Yes) N/A	3/7/05
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	3/7/05
24	Are investigation levels and administrative limits adequate, and are any associated actions clearly indicated?	(Yes) N/A	3/7/05
25	For sample analysis, have the required MDA values been determined.?	Yes (N/A)	3/7/05
26	Has any special sampling methodology been identified other than provided in Reference 6.3?	Yes (N/A)	3/7/05

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



ATTACHMENT 1 . 1

ATTACHMENT 1.2



ATTACHMENT 1.3

TABLE 1 - REDUCED LISTING

	BNEC Sample No	LAB No.	Location/Description	H-3	Sr-90	Cs-90	Cs-137	Am-241	Pu-238	Pu-239	Pu-241	C-14	Ni-63	Eu-152	Decay Date / Analysis Date
1	CV Tunnel	BWXT, 9102069-01	CV Tunnel Sediment Composite, CL1	9 4	9 67	1 26	1250	0 18	0 55	0 22	44 69	9 34	4 02	0 13	February 14, 2001
2	BXSL99219	111074	Subsurface Sample #29 (0-9'), AY-129, CL1			0 07	0 59								November 17, 1999
3	BXSL1053	Teledyne-80018; L19184-1	North CV Yard Soil BA-127, 812' El, Sample # 6, CL2	4 58	0 0531	0 0192	0 868	0 0981	0 0488	0 0327	3 77	0 21	10 9	0 0525	June 27, 2002
4	BXSL1059	Teledyne-80019; L19184-2	North CV Yard Soil AY-127, 810' El, Sample # 3, CL1	3 03	0 0695	0 0332	1 29	0 0993	0 128	0 05	4 67	0 21	7 54	0 0828	June 28, 2002
5	BXSL1115	Teledyne-80020; L19184-3	North CV Yard Soil AY-129, 804' El, Sample # 2, CL1	4 88	0 0536	0 0243	1 8	0 24	0 138	0 0407	4 21	0 21	7 6	0 0571	June 28, 2002
6	BXSL1122	Teledyne-80021; L19184-4	North CV Yard Soil AY-129, 799' El, Sample # 2, CL1	3 44	0 0529	0 0279	4 77	0 183	0 0894	0 04	3 69	0 208	8 75	0 0862	June 28, 2002
7	BXSL1130	Teledyne-80022; L19184-5	North CV Yard Soil AX-129, 803' El, Sample # 6, CL1	4 99	0 0648	0 0298	22 6	0 149	0 0856	0 0121	3 55	0 231	13 4	0 0989	July 3, 2002
8	BXSL1132	Teledyne-80023; L19184-6	North CV Yard Soil AZ-130, Sample # 5, CL1	2 98	0 0715	0 035	2 59	0 164	0 0746	0 0646	5 27	0 215	12 6	0 0734	July 3, 2002
9	BXSL1270	BWXT, 9109048-02	AX-129, S-3, Soil, CV SE Side 9' From CV, 800' El, CL1	11 31	0 02	0 01	23 1	0 037	0 007	0 007	2 104	3 93	8 68	0 07	July 26, 2001
10	BXSL1281	BWXT, 9109048-01	AX-129, S-1, Soil, CV Tunnel East 9' From CV, 800' El, CL1	11 52	0 03	0 01	4 38	0 031	0 016	0 007	1 908	4	7 78	0 04	July 26, 2001
11	BXSL2649	Teledyne-73220; L19077-2	Ana.ss Wst, A-2, 6 to 10' Depth, CL1	2	0 0314	0 1	0 8	0 00978	0 0133	0 011	1 87	0 183	1 75		February 13, 2002
12	BXSL2671	Teledyne-71949; L17836-11	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, CL1		0 03	0 07	0 58								March 8, 2002
13	BXSL2672	Teledyne-71948; L17836-10	CV Area - East Yard Dirt Pile - Bottom (dose top center), CL1		0 03	0 06	0 1								March 8, 2002
14	BXSL3140	BWXT,1939-003-19-01	East CV Yard, Soil Pile @ 9' on West Side (6" Depth), CL1	1 892	0 012	0 014	0 825	0 007	0 005	0 005	0 369	0 086	3 406	0 03	August 30, 2002
15	BXSL3142	Teledyne; L20326-3	Soil Pile, CV Yard, Three Feet on East Side, SR-37, CL1		0 0295	0 07	0 8								August 13, 2002
16	BXSL3145	BWXT,1939-003-19-01	East CV Yard, Soil Pile @ 3' on East Side (6" Depth), CL1	1 897	0 017	0 013	1 26	0 004	0 005	0 005	0 376	0 083	3 69	0 038	August 30, 2002
17	BXSL3149	Teledyne; L20326-4	Soil Pile CV Yard, Six Feet on East Side SR-37, CL1		0 0297	0 08	0 3								August 13, 2002
18	BXSL3153	BWXT,1939-003-19-01	East CV Yard, Soil Pile @ Top (6" Depth), CL1	1 937	0 043	0 023	0 3	0 003	0 005	0 005	0 343	0 087	4 177	0 051	August 30, 2002
19	BXSL4142	Teledyne; L22187-2	CV Yard Soil - West Side, AP1-7, CL1	2 22	0 0325	0 05	0 8	0 0176	0 0671	0 0202					October 2, 2003
20	BXSL4143	Teledyne; L22187-3	CV Yard Soil - West Side, AP1-7, CL1	2 23	0 0316	0 05	0 5	0 0221	0 0831	0 0364					October 2, 2003
21	BXSL4149	Teledyne; L22187-4	CV Yard Soil - West Side, AP1-7, CL1	2 24	0 0277	0 07	1 9	0 0277	0 043	0 0304					October 2, 2003

TABLE 2 - REDUCED LISTING - DECAYED

	BNEC Sample No	LAB No.	Location/Description	T 1/2 / H-3	T 1/2 / Sr-90	T 1/2 / Cs-90	T 1/2 / Cs-137	T 1/2 / Am-241	T 1/2 / Pu-238	T 1/2 / Pu-239	T 1/2 / Pu-241	T 1/2 / C-14	T 1/2 / Ni-63	T 1/2 / Eu-152	Decay Date / Analysis Date
				4485 27	10446 15	1925 23275	11019 5925	157861 05	32050 8875	8813847 75	5259 8	2092882 5	36581 525	4987 4	September 16, 2004
1	CV Tunnel	BWXT, 9102069-01	CV Tunnel Sediment Composite, CL1	7 68E+00	8 87E+00	7 87E-01	1 15E+02	1 79E-01	5 35E-01	2 20E-01	3 78E+01	9 34E+00	3 92E+00	1 08E-01	February 14, 2001
2	BXSL99219	111074	Subsurface Sample #29 (0-9'), AY-129, CL1	0 00E+00	0 00E+00	3 71E-02	6 28E-01	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	November 17, 1999
3	BXSL1053	Teledyne-80018; L19184-1	North CV Yard Soil BA-127, 812' El, Sample # 6, CL2	4 04E+00	5 03E-02	1 43E-02	8 42E-01	9 58E-02	4 60E-02	3 27E-02	3 39E+00	2 10E-01	1 07E+01	4 69E-02	June 27, 2002
4	BXSL1059	Teledyne-80019; L19184-2	North CV Yard Soil AY-127, 810' El, Sample # 3, CL1	2 67E+00	6 59E-02	2 48E-02	1 23E+00	9 69E-02	1 26E-01	5 00E-02	4 47E+00	2 10E-01	7 43E+00	7 40E-02	June 28, 2002
5	BXSL1115	Teledyne-80020; L19184-3	North CV Yard Soil AY-129, 804' El, Sample # 2, CL1	4 31E+00	5 08E-02	1 82E-02	1 71E+00	2 39E-01	1 36E-01	4 07E-02	3 78E+00	2 10E-01	7 48E+00	5 10E-02	June 28, 2002
6	BXSL1122	Teledyne-80021; L19184-4	North CV Yard Soil AY-129, 799' El, Sample # 2, CL1	3 04E+00	5 01E-02	2 09E-02	4 53E+00	1 82E-01	8 78E-02	4 00E-02	3 31E+00	2 06E-01	8 62E+00	7 70E-02	June 28, 2002
7	BXSL1130	Teledyne-80022; L19184-5	North CV Yard Soil AX-129, 803' El, Sample # 6, CL1	4 41E+00	6 14E-02	2 23E-02	2 18E+01	1 48E-01	8 41E-02	1 21E-02	3 19E+00	2 31E-01	1 32E+01	8 84E-02	July 3, 2002
8	BXSL1132	Teledyne-80023; L19184-6	North CV Yard Soil AZ-130, Sample # 5, CL1	2 63E+00	6 78E-02	2 62E-02	2 46E+00	1 63E-01	7 33E-02	6 46E-02	4 74E+00	2 15E-01	1 24E+01	6 56E-02	July 3, 2002
9	BXSL1270	BWXT, 9109048-02	AX-129, S-3, Soil, CV SE Side 9' From CV, 800' El, CL1	9 47E+00	1 85E-02	6 62E-03	2 19E+01	3 68E-02	6 83E-03	7 00E-03	1 81E+00	3 93E+00	8 49E+00	5 96E-02	July 26, 2001
10	BXSL1281	BWXT, 9109048-01	AX-129, S-1, Soil, CV Tunnel East 9' From CV, 800' El, CL1	9 65E+00	2 78E-02	6 62E-03	4 08E+00	3 88E-02	1 56E-02	7 00E-03	1 84E+00	4 00E+00	7 81E+00	3 41E-02	July 26, 2001
11	BXSL2649	Teledyne-73220; L19077-2	Ana.ss Wst, A-2, 6 to 10' Depth, CL1	1 73E+00	2 95E-02	7 12E-02	6 65E-01	9 74E-03	1 30E-02	1 10E-02	1 85E+00	1 83E-01	1 72E+00	0 00E+00	February 13, 2002
12	BXSL2671	Teledyne-71949; L17836-11	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, CL1	0 00E+00	2 82E-02	5 02E-02	5 28E-01	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	March 8, 2002
13	BXSL2672	Teledyne-71948; L17836-10	CV Area - East Yard Dirt Pile - Bottom (dose top center), CL1	0 00E+00	2 82E-02	4 30E-02	9 44E-02	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	March 8, 2002
14	BXSL3140	BWXT,1939-003-19-01	East CV Yard, Soil Pile @ 9' on West Side (6" Depth), CL1	1 69E+00	1 14E-02	1 07E-02	7 87E-01	6 98E-03	4 92E-03	5 00E-03	3 34E-01	8 60E-02	3 36E+00	2 70E-02	August 30, 2002
15	BXSL3142	Teledyne; L20326-3	Soil Pile, CV Yard, Three Feet on East Side, SR-37, CL1	0 00E+00	2 80E-02	5 32E-02	8 72E-01	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	August 13, 2002
16	BXSL3145	BWXT,1939-003-19-01	East CV Yard, Soil Pile @ 3' on East Side (6" Depth), CL1	1 69E+00	1 62E-02	9 93E-03	1 20E+00	3 99E-03	4 92E-03	5 00E-03	3 41E-01	8 30E-02	3 64E+00	3 42E-02	August 30, 2002
17	BXSL3149	Teledyne; L20326-4	Soil Pile CV Yard, Six Feet on East Side SR-37, CL1	0 00E+00	2 82E-02	6 08E-02	2 66E-01	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	August 13, 2002
18	BXSL3153	BWXT,1939-003-19-01	East CV Yard, Soil Pile @ Top (6" Depth), CL1	1 73E+00	4 09E-02	1 76E-02	2 66E-01	2 99E-03	4 92E-03	5 00E-03	3 11E-01	8 70E-02	4 12E+00	4 60E-02	August 30, 2002
19	BXSL4142	Teledyne; L22187-2	CV Yard Soil - West Side, AP1-7, CL1	2 10E+00	3 16E-02	4 41E-02	8 80E-01	1 78E-02	6 66E-02	2 02E-02	0 00E+00	0 00E+00	0 00E+00	0 00E+00	October 2, 2003
20	BXSL4143	Teledyne; L22187-3	CV Yard Soil - West Side, AP1-7, CL1	2 11E+00	3 09E-02	4 41E-02	4 89E-01	2 21E-02	8 26E-02	3 64E-02	0 00E+00	0 00E+00	0 00E+00	0 00E+00	October 2, 2003
21	BXSL4149	Teledyne; L22187-4	CV Yard Soil - West Side, AP1-7, CL1	2 12E+00	2 71E-02	6 17E-02	9 87E+00	2 77E-02	4 27E-02	3 04E-02	0 00E+00	0 00E+00	0 00E+00	0 00E+00	October 2, 2003

ATTACHMENT 2 - 1

REDUCED LISTING - DECAYED

	BNEC Sample No	LAB No	Location/Description	H-3	Sr-90	Co-60	Cs-137	Total pCi/g
1	CV Tunnel	BWXT, 0102099-01	CV Tunnel Sediment Composite, CL1		8 67E+00	7 67E-01	1 15E+03	1160 87
2	BXSL99219	111074	Subsurface Sample #29 (0-5'), AY-129, CL1				5 28E-01	0 53
3	BXSL1053	Teledyne-80918; L19184-1	North CV Yard Soil BA-127, 812' El, Sample # 6, CL2	4 04E+00			8 42E-01	4 88
4	BXSL1059	Teledyne-80919; L19184-2	North CV Yard Soil AY-127, 810' El, Sample # 5, CL1	2 87E+00			1 23E+00	3 90
5	BXSL1115	Teledyne-80920; L19184-3	North CV Yard Soil AY-129, 804' El, Sample # 3, CL1	4 31E+00			1 71E+00	6 02
6	BXSL1122	Teledyne-80921; L19184-4	North CV Yard Soil AY-129, 799' El, Sample # 2, CL1	3 04E+00			4 53E+00	7 57
7	BXSL1130	Teledyne-80922; L19184-5	North CV Yard Soil AX-129, 803' El, Sample # 4, CL1	4 41E+00		2 23E-02	2 15E+01	25 91
8	BXSL1132	Teledyne-80923; L19184-6	North CV Yard Soil AZ-130, Sample # 5, CL1	2 63E+00			2 46E+00	5 09
9	BXSL1270	BWXT, 0100058-02	AX-129, 3-3, Soil, CV SE Side 9' From CV, 800' El, CL1				2 15E+01	21 49
10	BXSL1281	BWXT, 0100058-01	AX-129, 3-1, Soil, CV Tunnel East 9' From CV, 800' El, CL1				4 08E+00	4 08
11	BXSL2649	Teledyne-73220; L19077-2	Anulus Well A-2, 5 to 10' Depth, CL1				9 63E-01	0 97
12	BXSL2671	Teledyne-71946; L17938-11	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, CL1				5 28E-01	0 53
13	BXSL2672	Teledyne-71948; L17938-10	CV Area - East Yard Dirt Pile - Bottom (see top center), CL1				9 44E-02	0 09
14	BXSL3140	BWXT,1030-003-10-01	East CV Yard, Soil Pile @ 9' on West Side (6" Depth), CL1				7 87E-01	0 79
15	BXSL3142	Teledyne; L20328-3	Soil Pile, CV Yard, Three Feet on East Side, SR-37, CL1				5 72E-01	0 57
16	BXSL3145	BWXT,1030-003-10-01	East CV Yard, Soil Pile @ 9' on East Side (6" Depth), CL1				1 20E+00	1 20
17	BXSL3149	Teledyne; L20328-4	Soil Pile, CV Yard, Six Feet on East Side, SR-37, CL1				2 86E-01	0 29
18	BXSL3153	BWXT,1030-003-10-01	East CV Yard, Soil Pile @ Top (6" Depth), CL1				2 86E-01	0 29
19	BXSL4142	Teledyne; L22187-2	CV Yard Soil - West Side, AP1-7, CL1				8 80E-01	0 88
20	BXSL4143	Teledyne; L22187-3	CV Yard Soil - West Side, AP1-7, CL1				4 89E-01	0 49
21	BXSL4149	Teledyne; L22187-4	CV Yard Soil - West Side, AP1-7, CL1			8 17E-02	3 82E+00	3 89

CV YARD SAMPLES - % OF TOTAL CALCULATION

	BNEC Sample No	LAB No	Location/Description	H-3	Sr-90	Co-60	Cs-137	Total
1	CV Tunnel	BWXT, 0102099-01	CV Tunnel Sediment Composite, CL1		0 76%	0 07%	99 17%	100 0%
2	BXSL99219	111074	Subsurface Sample #29 (0-5'), AY-129, CL1				100 00%	100 0%
3	BXSL1053	Teledyne-80918; L19184-1	North CV Yard Soil BA-127, 812' El, Sample # 6, CL2	82 76%			17 24%	100 0%
4	BXSL1059	Teledyne-80919; L19184-2	North CV Yard Soil AY-127, 810' El, Sample # 5, CL1	68 56%			31 44%	100 0%
5	BXSL1115	Teledyne-80920; L19184-3	North CV Yard Soil AY-129, 804' El, Sample # 3, CL1	71 57%			28 43%	100 0%
6	BXSL1122	Teledyne-80921; L19184-4	North CV Yard Soil AY-129, 799' El, Sample # 2, CL1	40 11%			59 89%	100 0%
7	BXSL1132	Teledyne-80922; L19184-5	North CV Yard Soil AX-129, 803' El, Sample # 4, CL1	17 00%		0 09%	82 91%	100 0%
8	BXSL1133	Teledyne-80923; L19184-6	North CV Yard Soil AZ-130, Sample # 5, CL1	51 66%			48 34%	100 0%
9	BXSL1270	BWXT, 0100058-02	AX-129, 3-3, Soil, CV SE Side 9' From CV, 800' El, CL1				100 00%	100 0%
10	BXSL1281	BWXT, 0100058-01	AX-129, 3-1, Soil, CV Tunnel East 9' From CV, 800' El, CL1				100 00%	100 0%
11	BXSL2649	Teledyne-73220; L19077-2	Anulus Well, A-2, 5 to 10' Depth, CL1				100 00%	100 0%
12	BXSL2671	Teledyne-71946; L17938-11	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, CL1				100 00%	100 0%
13	BXSL2672	Teledyne-71948; L17938-10	CV Area - East Yard Dirt Pile - Bottom (see top center), CL1				100 00%	100 0%
14	BXSL3140	BWXT,1030-003-10-01	East CV Yard, Soil Pile @ 9' on West Side (6" Depth), CL1				100 00%	100 0%
15	BXSL3142	Teledyne; L20328-3	Soil Pile, CV Yard, Three Feet on East Side, SR-37, CL1				100 00%	100 0%
16	BXSL3145	BWXT,1030-003-10-01	East CV Yard, Soil Pile @ 9' on East Side (6" Depth), CL1				100 00%	100 0%
17	BXSL3149	Teledyne; L20328-4	Soil Pile, CV Yard, Six Feet on East Side, SR-37, CL1				100 00%	100 0%
18	BXSL3153	BWXT,1030-003-10-01	East CV Yard, Soil Pile @ Top (6" Depth), CL1				100 00%	100 0%
19	BXSL4142	Teledyne; L22187-2	CV Yard Soil - West Side, AP1-7, CL1				100 00%	100 0%
20	BXSL4143	Teledyne; L22187-3	CV Yard Soil - West Side, AP1-7, CL1				100 00%	100 0%
21	BXSL4149	Teledyne; L22187-4	CV Yard Soil - West Side, AP1-7, CL1			1 59%	98 41%	100 0%
			Mean=>	0 5528	0 0076	0 0058	0 8409	1 4071
			Normalized=>	39 28%	0 54%	0 41%	59 76%	100 0%

CV YARD SAMPLES - NORMALIZED TO Cs-137

	BNEC Sample No	LAB No	Location/Description	H-3	Sr-90	Co-60	Cs-137	Total
1	CV Tunnel	BWXT, 0102049-01	CV Tunnel Sediment Composite, CL1		0 00770	0 00068	1 000	1 01
2	BXSL99219	111074	Subsurface Sample #29 (0-5'), AY-129, CL1				1 000	1 00
3	BXSL1063	Teledyne 80019; L19184-1	North CV Yard Soil BA-127, 817 El, Sample # 5, CL2	4 79913			1 000	5 80
4	BXSL1069	Teledyne 80019; L19184-2	North CV Yard Soil AY-127, 810' El, Sample # 3, CL1	2 19084			1 000	3 19
5	BXSL1115	Teledyne 80020; L19184-3	North CV Yard Soil AY-128, 804' El, Sample # 3, CL1	2 81743			1 000	3 82
6	BXSL1122	Teledyne 80021; L19184-4	North CV Yard Soil AY-129, 799' El, Sample # 3, CL1	0 60905			1 000	1 67
7	BXSL1130	Teledyne 80022; L19184-5	North CV Yard Soil AX-130, 803' El, Sample # 4, CL1	0 20610		0 00104	1 000	1 21
8	BXSL1132	Teledyne 80023; L19184-6	North CV Yard Soil AZ-130, Sample # 6, CL1	1 06877			1 000	2 07
9	BXSL1270	BWXT, 0109044-02	AX-129, 3-3, Soil, CV SE Side 6' From CV, 800' El , CL1				1 000	1 00
10	BXSL1281	BWXT, 0109044-01	AX-129, 3-1, Soil CV Tunnel East 6' From CV, 800' El, CL1				1 000	1 00
11	BXSL2640	Teledyne-71329; L19077-3	Anuba Well, A-2, 8 to 10' Depth, CL1				1 000	1 00
12	BXSL2671	Teledyne-71946; L17838-11	CV Area - East Yard Dirt Pile - Middle, 1/2 Way Up, CL1				1 000	1 00
13	BXSL2672	Teledyne-71946; L17838-10	CV Area - East Yard Dirt Pile - Bottom (see top center), CL1				1 000	1 00
14	BXSL3140	BWXT,1030-003-10-01	East CV Yard, Soil Pile @ 6' on West Side (6' Depth), CL1				1 000	1 00
15	BXSL3142	Teledyne; L20329-2	Soil Pile, CV Yard, Three Feet on East Side SR 37, CL1				1 000	1 00
16	BXSL3145	BWXT,1030-003-10-01	East CV Yard, Soil Pile @ 3' on East Side (6' Depth), CL1				1 000	1 00
17	BXSL3146	Teledyne; L20329-4	Soil Pile, CV Yard, Six Feet on East Side, SR-37, CL1				1 000	1 00
18	BXSL3153	BWXT,1030-003-10-01	East CV Yard, Soil Pile @ Top (6' Depth), CL1				1 000	1 00
19	BXSL4142	Teledyne; L27187-2	CV Yard Soil - West Side, AP1-7, CL1				1 000	1 00
20	BXSL4143	Teledyne; L27187-3	CV Yard Soil - West Side, AP1-7, CL1				1 000	1 00
21	BXSL4146	Teledyne; L27187-4	CV Yard Soil - West Side, AP1-7, CL1			0 01618	1 000	1 02
22			*Mean=>*	1 907	0 008	0 006	1 000	2 920
23			*Normalized=>*	65 29%	0 26%	0 20%	34 24%	100 0%

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

SNEC AL	75%	Total Activity Limit DCGLw		Administrative Limit	
		16.75	pCi/g	12.57	pCi/g

SAMPLE NUMBER(s)⇒ CV YARD SAMPLES - 9/15/04

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

17.43%	25.0	mrem/y TEDE Limit	
7.70%	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	23	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	0.0060	0.205%	3.5	9.7	0.03	0.08	0.03	0.04	0.00	Co-60
4	Cs-137	1.0000	34.235%	6.6	17	5.74	12.98	5.74	3.79	0.01	Cs-137
5	Eu-152		0.000%	10.1	140	0.00	0.00	0.00	0.00	0.00	Eu-152
6	H-3	1.9070	65.286%	132	1.1E+3	10.94	24.75	10.94	0.36	0.25	H-3
7	Ni-63		0.000%	747	1.9E+4	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%	88	19.6	0.00	0.00	0.00	0.00	0.00	Pu-241
11	Sr-90	0.0080	0.274%	1.2	0.61	0.05	0.10	0.05	0.17	0.05	Sr-90
		2.92E+00	100.000%			16.75	37.91	16.75	4.359	0.308	
						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 2 - 4

Effective DCGL Calculator for Cs-137 (dpm/100 cm^2)

Gross Activity DCGLw		Gross Activity Administrative Limit	
44353	dpm/100 cm^2	33265	dpm/100 cm^2

25.0 mrem/y TEDE Limit

SAMPLE NO(s)⇒ CV YARD SAMPLES - 9/15/04

Cs-137 Limit		Cs-137 Administrative Limit	
26508	dpm/100 cm^2	19881	dpm/100 cm^2

SNEC AL	75%

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	Individual Limits (dpm/100 cm^2)	Allowed dpm/100 cm^2	mrem/y TEDE	Beta dpm/100 cm^2	Alpha dpm/100 cm^2	
1	Am-241		0.000%	27	0.00	0.00	N/A	0.00	Am-241
2	C-14		0.000%	3,700,000	0.00	0.00	0.00	N/A	C-14
3	Co-60	4.10E-03	0.410%	7,100	181.86	0.64	181.86	N/A	Co-60
4	Cs-137	5.98E-01	59.766%	28,000	26507.83	23.67	26507.8	N/A	Cs-137
5	Eu-152		0.000%	13,000	0.00	0.00	0.00	N/A	Eu-152
6	H-3	3.93E-01	39.284%	120,000,000	17423.48	0.00	Not Detectable	N/A	H-3
7	Ni-63		0.000%	1,800,000	0.00	0.00	Not Detectable	N/A	Ni-63
8	Pu-238		0.000%	30	0.00	0.00	N/A	0.00	Pu-238
9	Pu-239		0.000%	28	0.00	0.00	N/A	0.00	Pu-239
10	Pu-241		0.000%	880	0.00	0.00	Not Detectable	N/A	Pu-241
11	Sr-90	5.40E-03	0.540%	8,700	239.53	0.69	239.53	N/A	Sr-90
			100.000%		44353	25.0	26929	0	
					Maximum Permissible dpm/100 cm^2				

ATTACHMENT 2.5

2350 INSTRUMENT AND PROBE EFFICIENCY CHART 10/06/04

Inst.#	Cal Due	AP #		Probe #	Cal Due	
95361	6/25/05	P & W		25086 Pk	6/28/05	211,709
98625	5/18/05	R & Y		211680 Pk	5/18/05	214,882
98642	9/28/04	B&W		185844	9/28/04	209,771
98647	5/18/05	G & Y		211667 Pk	5/18/05	218,807
117566	4/09/05	G&R		185852 Pk	4/13/05	209,862
117573	5/18/05	O &Y		211674 Pk	5/18/05	212,173
126172	6/07/05	G&W		196022 Pk	6/07/05	208,302
126198	11/03/04	R&W		196021Pk	5/25/05	209,194
129423	5/18/05	P &Y		211687 Pk	5/18/05	213,539
129440	4/09/05	O&W		210938 Pk	4/14/05	205,603

2350 INSTRUMENT AND PROBE EFFICIENCY CHART 8/26/04

INST #	INST C/D	43-68 PROBE #	PROBE C/D			BETA EFF	ALPHA EFF
79037	04/06/05	122014	04/23/05			25.8%	N/A
126188	1/27/05	099186	1/27/05			28.2%	10.7%
126218	01/08/05	095080	01/09/05			27.9%	N/A

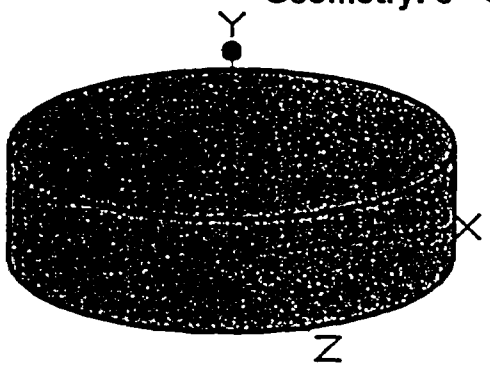
ATTACHMENT 3.1

MicroShield v5.05 (5.05-00121)
GPU Nuclear

Page : 1
DOS File : SOIL.MS5
Run Date: October 20, 2004
Run Time: 12:54:38 PM
Duration : 00:00:01

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Soil
Description: Soil Density 1.6 g/cc, 6" Deep Cylinder @ 5" 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

	X	Y	Z
# 1	0 cm	27.94 cm	0 cm
	0.0 in	11.0 in	0.0 in

Shields

Shield Name	Dimension	Material	Density
Source	2325.091 in³	Concrete	1.6
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Ba-137m	5.7670e-008	2.1338e+003	1.5136e-006	5.6003e-002
Cs-137	6.0962e-008	2.2556e+003	1.6000e-006	5.9200e-002

Buildup
The material reference is : Source

Integration Parameters

Radial	40
Circumferential	40
Y Direction (axial)	40

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.0318	4.418e+01	6.794e-06	8.222e-06	5.659e-08	6.849e-08
0.0322	8.150e+01	1.306e-05	1.591e-05	1.051e-07	1.280e-07
0.0364	2.966e+01	7.236e-06	9.448e-06	4.111e-08	5.368e-08
0.6616	1.920e+03	6.179e-02	1.091e-01	1.198e-04	2.115e-04

ATTACHMENT 4.1

DOS File : SOIL.MS5
Run Date: October 20, 2004
Run Time: 12:54:38 PM
Duration : 00:00:01

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	2.075e+03	6.182e-02	1.091e-01	1.200e-04	2.118e-04

ATTACHMENT 4.2

Nal Scan MDC Calculation

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

$Conv := 205.603$ $MS_{output} := 2.115 \cdot 10^{-4}$

$\frac{HS_d}{SR} = 2.257$ *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*

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

$MDER = 0.692$ µR/h

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

$MDC_{scan} = 3.273$ pCi/g

ATTACHMENT 5.1

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)

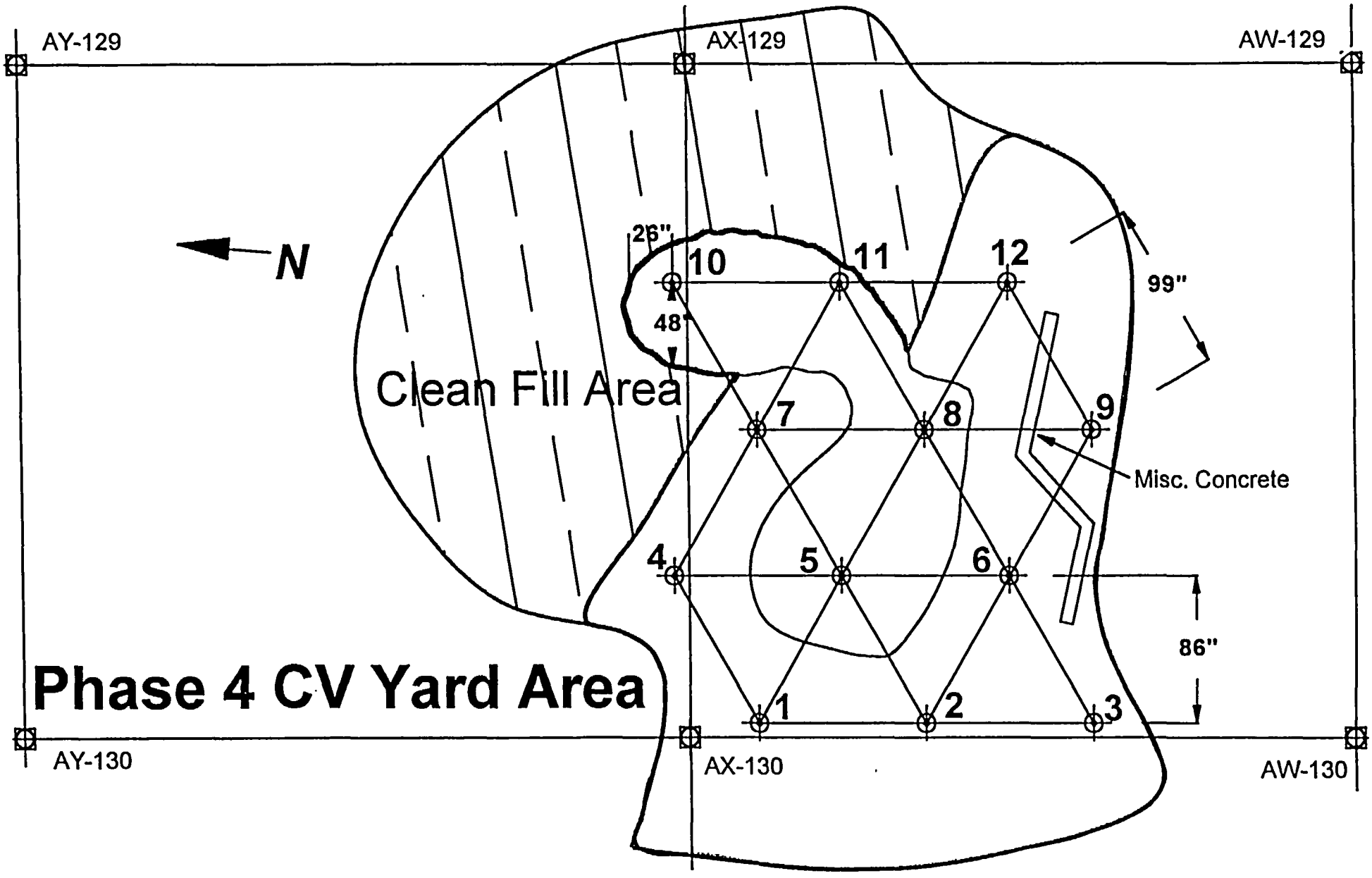
MS_{output} = *MicroShield output exposure rate for 1 pCi/g of contaminant (mR/h)*

O_i = *obervation Interval (seconds)*

p = *human performance factor*

SR = *scan rate in centimeters per second*

ATTACHMENT 5 . 2



ATTACHMENT 6 : 1

COMPASS Site Report

Site Summary

Site Name: CV Yard Area (OL1-2~~5~~) BMB 11/8/04

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 6 - 2

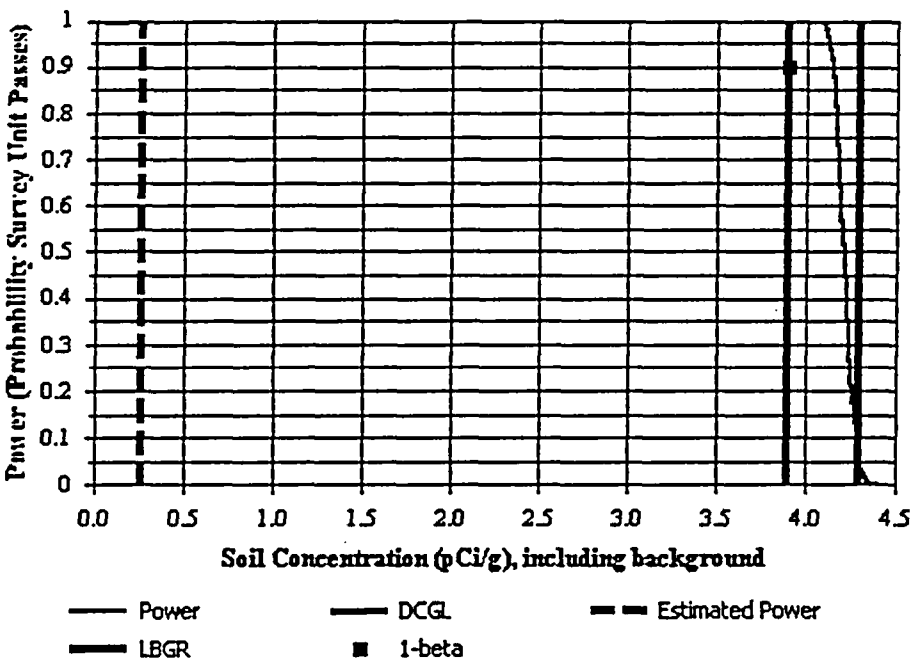
Surface Soil Survey Plan

Survey Plan Summary

Site:	CV Yard Area (OL1-3)		
Planner(s):	BHB		
Survey Unit Name:	Phase 4 Soil in SW Sector		
Comments:			
Area (m^2):	66	Classification:	1
Selected Test:	Sign	Estimated Sigma (pCi/g):	0.14
DCGL (pCi/g):	4.30	Sample Size (N):	11
LBGR (pCi/g):	3.9	Estimated Conc. (pCi/g):	0.3
Alpha:	0.050	Estimated Power:	1
Beta:	0.100	EMC Sample Size (N):	11

Scanning Instrumentation: 2" by 2" NaI (Cs-137 w)

Prospective Power Curve



ATTACHMENT 6.3

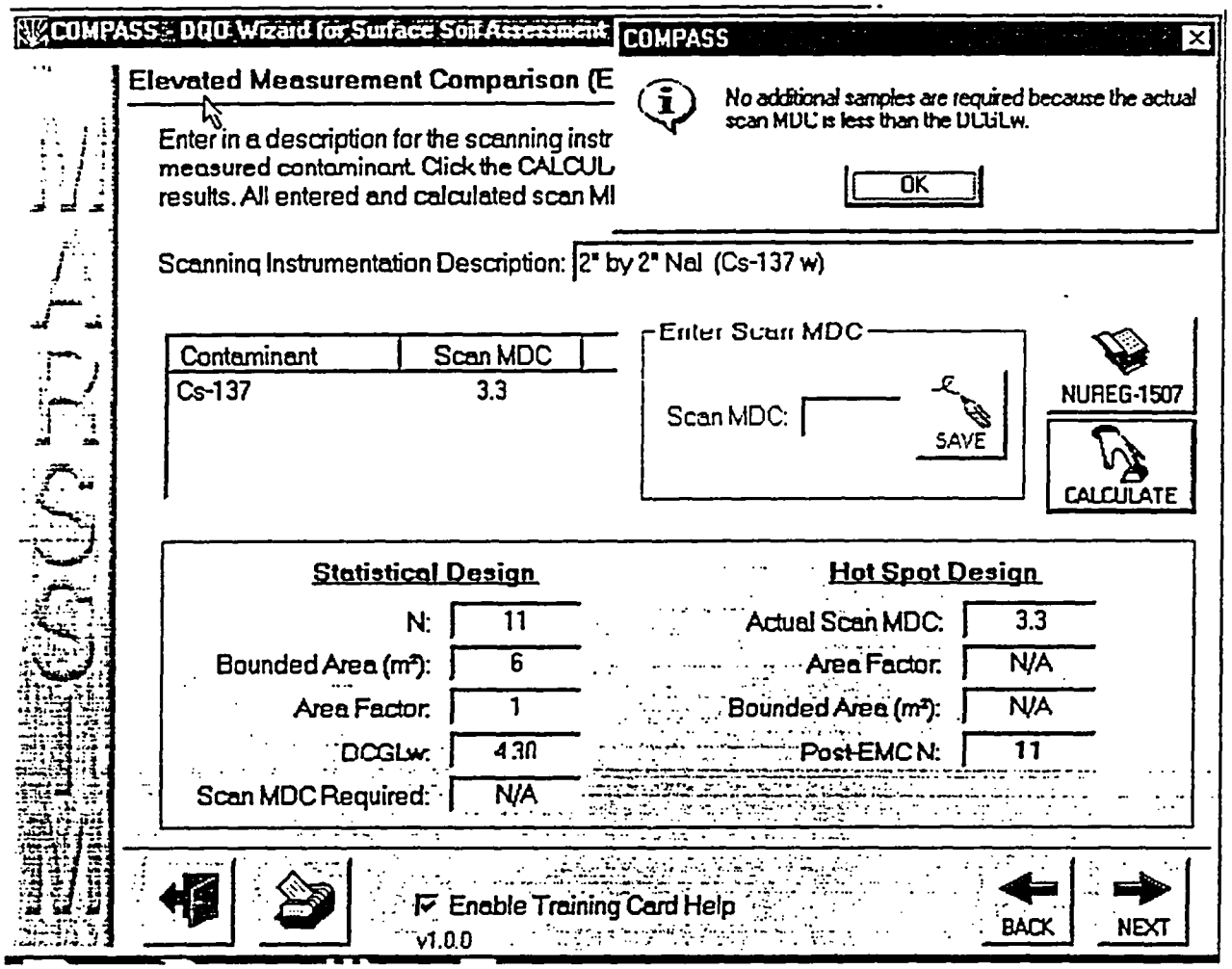
Surface Soil Survey Plan

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	3.3

Contaminant	Survey Unit Estimate (*Mean ± 1-Sigma*) (pCi/g)	Reference Area Estimate (*Mean ± 1-Sigma*) (pCi/g)
Cs-137	0.26 ± 0.14	0.28 ± 0.39

ATTACHMENT 6.4



ATTACHMENT 6.5

Exhibit 1
Survey Unit Inspection Check Sheet

ORIGINAL

SECTION 1 - SURVEY UNIT INSPECTION DESCRIPTION

Survey Unit #	OL1	Survey Unit Location	Phase 4 – CV Excavation (SW corner)
Date	11/3/04	Time	1440
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	

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.

Comments:

Response to Question 4:

Sump Pump, hose, and power cords are present to remove residual water until performance of FSS.

Notified D & D to remove prior to FSS.

Response to Question 5:

Concrete walls are covered with dirt residue in some areas. Notified D & D of necessity of cleaning walls prior to performance of FSS.

Survey Unit Inspector (print/sign)	D. Sarge /	Date	11/3/04
Survey Designer (print/sign)	B. Brosey / B. BROSEY	Date	11-4-04

ATTACHMENT 7.1

ORIGINAL

EXHIBIT 3
Surface Measurement Test Area (SMTA) Data Sheet

SECTION 1 - DESCRIPTION

SMTA Number	SMTA-OL1-1	Survey Unit Number	OL1		
SMTA Location	South Wall of the Phase 4 area (SW Corner of CV Excavation)				
Survey Unit Inspector	D. Sarge	Date	11/3/04	Time	1440

SECTION 2 - CALIPER INFORMATION & PERSONNEL INVOLVED

Caliper Manufacturer	Mitotoyo	Caliper Model Number	CD-6" CS		
Caliper Serial Number	763893	Calibration Due Date (as applicable)	N/A		
Rad Con Technician	D.Sarge	Date	11/3/04	Time	1440
Survey Unit Inspector Approval	D. Sarge /	Date	11/3/04		

SECTION 3 - MEASUREMENT RESULTS

SMTA Grid Map & Measurement Results in Units of mm
(Insert Results in White Blocks Below)

1	7	13	19	25	31
2	8	14	20	26	32
3	9	15	21	27	33
4	10	16	22	28	34
5	11	17	23	29	25
6	12	18	24	30	36

Average Measurement - mm

Comments

- Readings were taken with caliper without the use of plastic grid template in various locations on the South Wall surface.
- Twelve (12) readings obtained throughout, measured as follows (in mm): 52, 42, 24, 33, 32, 16, 12, 7, 26, 38, 50, and 49.

  Average depth: 30.9 mm.

Additional Measurements Required

ATTACHMENT 1.2

EXHIBIT 3

Surface Measurement Test Area (SMTA) Data Sheet

ORIGINAL

SECTION 1 - DESCRIPTION

SMTA Number	SMTA-OL1-2	Survey Unit Number	OL1		
SMTA Location	South Tunnel Wall of the Phase 4 area (SW Corner of CV Excavation)				
Survey Unit Inspector	D. Sarge	Date	11/3/04	Time	1450

SECTION 2 - CALIPER INFORMATION & PERSONNEL INVOLVED

Caliper Manufacturer	Mitotoyo	Caliper Model Number	CD-6" CS		
Caliper Serial Number	763893	Calibration Due Date (as applicable)	N/A		
Rad Con Technician	D.Sarge	Date	11/3/04	Time	1450
Survey Unit Inspector Approval	D. Sarge / [signature]	Date	11/3/04		

SECTION 3 - MEASUREMENT RESULTS

SMTA Grid Map & Measurement Results in Units of mm
(Insert Results in White Blocks Below)

1	7	13	19	25	31
2	8	14	20	26	32
3	9	15	21	27	33
4	10	16	22	28	34
5	11	17	23	29	25
6	12	18	24	30	36

Average Measurement - mm

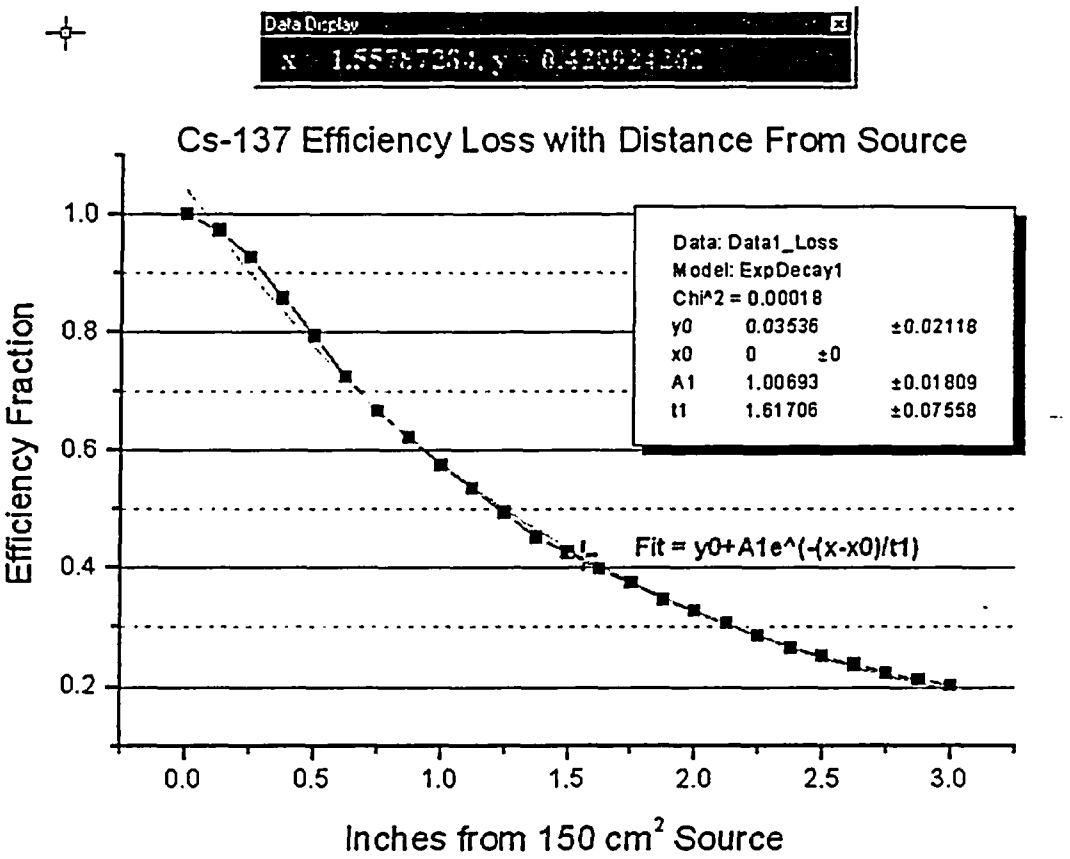
Comments

- Readings were taken with caliper without the use of plastic grid template in various locations on the South Tunnel Wall (Outer) surface.
- Ten (10) readings obtained throughout, measured as follows (in mm): 48, 17, 14, 72, 60, 52, 40, 35, 10, and 47.

  Average depth: 39.5 mm.

Additional Measurements Required

ATTACHMENT 7 - 3



ATTACHMENT 8 - 1

Site Report

Site Summary

Site Name: Phase 4 CV Yard Concrete

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
Gross Activity	Building Surface	33,265	No	0.5 BHB 11/8/04	10.1
				1	10.1
				4	3.4
				9	2
				16	1.5
				25	1.2
				36	1

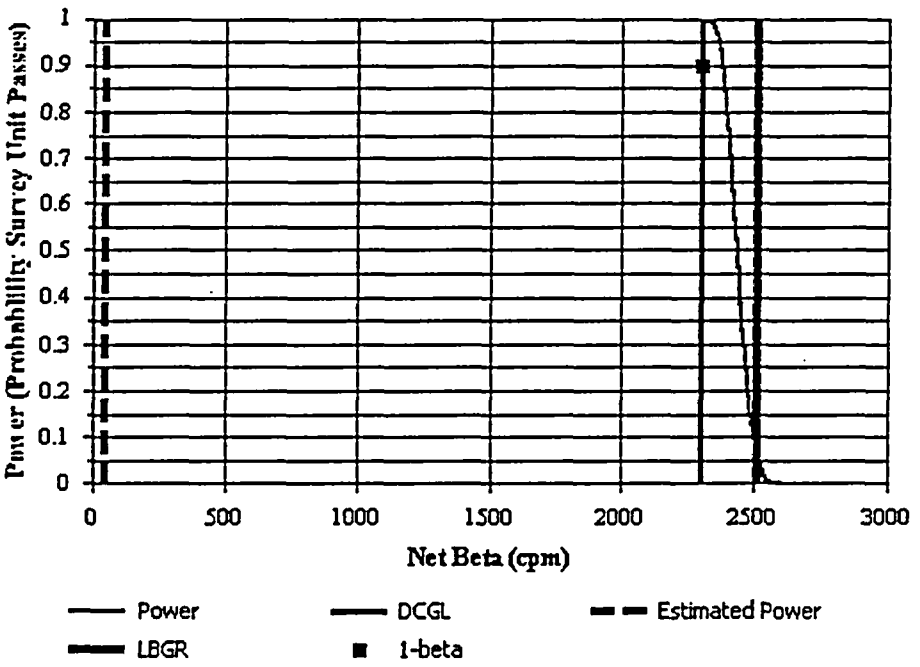
ATTACHMENT 10.1

Building Surface Survey Plan

Survey Plan Summary

Site:	Phase 4 CV Yard Concrete		
Planner(s):	BHB		
Survey Unit Name:	Misc. Concrete in Phase 4 Area		
Comments:	CV Yard Mix		
Area (m^2):	8	Classification:	1
Selected Test:	WRS	Estimated Sigma (cpm):	101
DCGL (cpm):	2,515	Sample Size (N/2):	10
LBGR (cpm):	2,300	Estimated Conc. (cpm):	48
Alpha:	0.050	Estimated Power:	1.00
Beta:	0.100	EMC Sample Size (N):	10

Prospective Power Curve



9 GHB 11/19/04

ATTACHMENT 10.2

Building Surface Survey Plan

Contaminant Summary

Contaminant	DCGLw (dpm/100 cm²)
Gross Activity	33,265

Beta Instrumentation Summary

Gross Beta DCGLw (dpm/100 cm²): 33,265
Total Efficiency: 0.06
Gross Beta DCGLw (cpm): 2,515

ID	Type	Mode	Area (cm²)
29	GFPC	Beta	126

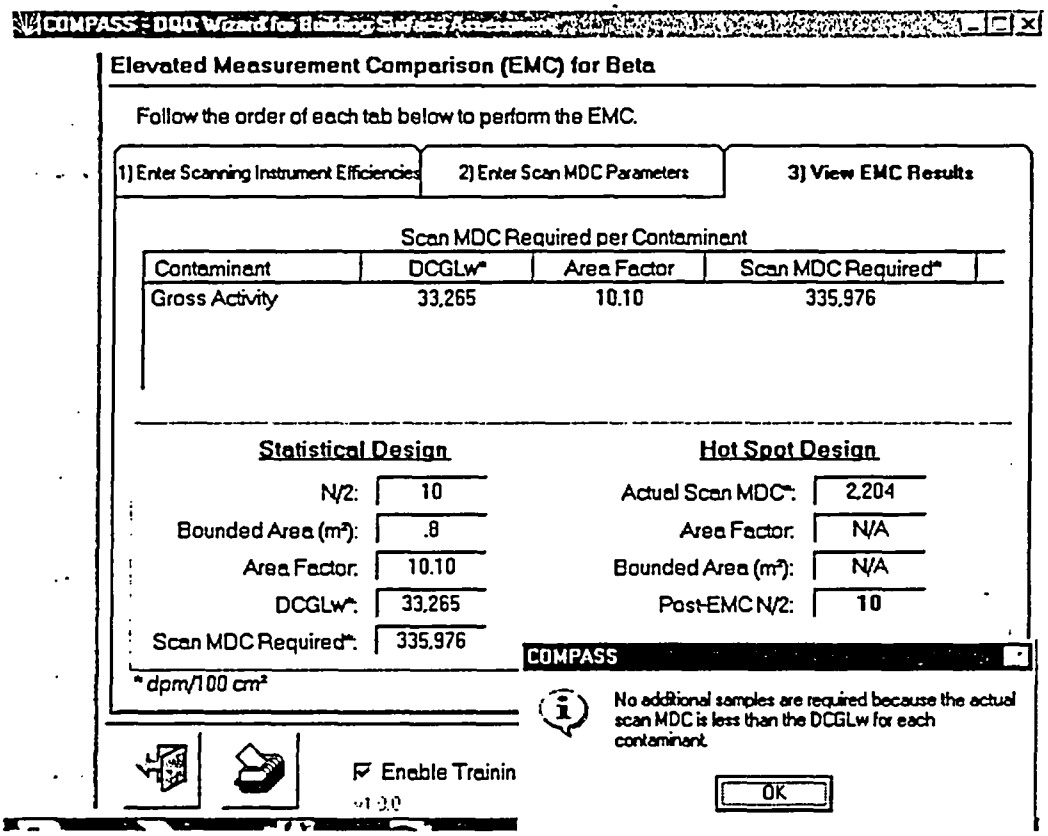
Contaminant	Energy[1]	Fraction[2]	Inst. Eff.	Surf. Eff.	Total Eff.
Gross Activity	187.87	1.0000	0.48	0.13	0.0602

[1] Average beta energy (keV) [N/A indicates alpha emission]
[2] Activity fraction

Gross Survey Unit Mean (cpm): 354 ± 101 (1-sigma)
Count Time (min): 1

Material	Number of BKG Counts	Average (cpm)	Standard Deviation (cpm)	MDC (dpm/100 cm²)
Concrete	31	306	34.5	1,116

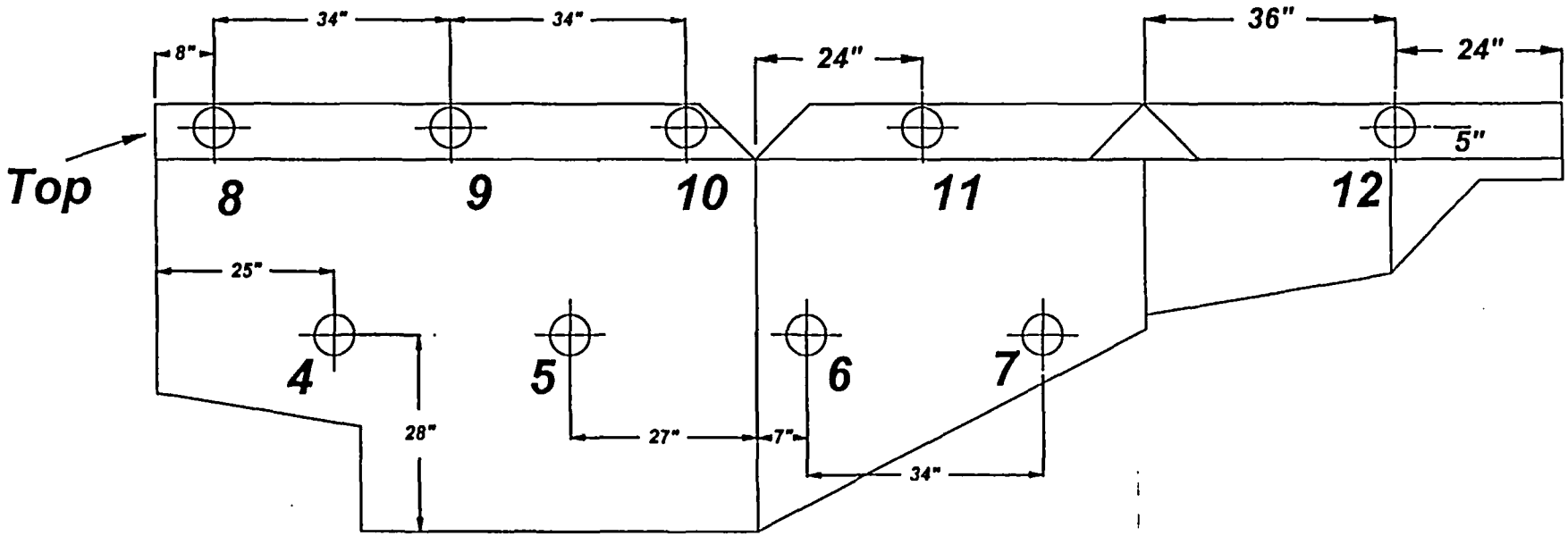
ATTACHMENT 10 - 3

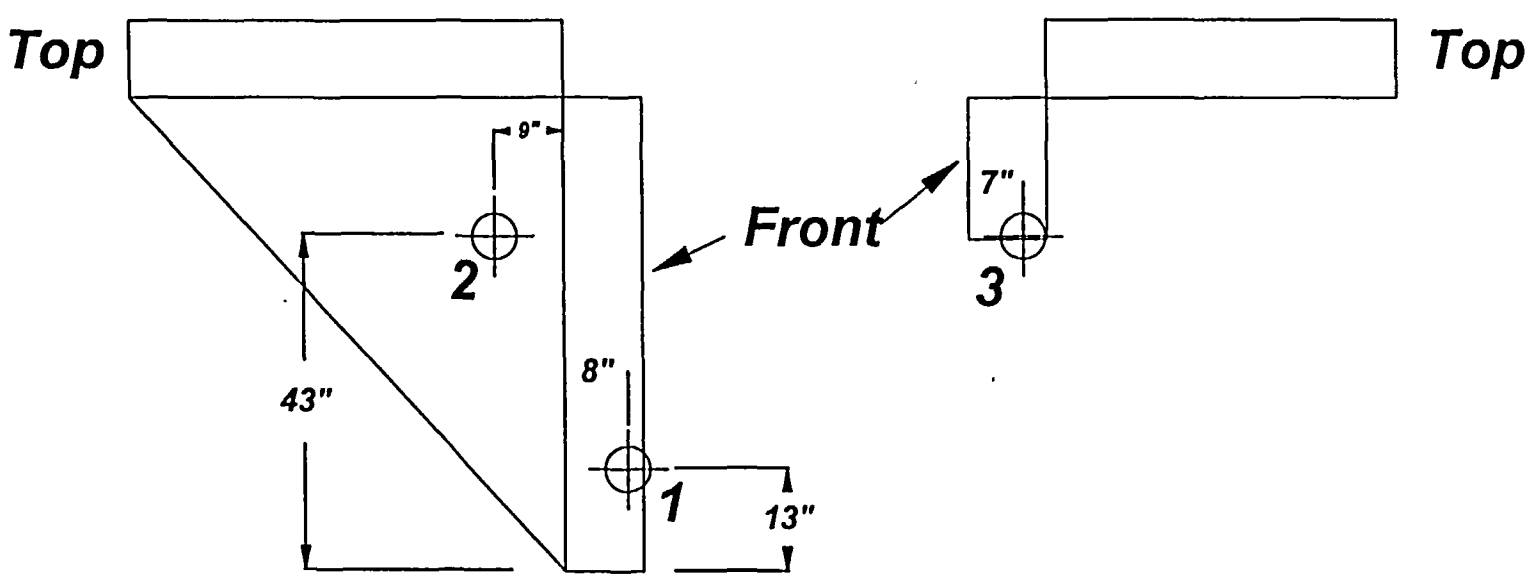


9 BNB 11/9/04

ATTACHMENT 10 - 4

Misc. Concrete Surfaces in Phase 4 Area





ATTACHMENT 4 . 5

Phase 4 Yard Area Soil Samples			
Sample No.	Cs-137 (pCi/g)	Co-60 (pCi/g)	Location Code
SXSL8040	0.31	0.16	SP-1
SXSL8041	0.18	0.19	SP-2
SXSL8042	0.11	0.14	SP-3
SXSL8043	0.51	0.15	SP-4
SXSL8044	0.25	0.14	SP-5
SXSL8045	0.17	0.17	SP-6
SXSL8046	0.21	0.15	SP-7
SXSL8047	0.16	0.13	SP-8
SXSL8043	0.16	0.17	SP-8 QC
SXSL8049	0.14	0.13	SP-9
SXSL8050	0.16	0.18	SP-10
Mean=>	0.215		
Sigma=>	0.112		
Yellow = Positive Result			

Phase 4 Yard Area Soil Samples			
Sample No.	Cs-137 (pCi/g)	Co-60 (pCi/g)	Location Code
SXSL8040	0.31	0.16	SP-1
SXSL8041		0.19	SP-2
SXSL8042	0.11	0.14	SP-3
SXSL8043	0.51	0.15	SP-4
SXSL8044	0.25	0.14	SP-5
SXSL8045	0.17	0.17	SP-6
SXSL8046	0.21	0.15	SP-7
SXSL8047		0.13	SP-8
SXSL8043		0.17	SP-8 QC
SXSL8049		0.13	SP-9
SXSL8050		0.18	SP-10
Mean=>	0.260		
Sigma=>	0.140		
Only Positive Cs-137 Values Retained			

ATTACHMENT 10 - 1

Phase 4 CV Yard Concrete Measurements SR-173

D. Houtz	Instrument 126218	Date	Time	Detector	Counts	Count Time (sec)	Mode	Designator		FSS-1122 Shielded	BHB Unshielded
1	NW FP1S	10/26/2004	14:19	1	3.84E+02	60	SCL	Shielded	β	3.84E+02	
2	NW FP1U	10/26/2004	14:20	1	6.37E+02	60	SCL	Unshielded	β		6.37E+02
3	NW FP2S	10/26/2004	14:22	1	3.40E+02	60	SCL	Shielded	β	3.40E+02	
4	NW FP2U	10/26/2004	14:24	1	4.90E+02	60	SCL	Unshielded	β		4.90E+02
5	SW FP3S	10/26/2004	14:26	1	3.71E+02	60	SCL	Shielded	β	3.71E+02	
6	SW FP3U	10/26/2004	14:27	1	4.39E+02	60	SCL	Unshielded	β		4.39E+02
7	SW FP4S	10/26/2004	14:29	1	3.56E+02	60	SCL	Shielded	β	3.56E+02	
8	SW FP4U	10/26/2004	14:30	1	4.23E+02	60	SCL	Unshielded	β		4.23E+02
9	SW FP5S	10/26/2004	14:32	1	2.81E+02	60	SCL	Shielded	β	2.81E+02	
10	SW FP5U	10/26/2004	14:33	1	3.96E+02	60	SCL	Unshielded	β		3.96E+02
11	SW FP6S	10/26/2004	14:35	1	2.34E+02	60	SCL	Shielded	β	2.34E+02	
12	SW FP6U	10/26/2004	14:37	1	3.11E+02	60	SCL	Unshielded	β		3.11E+02
13	STW FP7S	10/26/2004	14:40	1	2.81E+02	60	SCL	Shielded	β	2.81E+02	
14	STW FP7U	10/26/2004	14:42	1	3.34E+02	60	SCL	Unshielded	β		3.34E+02
15	STW FP8S	10/26/2004	14:43	1	2.43E+02	60	SCL	Shielded	β	2.43E+02	
16	STW FP8U	10/26/2004	14:45	1	3.09E+02	60	SCL	Unshielded	β		3.09E+02
17	STW FP9S	10/26/2004	14:46	1	2.62E+02	60	SCL	Shielded	β	2.62E+02	
18	STW FP9U	10/26/2004	14:48	1	2.90E+02	60	SCL	Unshielded	β		2.90E+02
19	STW FP10S	10/26/2004	14:49	1	2.72E+02	60	SCL	Shielded	β	2.72E+02	
20	STW FP10U	10/26/2004	14:51	1	3.28E+02	60	SCL	Unshielded	β		3.28E+02
21	STW FP11S	10/26/2004	14:52	1	2.15E+02	60	SCL	Shielded	β	2.15E+02	
22	STW FP11U	10/26/2004	14:53	1	2.86E+02	60	SCL	Unshielded	β		2.86E+02
23	STW FP12S	10/26/2004	14:55	1	2.20E+02	60	SCL	Shielded	β	2.20E+02	
24	STW FP12U	10/26/2004	14:56	1	2.80E+02	60	SCL	Unshielded	β		2.80E+02
25	STW FP13S	10/26/2004	14:58	1	2.45E+02	60	SCL	Shielded	β	2.45E+02	
26	STW FP13U	10/26/2004	14:59	1	3.24E+02	60	SCL	Shielded	β		3.24E+02
27	STW FP14S	10/26/2004	15:01	1	2.45E+02	60	SCL	Unshielded	β	2.45E+02	
28	STW FP14U	10/26/2004	15:02	1	2.96E+02	60	SCL	Shielded	β		2.96E+02
29	STW FP15S	10/26/2004	15:04	1	2.53E+02	60	SCL	Unshielded	β	2.53E+02	
30	STW FP15U	10/26/2004	15:05	1	2.68E+02	60	SCL	Shielded	β		2.68E+02
31	STW FP16S	10/26/2004	15:07	1	2.84E+02	60	SCL	Shielded	β	2.84E+02	
32	STW FP16U	10/26/2004	15:08	1	2.51E+02	60	SCL	Unshielded	β		2.51E+02
									Minimum ⇒	2.15E+02	2.51E+02
									Maximum ⇒	3.84E+02	6.37E+02
									Mean ⇒	2.80E+02	3.54E+02
									Sigma ⇒	5.38E+01	1.01E+02

ATTACHMENT 11 - 1

Williamsburg Concrete Background Measurements

37122N21	Instrument 95348	RLM6220	Time	Detector	Counts	Count Time (sec)	Mode	Designator		FSS-001	BHB
0	BKGND	1/4/2002	8:52	1	7.26E+03	1800	SCL	Inital Background	β		
1	Source Check	1/4/2002	9:07	1	1.79E+05	60	SCL	Source	β		
2	BKGND	1/4/2002	10:05	2	4.40E+01	1800	SCL	Inital Background	α	Concrete CF(cpm) ⇒	0.00E+00
14	Source Check	1/4/2002	10:39	2	1.51E+05	60	SCL	Source	α	Shielded	Unshielded
15	CON A1S	1/4/2002	13:00	1	2.78E+02	60	SCL	Shielded	β	2.78E+02	
16	CON A1U	1/4/2002	13:02	1	3.88E+02	60	SCL	Unshielded	β		3.88E+02
17	CON A2S	1/4/2002	13:20	1	2.39E+02	60	SCL	Shielded	β	2.39E+02	
18	CON A2U	1/4/2002	13:21	1	2.22E+02	60	SCL	Unshielded	β		2.22E+02
19	CON A3S	1/4/2002	13:28	1	2.39E+02	60	SCL	Shielded	β	2.39E+02	
20	CON A3U	1/4/2002	13:30	1	2.62E+02	60	SCL	Unshielded	β		2.62E+02
21	CON A4S	1/4/2002	13:36	1	2.45E+02	60	SCL	Shielded	β	2.45E+02	
22	CON A4U	1/4/2002	13:38	1	2.71E+02	60	SCL	Unshielded	β		2.71E+02
23	CON A5S	1/4/2002	13:58	1	2.00E+02	60	SCL	Shielded	β	2.00E+02	
24	CON A5U	1/4/2002	14:00	1	2.82E+02	60	SCL	Unshielded	β		2.82E+02
25	CON A6S	1/4/2002	14:03	1	1.84E+02	60	SCL	Shielded	β	1.84E+02	
26	CON A6U	1/4/2002	14:05	1	3.10E+02	60	SCL	Unshielded	β		3.10E+02
27	CON A7S	1/4/2002	14:09	1	1.98E+02	60	SCL	Shielded	β	1.98E+02	
28	CON A7U	1/4/2002	14:10	1	3.15E+02	60	SCL	Unshielded	β		3.15E+02
29	CON A8S	1/4/2002	14:19	1	2.34E+02	60	SCL	Shielded	β	2.34E+02	
30	CON A8S	1/4/2002	14:22	1	2.31E+02	60	SCL	Shielded	β	2.31E+02	
31	CON A8U	1/4/2002	14:24	1	2.88E+02	60	SCL	Unshielded	β		2.88E+02
32	CON A9S	1/4/2002	14:31	1	2.65E+02	60	SCL	Shielded	β	2.65E+02	
33	CON A9U	1/4/2002	14:33	1	2.89E+02	60	SCL	Unshielded	β		2.89E+02
34	CON A10S	1/4/2002	14:42	1	2.46E+02	60	SCL	Shielded	β	2.46E+02	
35	CON A10U	1/4/2002	14:43	1	3.16E+02	60	SCL	Unshielded	β		3.16E+02
36	CON A11S	1/4/2002	15:10	1	1.95E+02	60	SCL	Shielded	β	1.95E+02	
37	CON A11U	1/4/2002	15:12	1	2.94E+02	60	SCL	Unshielded	β		2.94E+02
38	CON A12S	1/4/2002	15:13	1	2.21E+02	60	SCL	Shielded	β	2.21E+02	
39	CON A12U	1/4/2002	15:14	1	2.84E+02	60	SCL	Unshielded	β		2.84E+02
40	CON A13S	1/4/2002	15:23	1	1.74E+02	60	SCL	Shielded	β	1.74E+02	
41	CON A13U	1/4/2002	15:24	1	2.94E+02	60	SCL	Unshielded	β		2.94E+02
42	CON A14S	1/4/2002	15:25	1	1.96E+02	60	SCL	Shielded	β	1.96E+02	
43	CON A14U	1/4/2002	15:26	1	3.33E+02	60	SCL	Unshielded	β		3.33E+02
44	CON A15S	1/4/2002	15:28	1	2.16E+02	60	SCL	Shielded	β	2.16E+02	
45	CON A15U	1/4/2002	15:29	1	3.45E+02	60	SCL	Unshielded	β		3.45E+02
46	CON A16S	1/4/2002	15:30	1	1.83E+02	60	SCL	Shielded	β	1.83E+02	
47	CON A16U	1/4/2002	15:31	1	3.13E+02	60	SCL	Unshielded	β		3.13E+02
48	CON A17S	1/4/2002	15:33	1	1.82E+02	60	SCL	Shielded	β	1.82E+02	
49	CON A17U	1/4/2002	15:34	1	3.22E+02	60	SCL	Unshielded	β		3.22E+02
50	CON A18S	1/4/2002	15:35	1	1.84E+02	60	SCL	Shielded	β	1.84E+02	
51	CON A18U	1/4/2002	15:36	1	3.24E+02	60	SCL	Unshielded	β		3.24E+02
52	CON A19S	1/4/2002	15:37	1	1.91E+02	60	SCL	Shielded	β	1.91E+02	
53	CON A19U	1/4/2002	15:39	1	3.07E+02	60	SCL	Unshielded	β		3.07E+02
54	CON A20S	1/4/2002	15:40	1	1.94E+02	60	SCL	Shielded	β	1.94E+02	
55	CON A20U	1/4/2002	15:41	1	3.33E+02	60	SCL	Unshielded	β		3.33E+02
56	CON A21S	1/4/2002	15:57	1	2.23E+02	60	SCL	Shielded	β	2.23E+02	
57	CON A21U	1/4/2002	15:58	1	2.92E+02	60	SCL	Unshielded	β		2.92E+02
58	CON A22S	1/4/2002	15:59	1	1.72E+02	60	SCL	Shielded	β	1.72E+02	
59	CON A22U	1/4/2002	16:00	1	2.80E+02	60	SCL	Unshielded	β		2.80E+02
60	CON A23S	1/4/2002	16:01	1	1.94E+02	60	SCL	Shielded	β	1.94E+02	
61	CON A23U	1/4/2002	16:02	1	3.29E+02	60	SCL	Unshielded	β		3.29E+02
62	CON A24S	1/4/2002	16:04	1	1.87E+02	60	SCL	Shielded	β	1.87E+02	
63	CON A24U	1/4/2002	16:05	1	3.48E+02	60	SCL	Unshielded	β		3.48E+02
64	CON A25S	1/4/2002	16:06	1	2.07E+02	60	SCL	Shielded	β	2.07E+02	
65	CON A25U	1/4/2002	16:07	1	3.72E+02	60	SCL	Unshielded	β		3.72E+02
66	CON A26S	1/4/2002	16:09	1	2.09E+02	60	SCL	Shielded	β	2.09E+02	
67	CON A26U	1/4/2002	16:10	1	3.26E+02	60	SCL	Unshielded	β		3.26E+02
68	CON A27S	1/4/2002	16:11	1	2.07E+02	60	SCL	Shielded	β	2.07E+02	
69	CON A27U	1/4/2002	16:12	1	3.30E+02	60	SCL	Unshielded	β		3.30E+02
70	CON A28S	1/4/2002	16:14	1	2.30E+02	60	SCL	Shielded	β	2.30E+02	
71	CON A28U	1/4/2002	16:15	1	3.06E+02	60	SCL	Unshielded	β		3.06E+02
72	CON A29S	1/4/2002	16:20	1	2.13E+02	60	SCL	Shielded	β	2.13E+02	
73	CON A29U	1/4/2002	16:21	1	2.58E+02	60	SCL	Unshielded	β		2.58E+02
74	CON A30S	1/4/2002	16:24	1	2.33E+02	60	SCL	Shielded	β	2.33E+02	
75	CON A30U	1/4/2002	16:25	1	2.89E+02	60	SCL	Unshielded	β		2.89E+02
76	CON A31S	1/4/2002	16:28	1	1.84E+02	60	SCL	Shielded	β	1.84E+02	
77	CON A31U	1/4/2002	16:29	1	2.63E+02	60	SCL	Unshielded	β		2.63E+02
—	Source Check	1/4/2002	17:27	1	1.70E+05	60	SCL	—	β		
										Minimum ⇒	1.72E+02	2.22E+02
										Maximum ⇒	2.78E+02	3.88E+02
										Mean ⇒	2.11E+02	3.06E+02
										Sigma ⇒	2.69E+01	3.45E+01

ATTACHMENT 11.2