Appendix B

Chambers 2 and 3 area
Survey Design

ORIGINAL

FirstEnergy

SNEC CALCULATION COVER SHEET

CALCULATION DESCRIPTION

Calculation Number	Revision Number	Effective Date	Page Number
E900-04-012	0	6/30/04	1 of 10

Subject

CV Tunnel & Top of Seal Chambers 1 & 2 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 ☐

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/ [signature]	Date	6/29/04
Technical Reviewer	P. Donnachie/ [signature]	Date	6/30/04
Additional Review	A. Paynter/ [signature]	Date	1 July 04
Additional Review		Date	
SNEC Management Approval		Date	

1.0 PURPOSE

1.1 The purpose of this calculation is to develop a survey design for the SNEC CV Steam Tunnel interior concrete surface and the top of Seal Chambers 1 and 2. Survey locations are shown on **Attachment 1-1. Attachment 2-1** and **2-2** show the individual structures that are to be surveyed using this survey design.

2.0 SUMMARY OF RESULTS

2.1 The following information should be used to develop a survey request for this survey work:

2.1.1 Basic survey unit information is provided in the following Table.

Table 1, Basic Information

Survey Unit No.	Area Description	Classification	Survey Coverage	Area (m^2)
SS22-1	CV Pipe Tunnel Floor	1	100%	20.6
SS22-2	CV Pipe Tunnel Walls	1	100%	47.8
SS22-3	CV Pipe Tunnel Ceiling	1	100%	16.2
SS17-2	Walls Around Top of Seal Chambers 1 & 2	2	50%	50.3
SS18-2	Top of Seal Chamber 1 & 2	1	100%	43.3

2.1.2 The effective DCGLw values for these survey units are provided below.

Table 2, DCGLw Values

Gross Surface DCGLw* (dpm/100 cm^2)*	Volumetric DCGLw* (pCi/g)	Cs-137 Fraction
20,609	4.74 (Cs-137)	0.992

*Administrative limit (75% of DCGLw value) from Attachment 3-1 to 3-6.

2.2 NaI Scan Survey Work

2.2.1 NaI detector scanning parameters shall be IAW MicroShield model(s) used to develop applicable MDCscan values (see the following Table and **Attachments 4-1** to **4-9**).

Table 3, SUMMARY OF NaI SCANNING PARAMETERS

Model Type	Scan Speed	Surface to Detector Face	Calculated MDCscan Values
Surface Deposition	~2" per sec (5 cm/sec)	2" (5.1 cm)	4,128 – 5,838 dpm/100 cm^2 (~100 -200 cpm bkgnd)*
Volumetric	~2" per sec (5 cm/sec)	2" (5.1 cm)	3.7 – 5.3 pCi/g Cs-137 (~100 -200 cpm bkgnd)

* NOTE: Values from Attachment 4-3 and 4-4 have been corrected to gross activity by dividing by the Cs-137 fraction from Table 2.

2.2.2 The NaI scan MDC calculation is determined based on a 5 cm/sec scan rate, a 1.38 index of sensitivity (95% correct detection probability and 60% false positive) and a detector sensitivity of at least 208 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 is about 100 cpm to ~200 cpm. Thus the resulting MDCscan is about 3.7 to 5.3 pCi/g (see **Attachment 4-1** to **4-9**).

Table 4, NaI Scanning & Instrumentation Parameters (Cont'd)

Scanning Width	Required Conversion/Efficiency*
0.305 meters (12")	> = 208 *cpm/μR/h*

* Minimum requirement. See **Attachment 5-1** for typical site instrument efficiencies as of 6-01-04.

2.2.3 All NaI detectors (*2" by 2"*) shall employ a Cs-137 window setting (single channel analyzer). The window width should straddle the Cs-137 662 keV full peak (see **Reference 3.1**).

2.2.4 The following have been identified as the initial action levels for these survey units.

Table 5, NaI Alarm Set-Point (in Gross CPM)

Material	GCPM
All Types	300

2.2.5 All survey personnel shall be trained to identify the action levels (alarm set-points are considered action levels) described above in Section 2.2.4 based on the audible instrument indicators.

2.2.6 If a count rate of greater than ***300 gross cpm*** is identified during the scanning process, stop and locate the boundary of the elevated area. Mark the elevated area with a magic marker, chalk or other appropriate marking tool.

2.2.6.1 Sample any elevated areas(s) IAW applicable sections of SNEC procedure E900-IMP-4520.04 (**Reference 3-2**), and Section 2.4 of this survey design.

2.3 GFPC Survey Work

2.3.1 A gas flow proportional counter (GFPC) shall be used in the beta detection mode for this survey work (Ludlum 2350-1 with a 43-68B probe).

2.3.2 The action level during first phase scanning is ***1,100 gross cpm***. 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 (second phase scanning).

2.3.3 ***Areas greater than the DCGLw (2,077 ncpm) (identified during second phase scanning), must be documented, marked, and bounded to include an area estimate***.

2.3.4 Following remediation, a portion of the survey unit inspection reports for these areas are included in this calculation as **Attachment 6-1** through **6-8**. For the CV tunnel area (excluding core bore holes and unistrut areas), the Surface Measurement Test

Area (SMTA) result indicated that a nominal deviation from a smooth surface characteristic was ~0.2 cm with some trough areas reaching 2" in depth. On the top of Seal Chamber 1 and 2, the mean SMTA result was ~0.84 mm with one cradle having a roughness of up to 1.75". Using the larger of these values (2") and **Reference 3.3** data, an efficiency correction factor (CF) of 0.328 is assumed for these areas. See **Attachment 7-1**.

Table 6, GFPC Detection Efficiency Used for Planning

Material Type	ε_i*	ε_s	ε_t (as %)	% Cs-137	Efficiency CF	Resulting counts/disintegration
All	0.478	0.5	23.9%	0.9916	0.33	0.0776

*See **Attachment 5-1** as an example of current typical detector efficiency factors used at the SNEC site (as of 6/1/04).
NOTE 1: Instruments are changed out frequently due to re-calibration requirements and failures in the field. The 23.9% value in Table 6 above, is from a previous instrument calibration check for an instrument not currently in service.
NOTE 2: Total efficiency shall not be less than ε_t value for any instrument used during this survey effort.

2.3.5 The Compass computer program (**Reference 3.4**) is used to calculate the required number of random **8-1** to **8-15**.

Table 7, Minimum Random Start Systematic Measurements

Survey Unit No.	Area Description	No. of Points
SS22-1	CV Pipe Tunnel Floor	8
SS22-2	CV Pipe Tunnel Walls	8
SS22-3	CV Pipe Tunnel Ceiling	8
SS17-2	Walls Around Top of Seal Chambers 1 & 2	8
SS18-2	Top of Seal Chamber 1 & 2	8

See Attachment 11-1 to 11-5 for point locations as plotted by VSP.

2.3.6 VSP (**Reference 3.5**) is used to plot all measurement points on the included diagrams. 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

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 random start systematically spaced sampling points.

Table 8, SUMMARY OF GFPC SCANNING PARAMETERS

Structural Material	Scan Speed	Surface to Detector Face
All Types	0.9" per sec (2.2 cm/sec)	Contact

2.3.7 Scanning efforts shall be based on audible speaker output levels. Earphones are recommended.

2.3.8 When an obstruction is encountered during the static measurement phase that will not allow placement of a static survey point, contact the cognizant SR coordinator for permission to delete that survey point. Document the reason for the deletion. Note that up to two survey points in any survey unit, may be deleted without reducing survey design effectiveness.

2.3.9 A smear survey shall be performed in each survey unit at static measurement point locations. These smears shall be obtained after static measurements are acquired. These smears shall be assayed for beta/gamma and alpha contamination. A composite gamma scan of each survey units smear group shall be performed and reported.

2.3.10 ***Other instruments of the type specified in 2.3.1 above may be used during the FSS but they must demonstrate an efficiency at or above the value listed in Table 6 (23.9%).***

2.4 Sampling

2.4.1 Whenever possible, sample concrete by extracting a 4" long core bore so that the depth of penetration can be identified. When a core bore cannot be taken because of the quality of the concrete, or because of limited access in an area, sampling should remove the first 1" of concrete 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).

2.4.2 For steel surfaces, scrape the surface to collect a sample for gamma scanning by removing as much material as possible over/in the suspect area. Document the approximate size of the area where the materials were removed. Whenever possible, obtain a volume of no less then 25 cc's (200 cc's is preferred).

2.4.3 In general, samples shall be collected at biased locations where measurements indicate elevated count rates exist, or where measurement capability is deemed inadequate due to poor geometry.

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

3.0 REFERENCES

3.1 SNEC Calculation No. E900-03-018, "Optimized 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 SNEC Calculation No. 6900-02-028, "GFPC Instrument Efficiency Loss Study".

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

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

3.6 SNEC Facility License Termination Plan.

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

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

3.9 1994 Saxton Soil Remediation Project Report, GPU Nuclear Inc., May 11, 1995.

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

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

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

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

4.0 ASSUMPTIONS AND BASIC DATA

4.1 Remediation History

The below grade CV Pipe Tunnel originally extended around the base of the CV approximately 270 degrees and connected to the old Radioactive Waste Disposal Facility (RWDF), Control and Auxiliary building the Saxton Steam Generating Station (SSGS) Footprint buildings. The only remaining section still in tact extends from the SSGS footprint East approximately 36 feet toward the CV area. The remaining CV Tunnel section diagram is shown on **Attachment 1-1.**

Piping systems originally installed in the CV Tunnel, were removed from about 1972 to 1974. These early remediation efforts were not specifically documented. In the late 80's an isolation wall was erected at the far eastern end. Since the CV Tunnel collected seasonal rain and ground water seepage, this wall served to isolate water accumulation to only a portion of the remaining structure.

In the spring of 1994, SNEC personnel entered the tunnel through a hole installed in the ceiling to complete characterization surveys for this structure. No evidence of abrasive remediation of the interior surface of the tunnel was noted. A thorough characterization survey was performed in late 1994. Areas indicating elevated activity were core bored to determine the depth of the contamination.

Most of the CV Tunnel has now been removed, leaving only about a 36' section remaining as shown on **Attachment 2-1.** In the summer of 2003, Shonka Research Associates (SRA) surveyed the remaining section of tunnel area using a large area GFPC detector array. Remediation was then performed to reduce the residual volumetric concentration of Cs-137 and lower the general area exposure rate before a final round of FSS work.

The Seal Chambers are located in the Discharge Tunnel, but the tops are exposed in the SSGS footprint area. The tops of Seal Chamber 1 and 2 are not extensively contaminated, and in August of 2003 the concrete surfaces were cleared of sediment and debris in preparation for FSS work by SRA (see **Attachment 2-2**). After the initial survey work was performed, several small locations were identified that required further remediation. A final round of survey work was then planned.

4.2 The MARSSIM WRS Test will be applicable for this survey design.

4.3 Variability in these survey units includes both steel and concrete surface measurements. However, steel surfaces represent only ~10% of the surface area in only one (1) survey unit. The remainder of these survey units have little or no steel surface area present. Therefore, true variability within these survey units is driven by one main material type (concrete). Variability for these two (2) survey units is shown in **Attachment 9-1** to **9-2**.

4.4 Backgrounds for these survey units are taken from the Williamsburg background materials study (see **Attachment 10-1**).

4.5 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 3.5**). VSP is used to plot random start systematically spaced sampling points. The coordinates of the survey points are provided for each survey unit referenced to an existing survey area landmark (key point measurement location). Because of edge effects and a desire to error on the conservative side, additional measurement points have been forced by increasing the MARSSIM overage above the required 20%.

4.6 **Reference 3.6** and **3.7** was used as guidance during the survey design development phase.

4.7 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 volumetric 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. The surface DCGLw is a gross activity values that includes all relevant radionuclides. For both DCGLw values, an administrative limit has been set that further lowers the permissible Cs-137 concentration to an effective DCGLw for this radionuclide. The sample data base used to determine the effective radionuclide mix for the CV Tunnel and Seal Chambers has been drawn from samples that were assayed at off-site laboratories. This list is shown as **Attachment 3-1** and **3-6**. Review of the data points out that only three radionuclides have been positively identified (Co-60, Cs-137 & Sr-90). Inspection of the data also shows that Cs-137 is by far the predominant radioactive contaminant found in this area (>99%). Both Sr-90 and Co-60 combined are < 1% of the mix.

Remediation has further impacted the radionuclide concentration levels in this area. Remediation efforts have been shown to be effective in the CV Tunnel and Seal Chamber areas. Therefore, the impact of remediation must be considered in determining the effective Cs-137 DCGLw surrogate value. The final sample listing was decayed to January 15th, 2004.

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

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

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

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

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

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

4.14 Area factors for structural surfaces are shown below. 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 Co-60 values. The lower limit area factor for areas less than 1 square meter is 10.1. Area factors for values between the values listed in the following table, are interpolated from the data by Compass.

AREA (m^2)	AREA FACTOR
1	10.1
4	3.4
9	2
16	1.5
25	1.2
36	1

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 the SNEC site area showing the CV Tunnel.

6.2 **Attachment 2**

6.2.1 **Attachment 2-1**, is a diagram of the remaining CV Tunnel remnant.

6.2.2 **Attachment 2-2**, is a diagram of the top of Seal Chamber 1 & 2.

6.3 **Attachment 3-1** to **3-6**, is the final list of sample results decayed to January 15, 2004 and the "Effective DCGLw Calculator" spreadsheet file used to determine the effective Cs-137 concentration for the CV Tunnel and Seal Chamber 1 & 2 areas.

6.4 **Attachment 4-1** to **4-9**, are MicroShield models of surface and volumetric concentrations used to determine the MDCscan values for various scanning conditions in these survey units.

6.5 **Attachment 5-1**, is a listing of typical detection efficiencies for NaI and GFPC instrumentation at the SNEC site.

6.6 **Attachment 6-1** to **6-8**, are copies of inspection reports for these two survey areas.

6.7 **Attachment 7-1**, is a graph of efficiency loss results with increasing distance from a source of Cs-137 for the GFPC instrument.

6.8 **Attachment 8-1** to **8-15**, are the Compass output reports for these survey units.

6.9 **Attachment 9-1** and **9-2**, are the variability results for these two survey areas.

6.10 **Attachment 10-1**, is the Williamsburg background measurements of concrete materials made with the GFPC instrument.

6.11 **Attachment 11-1** to **11-5**, are fixed point measurement locations determined by the VSP computer code.

Exhibit 1

SNEC Facility 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.

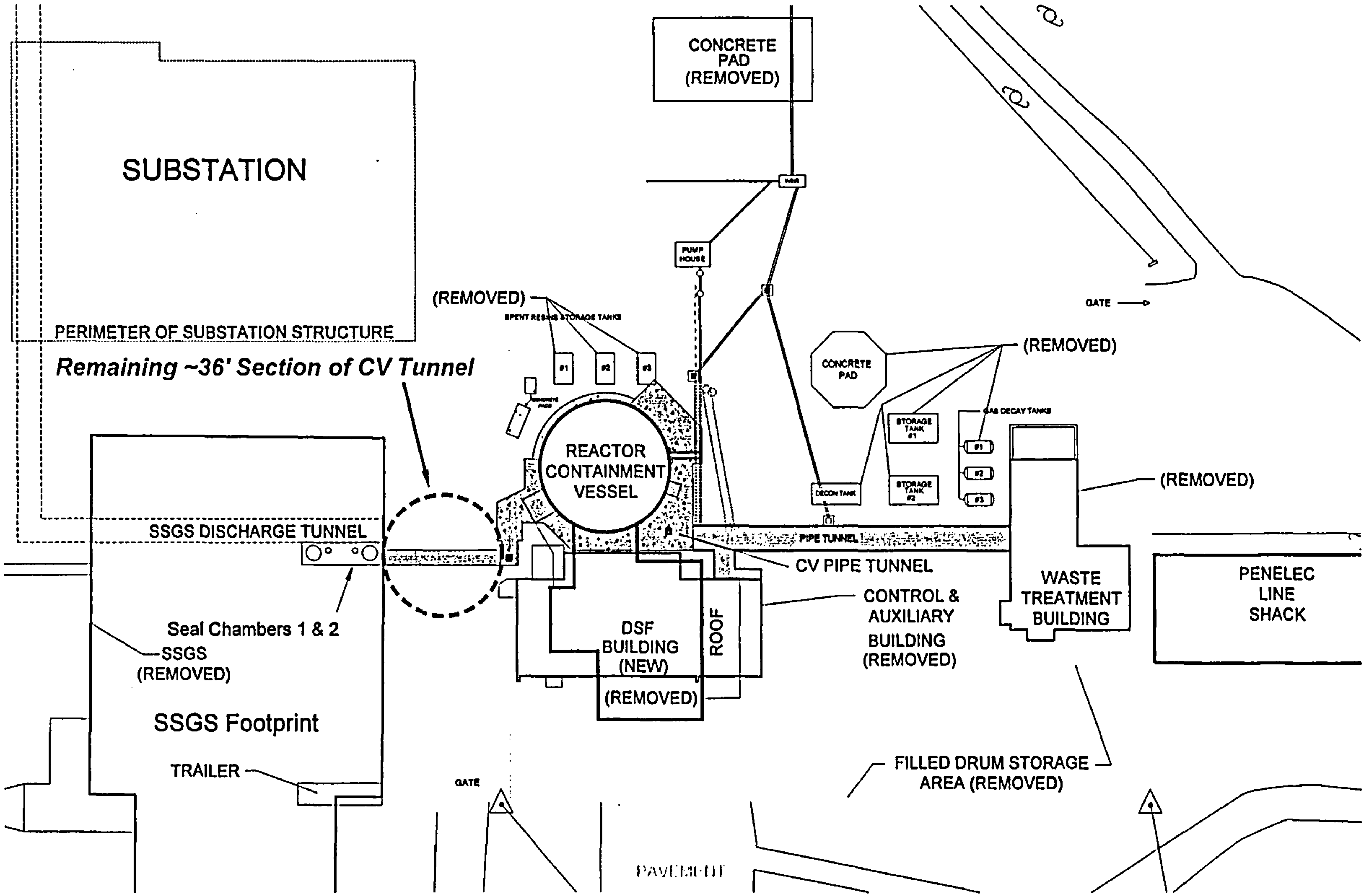
(b) Listed values are from the subsurface model. These values are the most conservative values between the two models (i.e., surface & subsurface).

Exhibit 2

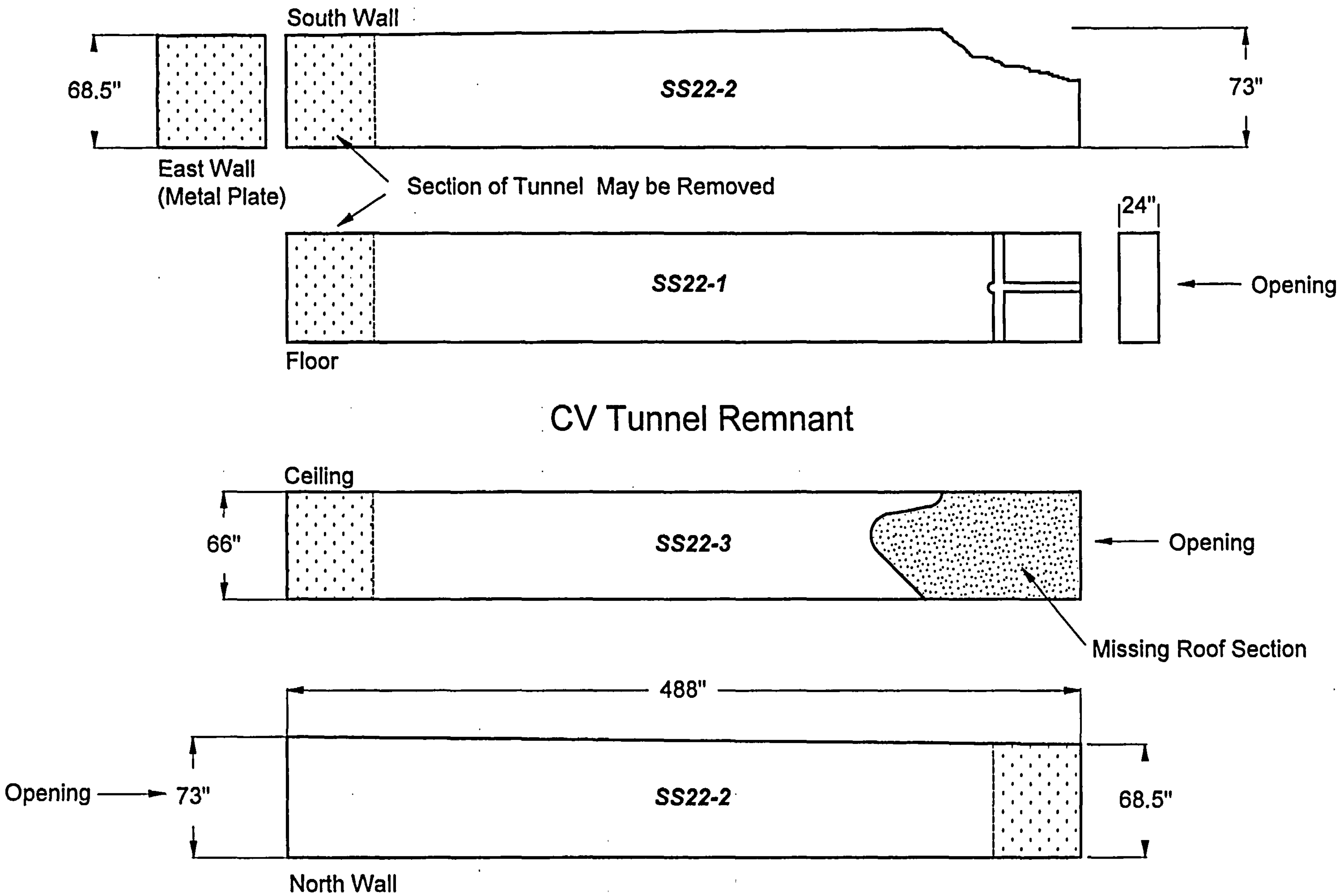
Survey Design Checklist

Calculation No. E900-04-012	Location Codes SS22-1, SS22-2, SS22-3, SS17-2 and SS18-2		
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	HD 6/30/04
2	Are drawings/diagrams adequate for the subject area (drawings should have compass headings)?	(Yes) N/A	HD 6/30/04
3	Are boundaries properly identified and is the survey area classification clearly indicated?	(Yes) N/A	HD 6/30/04
4	Has the survey area(s) been properly divided into survey units IAW EXHIBIT 10	(Yes) N/A	HD 6/30/04
5	Are physical characteristics of the area/location or system documented?	(Yes) N/A	HD 6/30/04
6	Is a remediation effectiveness discussion included?	(Yes) N/A	HD 6/30/04
7	Have characterization survey and/or sampling results been converted to units that are comparable to applicable DCGL values?	(Yes) N/A	HD 6/30/04
8	Is survey and/or sampling data that was used for determining survey unit variance included?	(Yes) N/A	HD 6/30/04
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	HD 6/30/04
10	Are applicable survey and/or sampling data that was used to determine variability included?	(Yes) N/A	HD 6/30/04
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)	HD 6/30/04
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)	HD 6/30/04
13	Are all necessary supporting calculations and/or site procedures referenced or included?	(Yes) N/A	HD 6/30/04
14	Has an effective DCGLw been identified for the survey unit(s)?	(Yes) N/A	HD 6/30/04
15	Was the appropriate $DCGL_{EMC}$ included in the survey design calculation?	(Yes) N/A	HD 6/30/04
16	Has the statistical tests that will be used to evaluate the data been identified?	(Yes) N/A	HD 6/30/04
17	Has an elevated measurement comparison been performed (Class 1 Area)?	Yes, (N/A)	HD 6/30/04
18	Has the decision error levels been identified and are the necessary justifications provided?	(Yes) N/A	HD 6/30/04
19	Has scan instrumentation been identified along with the assigned scanning methodology?	(Yes) N/A	HD 6/30/04
20	Has the scan rate been identified, and is the MDCscan adequate for the survey design?	(Yes) N/A	HD 6/30/04
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)	HD 6/30/04
22	Is survey instrumentation calibration data included and are detection sensitivities adequate?	(Yes) N/A	HD 6/30/04
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	HD 6/30/04
24	Are investigation levels and administrative limits adequate, and are any associated actions clearly indicated?	(Yes) N/A	HD 6/30/04
25	For sample analysis, have the required MDA values been determined.?	Yes (N/A)	HD 6/30/04
26	Has any special sampling methodology been identified other than provided in Reference 6.3?	Yes, (N/A)	HD 6/30/04

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

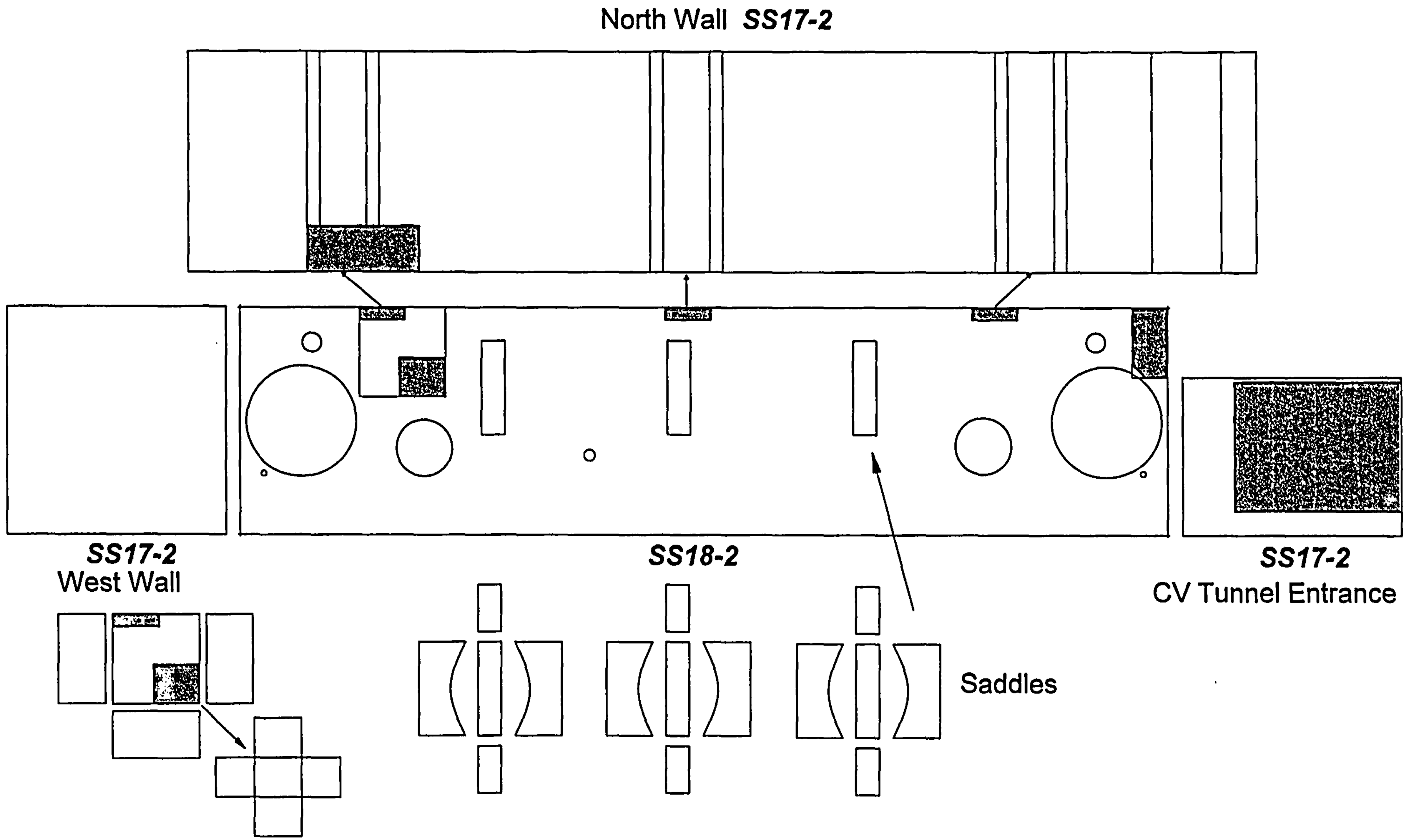


ATTACHMENT 1.1



ATTACHMENT 2.1

TOP OF SEAL CHAMBER 1 & 2



ATTACHMENT 2 . 2

DCGL Calculation Logic-CV Steam Tunnel/Seal Chamber Roof

I. **Survey Unit:** SNEC Containment Vessel (CV) Steam Tunnel & Top of Seal Chamber 1 & 2 Roof

II. **Description:** The purpose of this calculation is to determine a representative isotopic mix for the CV Steam Tunnel and top of the Seal Chamber 1 & 2 roof from available sample analyses. The effective surface area and 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 for the CV Steam Tunnel and top of the Seal Chamber 1 & 2 roof. These results are from scoping, characterization, and pre/post remediation surveys. The samples consist of various sediments, scrapings and concrete cores that were 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 MDAs are noted in the gray shaded fields.

Table 2: Decayed Listing of Positive Nuclides & MDAs Removed – This table provides the best overall representation of data selected from Table 1. Half-life values (days) are listed above each respective nuclide column. Samples are decayed to the date noted above Table 1 (e.g. January 15, 2004). Positive results are denoted in a yellow background while the MDA values, which were listed in Table 1, have been stripped out.

Table 3: Mean Percent of Total for Positive Nuclides – This table provides the calculation methodology for determining the relative fractions of the total activity contributed by each radionuclide. From this information the mean, sigma, and mean % of total are calculated. The mean % of total values is used to calculate the surface gross activity $DCGL_w$ per MARSSIM equation 4-4. See Table 5. Note that the Co-60 mean percent values were averaged using only samples 1 & 5. In addition, the mean percent calculated from sample 1 for Sr-90 was not averaged throughout the spreadsheet, since this sample was the only one where this respective nuclide was positive. This results in higher "mean percent of total" values in the mix, which is conservative.

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 6. Note that the Co-60 ratios were averaged using only samples 1 & 5. In addition, the ratio value calculated from sample 1 for Sr-90 was not averaged throughout the spreadsheet, since this sample was the only one where this respective nuclide was positive. This results in higher "mean percent of total" values in the mix, which are conservative.

Note: From Tables 3 and 4 only the "mean % of total" values are used as input to the "Effective DCGL Calculation Spreadsheet" as illustrated in Tables 5 and 6.

Table 5: Effective DCGL Calculator for Cs-137 (dpm/100 cm^2) – This table provides the surface gross activity $DCGL_w$ calculation results from data derived from Table 3.

ATTACHMENT 3 - 1

Table 6: Effective DCGL Calculator for Cs-137 (in pCi/g) – This table provides the surrogate volumetric concentration for the Cs-137 $DCGL_w$ calculation results from data derived from Table 4.

IV. **Summary** – Since the CV Steam Tunnel is a concrete structure the release limit is primarily based on the surface area $DCGL_w$. However, some CV Tunnel walls contain unistrut, which are treated as volumetric contamination. Therefore, a volumetric $DCGL_w$ is also determined. The Seal Chamber 1 & 2 roof release limit will be based on the surface area $DCGL_w$ only. Using the above data selection logic tables, the calculated gross activity $DCGL_w$ for surface area is 27,479 dpm/100 cm^2. The Cs-137 volumetric $DCGL_w$ is 6.32 pCi/g. These values would be reduced by 25% as part of SNEC's requirement to apply an administrative limit as discussed in the License Termination Plan (LTP).

ATTACHMENT 3 . 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	Decay Date: January 15, 2004 / Analysis Date
1	CV Tunnel	CV Tunnel Sediment Composite, OL1	< 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	SXSD105	CV Steam Tunnel, Vac-Pac Debris	< 0.808	< 0.0382	< 0.0251	9.26	< 0.0221	< 0.0348	< 0.00279	< 2.6	< 0.147	< 0.322	< 0.0899	December 10, 2003
3	SXSD1531,1532, 1533	CV Steel Shell Scrapings - Exterior Below Grade (Tar)		< 0.04	< 0.0331	0.177	< 0.0246	< 0.0517	< 0.0231	< 3.99				October 11, 2001
4	SXSD1552, 1553	CV Steel Shell Scrapings - Exterior Below Grade (Tar)		< 0.04	< 0.0305	0.297	< 0.0113	< 0.0372	< 0.0131	< 2.36				October 11, 2001
5	SXSD744	SSGS Mezzanine, East, Pipe Internals, SR-0004	< 123	< 0.18	2.26	39.6	< 0.709	< 0.33	< 0.33	< 50.8	< 37.9	< 82.6	< 1.46	March 21, 2001

TABLE 2 - Decayed Listing of Positive Nuclides & MDAs Removed (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	
			4485.27	10446.15	1925.23275	11019.5925	157861.05	32050.6875	8813847.75	5259.6	2092882.5	36561.525	4967.4	
	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	Total (pCi/g)
1	CV Tunnel	CV Tunnel Sediment Composite, OL1		9.01E+00	8.59E-01	1.17E+03								1178.89
2	SXSD105	CV Steam Tunnel, Vac-Pac Debris				9.24E+00								9.24
3	SXSD1531,1532, 1533	CV Steel Shell Scrapings - Exterior Below Grade (Tar)				1.68E-01								0.17
4	SXSD1552, 1553	CV Steel Shell Scrapings - Exterior Below Grade (Tar)				2.82E-01								0.28
5	SXSD744	SSGS Mezzanine, East, Pipe Internals, SR-0004			1.56E+00	3.71E+01								38.68
		Mean⇒		9.01E+00	8.59E-01	2.95E+02								304.55
		Sigma⇒				582.912								
		Mean % of Total⇒		2.96%	0.28%	96.76%								100.00%

KEY

(yellow)	Yellow Shaded Background = Positive Result
(gray)	Gray Shaded Background = MDA

C01

TABLE 3 - Mean Percent of Total for Positive Nuclides

	SNEC Sample No	Location/Description	Sr-90	Co-60	Cs-137	Total
1	CV Tunnel	CV Tunnel Sediment Composite, OL1	0.76%	0.07%	99.16%	100.00%
2	SXSD105	CV Steam Tunnel, Vac-Pac Debris			100.00%	100.00%
3	SXSD1531,1532, 1533	CV Steel Shell Scrapings - Exterior Below Grade (Tar)			100.00%	100.00%
4	SXSD1552, 1553	CV Steel Shell Scrapings - Exterior Below Grade (Tar)			100.00%	100.00%
5	SXSD744	SSGS Mezzanine, East, Pipe Internals, SR-0004		4.03%	95.97%	100.00%
		Mean⇒	7.64E-03	7.28E-04	9.98E-01	1.01
		Sigma⇒			0.004185775	
		Mean % of Total⇒	0.76%	0.07%	99.17%	100.00%

TABLE 4 - Ratio To Cs-137 for Positive Nuclides

	SNEC Sample No	Location/Description	Sr-90	Co-60	Cs-137	Total
1	CV Tunnel	CV Tunnel Sediment Composite, OL1	0.008	0.001	1.000	1.008
2	SXSD105	CV Steam Tunnel, Vac-Pac Debris			1.000	1.000
3	SXSD1531,1532, 1533	CV Steel Shell Scrapings - Exterior Below Grade (Tar)			1.000	1.000
4	SXSD1552, 1553	CV Steel Shell Scrapings - Exterior Below Grade (Tar)			1.000	1.000
5	SXSD744	SSGS Mezzanine, East, Pipe Internals, SR-0004		0.042	1.000	1.04
		Mean⇒	7.71E-03	7.35E-04	1.00E+00	1.01
		Sigma⇒			0.00E+00	
		Mean % of Total⇒	0.76%	0.07%	99.16%	100.00%

C02

ATTACHMENT 3-5

Table 5

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

Gross Activity DCGLw		Gross Activity Administrative Limit	
27479	dpm/100 cm^2	20609	dpm/100 cm^2

Cs-137 Limit		Cs-137 Administrative Limit	
27250	dpm/100 cm^2	20438	dpm/100 cm^2

25.0 mrem/y TEDE Limit

SAMPLE NO(s)⇒ CV Tunnel

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	7.28E-04	0.072%	7,100	19.88	0.07	19.88	N/A	Co-60
4	Cs-137	9.98E-01	99.168%	28,000	27250.22	24.33	27250.2	N/A	Cs-137
5	Eu-152		0.000%	13,000	0.00	0.00	0.00	N/A	Eu-152
6	H-3		0.000%	120,000,000	0.00	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	0.759%	8,700	208.61	0.60	208.61	N/A	Sr-90
			100.000%		27479	25.0	27479	0	
					Maximum Permissible dpm/100 cm^2				

Table 6

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

SNEC AL	75%	Total Activity Limit DCGLw		Administrative Limit	
		6.38	pCi/g	4.78	pCi/g

SAMPLE NUMBER(s)⇒ CV Tunnel

Cs-137 Limit		Cs-137 Administrative Limit	
6.32	pCi/g	4.74	pCi/g

15.82%	25.0	mrem/y TEDE Limit
1.52%	4.0	mrem/y Drinking Water (DW) Limit

☑ Check for 25 mrem/y

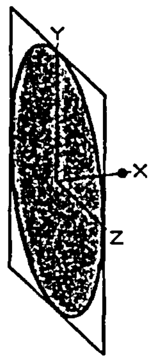
	Isotope	Sample Input (pCi/g, uCi, % of Total, etc.)	% of Total	25 mrem/y TEDE Limits (pCi/g)	4 mrem/y DW Limits (pCi/g)	A - Allowed pCi/g for 25 mrem/y TEDE	B - Allowed pCi/g for 4 mrem/y DW	Value Checked from Column A or B	This Sample mrem/y TEDE	This Sample mrem/y DW	
1	Am-241		0 000%	9.9	2.3	0 00	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	0.0007	0 073%	3.5	67.0	0 00	0.05	0 00	0 01	0.00	Co-60
4	Cs-137	1.0000	99.163%	6.6	397	6 32	65.92	6.32	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		0 000%	132	31.1	0 00	0.00	0 00	0 00	0.00	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	0 765%	1.2	0.61	0 05	0.51	0 05	0.16	0.05	Sr-90
		1.01E+00	100.000%			6.38	66.48	6.38	3.954	0.061	
						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 3-6

Page : 1
DOS File : SURFC.MS5
Run Date: June 24, 2004
Run Time: 8:55:39 AM
Duration : 00:00:00

File Ref: ____________
Date: ____________
By: ____________
Checked: ____________

Case Title: Steel Surface
Description: 12" Diameter Model - FeO
Geometry: 3 - Disk



Source Dimensions

Radius	15.24 cm	6.0 in

Dose Points

	X	Y	Z
# 1	7.72 cm	0 cm	0 cm
	3.0 in	0.0 in	0.0 in

Shields

Shield Name	Dimension	Material	Density
Shield 1	.1 cm	Iron Oxide	5.1
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	µCi/cm²	Bq/cm²
Ba-137m	6.9026e-010	2.5540e+001	9.4600e-007	3.5002e-002
Cs-137	7.2966e-010	2.6997e+001	1.0000e-006	3.7000e-002

Buildup
The material reference is : Air Gap

Integration Parameters

Radial	40
Circumferential	40

Results

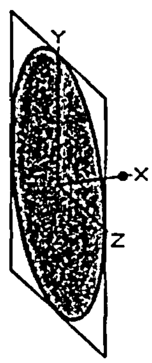
Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.0318	5.287e-01	3.025e-07	1.444e-06	2.520e-09	1.203e-08
0.0322	9.755e-01	6.265e-07	3.026e-06	5.042e-09	2.435e-08
0.0364	3.550e-01	6.443e-07	3.392e-06	3.661e-09	1.927e-08
0.6616	2.298e+01	7.805e-03	8.209e-03	1.513e-05	1.591e-05
TOTALS:	2.484e+01	7.806e-03	8.217e-03	1.514e-05	1.597e-05

ATTACHMENT 4 . 1

Page : 1
DOS File : SURFC.MS5
Run Date: June 24, 2004
Run Time: 8:49:11 AM
Duration : 00:00:00

File Ref: ____
Date: ____
By: ____
Checked: ____

Case Title: Concretel Surface
Description: 12" Diameter Model - Paint
Geometry: 3 - Disk



Source Dimensions

Radius	15.24 cm	6.0 in

Dose Points

	X	Y	Z
# 1	7.6708 cm	0 cm	0 cm
	3.0 in	0.0 in	0.0 in

Shields

Shield Name	Dimension	Material	Density
Shield 1	.051 cm	Concrete	2.35
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm²	Bq/cm²
Ba-137m	6.9026e-010	2.5540e+001	9.4600e-007	3.5002e-002
Cs-137	7.2966e-010	2.6997e+001	1.0000e-006	3.7000e-002

Buildup
The material reference is : Air Gap

Integration Parameters

Radial	40
Circumferential	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	5.287e-01	7.676e-06	9.614e-06	6.394e-08	8.008e-08
0.0322	9.755e-01	1.441e-05	1.799e-05	1.159e-07	1.448e-07
0.0364	3.550e-01	6.203e-06	7.507e-06	3.524e-08	4.265e-08
0.6616	2.298e+01	8.203e-03	8.312e-03	1.590e-05	1.611e-05
TOTALS:	2.484e+01	8.232e-03	8.347e-03	1.612e-05	1.638e-05

ATTACHMENT 4 . 2

NaI Scan MDC Calculation - Surface Deposition

$b := 100 \quad p := 0.5 \quad HS_d := 30.48 \quad SR := 5 \quad d := 1.38$

$Conv := 208.705 \quad MS_{output} := 1.591 \cdot 10^{-5} \quad O_i := \frac{HS_d}{SR}$

$O_i = 6.096$ *Observation Interval (seconds)*

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

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

$MDCR_i = 43.294$ *net counts per minute*

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

$MDCR_{surveyor} = 61.228$ *net counts per minute*

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

$MDER = 0.293$ μR/h

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

$MDC_{scan} = 18.439$ pCi/cm^2

$MDC_{scan} \cdot 222 = 4093.522$ *$dpm/100\ cm^2$*

NaI Scan MDC Calculation - Surface Deposition

$b := 200 \quad p := 0.5 \quad HS_d := 30.48 \quad SR := 5 \quad d := 1.38$

$Conv := 208.705 \quad MS_{output} := 1.591 \cdot 10^{-5} \quad O_i := \frac{HS_d}{SR}$

$O_i = 6.096$ *Observation Interval (seconds)*

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

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

$MDCR_i = 61.228$ *net counts per minute*

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

$MDCR_{surveyor} = 86.589$ *net counts per minute*

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

$MDER = 0.415$ µR/h

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

$MDC_{scan} = 26.077$ pCi/cm^2

$MDC_{scan} \cdot 222 = 5789.115$ *dpm/100 cm^2*

where:

b = *background in counts per minute*

b_i = *background counts in observation interval*

Conv = NaI manufacturers or calibration information 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/cm²)*

$MDCR_i$ = *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/cm² of contaminant (mR/h)*

O_i = *obervation Interval (seconds)*

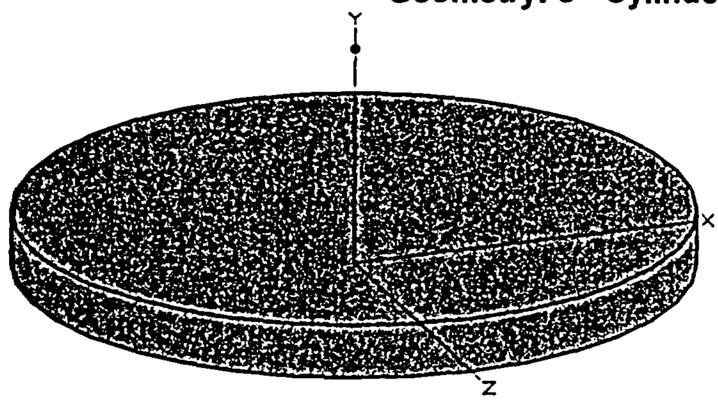
p = *human performance factor*

SR = scan rate in centimeters per second

Page : 1
DOS File : SLABD.MS5
Run Date: June 24, 2004
Run Time: 9:09:00 AM
Duration : 00:00:02

File Ref: ________
Date: ________
By: ________
Checked: ________

Case Title: Concrete Slab
Description: 12" Diameter by 1" Deep - Cs-137 @ 1 pCi/g
Geometry: 8 - Cylinder Volume - End Shields



Source Dimensions

Height	2.54 cm	1.0 in
Radius	15.24 cm	6.0 in

Dose Points

	X	Y	Z
# 1	0 cm	10.16 cm	0 cm
	0.0 in	4.0 in	0.0 in

Shields

Shield Name	Dimension	Material	Density
Source	1853.333 cm³	Concrete	2.35
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Ba-137m	4.1201e-009	1.5245e+002	2.2231e-006	8.2255e-002
Cs-137	4.3553e-009	1.6115e+002	2.3500e-006	8.6950e-002

Buildup
The material reference is : Source

Integration Parameters

Radial	60
Circumferential	60
Y Direction (axial)	60

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	3.156e+00	6.355e-06	7.682e-06	5.293e-08	6.399e-08
0.0322	5.823e+00	1.222e-05	1.486e-05	9.832e-08	1.196e-07
0.0364	2.119e+00	6.726e-06	8.749e-06	3.821e-08	4.971e-08
0.6616	1.372e+02	3.200e-02	4.053e-02	6.204e-05	7.858e-05
TOTALS:	1.483e+02	3.203e-02	4.057e-02	6.223e-05	7.881e-05

ATTACHMENT 4 - 6

NaI Scan MDC Calculation - Concrete Volume

$b := 100 \quad p := 0.5 \quad HS_d := 30.48 \quad SR := 5 \quad d := 1.38$

$Conv := 208.705 \quad MS_{output} := 7.858\ 10^{-5}$

$\frac{HS_d}{SR} = 6.096$ *Observation Interval (seconds)*

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

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

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

$MDCR_i = 43.294$ net counts per minute

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

$MDCR_{surveyor} = 61.228$ net counts per minute

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

$MDER = 0.293$ µR/h

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

$MDC_{scan} = 3.733$ pCi/g

NaI Scan MDC Calculation - Concrete Volume

$b := 200 \quad p := 0.5 \quad HS_d := 30.48 \quad SR := 5 \quad d := 1.38$

$Conv := 208.705 \quad MS_{output} := 7.858 \cdot 10^{-5}$

$$\frac{HS_d}{SR} = 6.096$$ *Observation Interval (seconds)*

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

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

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

$MDCR_i = 61.228$ *net counts per minute*

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

$MDCR_{surveyor} = 86.589$ *net counts per minute*

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

$MDER = 0.415$ µR/h

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

$MDC_{scan} = 5.28$ pCi/g

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

2350 INSTRUMENT AND PROBE EFFICIENCY CHART
6/1/04 **TYPICAL GFPC EFFICIENCY FACTORS**

INST #	INST C/D	43-68 PROBE #	PROBE C/D	44-10 PROBE #	PROBE C/D	BETA EFF	ALPHA EFF
126179	1/27/05	094819	1/27/05			25.1%	N/A
126188	1/27/05	099186	1/27/05			28.2%	N/A
126218	01/08/05	095080	01/09/05			27.9%	N/A

TYPICAL 2"X 2" NAI EFFICIENCY FACTORS

Inst.#	Cal Due	AP #		Probe #	Cal Due	cpm/mR/h
98625	5/18/05	R & Y		211680 Pk	5/18/05	214,882
98647	5/18/05	G &Y		211667 Pk	5/18/05	218,807
129423	5/18/05	P &Y		211687 Pk	5/18/05	213,539
117573	5/18/05	O &Y		211674 Pk	5/18/05	212,173
117566	4/9/05	G&R		185852 Pk	4/13/05	209,862
129429	11/3/04	W&Y		206283 Pk	10/31/04	177185
126183	11/19/04	R&B		206280 Pk	12/12/04	190,907
126198	11/03/04	R&W		196021Pk	5/25/05	209,194
Inst not in use		~~(6L)~~		~~210938 Pk~~	~~4/14/05~~	~~205,603~~ RK 6-1-04

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

ATTACHMENT 5 - 1

INFORMATION ONLY

ORIGINAL

Exhibit 1

Survey Unit Inspection Check Sheet

SECTION 1 - SURVEY UNIT INSPECTION DESCRIPTION			
Survey Unit #	SS18-2, SS17-2	Survey Unit Location	Top of Seal Chambers 1 and 2 Floor and Walls (up to 812')

Date	6/28/04	Time	0800	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 – The wooden stairway needs to be removed prior to FSS.

Response to Question 5 – Freestanding water has been identified to be present in three areas: west side –on cover to 2' downcomer, east end – core bore / scabbled areas (2).

Response to question #6 – The floor has to be swept prior to survey, (loose stones and sediment present).

Response to Question #12 – Lead-containing paint has been identified on the walls. The paint is not loose but the technicians performing FSS must not disturb surface to the best of their ability.
Additionally, the downcomer to #2 Seal Chamber is covered with plywood that must be removed when performing scan surveys. This will expose the individual to a potential fall hazard.

Survey Unit Inspector (print/sign)	David Sarge / [signature]	Date	6/28/04
Survey Designer (print/sign)		Date	

ATTACHMENT 6-1

06/28/2004 09:46 8146352317 SNEC FACILITY RADCON PAGE 07

INFORMATION ONLY
ORIGINAL

EXHIBIT 3
Surface Measurement Test Area (SMTA) Data Sheet

SECTION 1 - DESCRIPTION			
SMTA Number	SMTA-SS17-2-1	Survey Unit Number	SS17-2
SMTA Location	Top of Seal Chambers 1 and 2 (Wall Area)		

Survey Unit Inspector	D. Sarge /	Date	4/15/04	Time	1200

SECTION 2 - CALIPER INFORMATION & PERSONNEL INVOLVED			
Caliper Manufacturer	Mitotoyo	Caliper Model Number	CD-6" CS
Caliper Serial Number	783893	Calibration Due Date (as applicable)	N/A

Rad Con Technician	D. Sarge / [signature]	Date	4/15/04	Time	1200
Survey Unit Inspector Approval	D. Sarge / [signature]	Date	4/15/04		

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
1.4	0.78	0.62	4.1	0.73	0.37
2	8	14	20	26	32
1.94	1.25	2.46	0.67	1.05	0.4
3	9	15	21	27	33
0.08	1.05	0.78	2.32	0.18	0.25
4	10	16	22	28	34
0.19	0.63	0.8	2.36	0.16	0 11
5	11	17	23	29	35
0.4	0 45	0.39	0 28	0.58	0.05
6	12	18	24	30	36
0 30	0.53	0.69	0.63	0 3	0 89

Average Measurement – 0 84mm

Comments

Additional Measurements Required

ATTACHMENT 6-2

INFORMATION ONLY

ORIGINAL

EXHIBIT 3

Surface Measurement Test Area (SMTA) Data Sheet

SECTION 1 - DESCRIPTION					
SMTA Number	SMTA-SS18-2-1	Survey Unit Number	SS18-2		
SMTA Location	Top of Seal Chambers 1 and 2 (Floor)				
Survey Unit Inspector	D. Sarge /	Date	4/15/04	Time	1100
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 / [signature]	Date	4/15/04	Time	1100
Survey Unit Inspector Approval	D. Sarge / [signature]	Date	4/15/04		

SECTION 3 - MEASUREMENT RESULTS

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

1 0.24	7 0.03	13 0.27	19 1.13	25 0.22	31 0.37
2 0.09	8 0.3	14 0.06	20 1.86	26 0.76	32 0.12
3 0.19	9 0.3	15 0.06	21 0.27	27 0.15	33 0.02
4 0.31	10 0.63	16 0.01	22 0.34	28 0.17	34 0.05
5 1.39	11 0.64	17 0.5	23 0.07	29 0.99	35 0.56
6 0.04	12 0.15	18 0.11	24 0.15	30 0.43	36 0.34

Average Measurement – 0.37mm

Comments

Additional Measurements Required

ATTACHMENT 6-3

INFORMATION ONLY

ORIGINAL

EXHIBIT 3

Surface Measurement Test Area (SMTA) Data Sheet

SECTION 1 - DESCRIPTION			
SMTA Number	SMTA-SS18-2-2	Survey Unit Number	SS18-2
SMTA Location	Top of Seal Chamber 1 Tank Cradle (East Side)		
Survey Unit Inspector	D. Sarge /	Date 6/28/04	Time 1000

SECTION 2 - CALIPER INFORMATION & PERSONNEL INVOLVED			
Caliper Manufacturer	N/A	Caliper Model Number	
Caliper Serial Number		Calibration Due Date (as applicable)	
Rad Con Technician	D. Sarge / DGS	Date 6/28/04	Time 1000
Survey Unit Inspector Approval	D. Sarge / DGS	Date	6/28/04

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 N	21 A	27	33
4	10	16	22	28	34
5	11	17	23	29	35
6	12	18	24	30	36

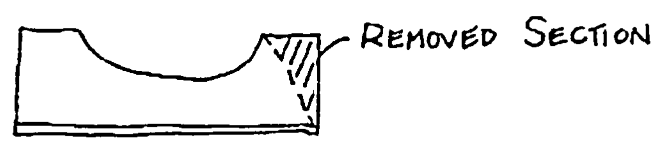
Average Measurement – mm

Comments

- Depth measurements were obtained using a tape measure and detector holder to simulate actual measurement distance.
- Ten measurements obtained of the destructed edge of the cradle, ranged from 0.5 to 1.75 inches.
- The average for the readings was 1.0 inches.

Additional Measurements Required

SSGS OIL STORAGE TANK CRADLE



ATTACHMENT 6 - 4

Exhibit 1

Survey Unit Inspection Check Sheet

SECTION 1 - SURVEY UNIT INSPECTION DESCRIPTION			
Survey Unit #	SS22-1,2,3,5	Survey Unit Location	CV Steam Pipe Tunnel – floors, walls, ceiling, and uni-strut

Date	4/27/04	Time	0900	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:

FINAL INSPECTION PRIOR TO SETTING "PFI".

Survey Unit Inspector (print/sign)	David Sarge / [signature]	Date	4/27/04
Survey Designer (print/sign)	D. Sarge / [signature] FOR B. BROSEY	Date	6/28/04

ATTACHMENT 6 - 5

Exhibit 1
Survey Unit Inspection Check Sheet

SECTION 1 - SURVEY UNIT INSPECTION DESCRIPTION						
Survey Unit #	SS22-1, 2, 3, 5		Survey Unit Location	CV Steam Pipe Tunnel – floor, walls, and ceiling		
Date	4/8/04	Time	1100	Inspection Team Members	D.Sarge, G. Houtz, B. Stoner, G. Woomer, M. McConahy	

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 #3 – Vacuuming is required prior to FSS. (especially in troughs and core boreholes).

Response to Question #4 – Items to be removed – 2 scabble guns, air hose, and misc. equipment/liquids.

Response to Question #6 – Standing water located in troughs (west end).

Response to Question #7 – Spray paint used on walls to mark survey grids.

Response to Question #10 – Some areas of ceiling and walls (West end) are inaccessible due to temporary ceiling supports and (East end) are inaccessible due to steel wall comp~~o~~onents. 4/12/04

Survey Unit Inspector (print/sign)	G. Houtz / [signature]	Date	4/12/04
Survey Designer (print/sign)	D. Sarge / [signature]	Date	6/28/04

ATTACHMENT 6-6

ORIGINAL

SECTION 1 - DESCRIPTION

SMTA Number	SMTA-SS-22-1	Survey Unit Number	SS22-1		
SMTA Location	CV Steam Pipe Tunnel				
Survey Unit Inspector	G. Houtz	Date	4/8/04	Time	1120

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	G. Houtz	Date	4/8/04	Time	1120
Survey Unit Inspector Approval	G. Houtz / [signature]	Date	1120		

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
0.21	1.44	2.97	2.28	1.05	2.5
2	8	14	20	26	32
1.58	1.0	1.44	1.09	0.95	1.35
3	9	15	21	27	33
2.3	1.42	1.03	1.47	1.25	1.32
4	10	16	22	28	34
2.94	4.82	1.18	2.31	1.48	1.32
5	11	17	23	29	35
1.99	9.11	1.91	1.62	0.44	1.94
6	12	18	24	30	36
0.74	1.71	1.4	1.37	2.63	1.46

Average Measurement - 1.86 mm

Comments

- Entire floor has been scabbled (1 – 2" depth)
- East end has steel plate installed with bracing anchored into floor. Brace obstructs floor access (5' length x 8 " width). Plate installed within the plane of the floor, therefore obstructs survey.
- Troughs scabbled into floor at wall seams require special survey considerations
- Core bore holes pose same survey considerations
- Drain trench has been chiseled/scabbled into a "V" shaped configuration. Poses same survey considerations

Additional Measurements Required

- 3 (three) 6" core boreholes spaced evenly along length of floor. Depths between 1'-4" to 2'-6".
- 1 (one) trough along South wall. 8" wide x 24'-2" length. Depth between 1.5 to 2".
- 1 (one) trough along North wall (west end). 5" wide x 7'-2". Depth between 1-1.5".
- 1 (one) trough along North wall (east end). 4" wide x 12' length. Depth between 1-1.5".
- Drain trenching (west end). 10" wide x 5'-6" length x 8" depth and 10" wide x 4' length x 8" depth.
- 4 (four) 3" core boreholes. 3" depth.

INFORMATION ONLY ORIGINAL

EXHIBIT 3

Surface Measurement Test Area (SMTA) Data Sheet

SECTION 1 - DESCRIPTION			
SMTA Number	SMTA-SS-22-2 and 3	Survey Unit Number	SS22-2 and 3
SMTA Location	CV Steam Pipe Tunnel (Walls and Ceiling)		

Survey Unit Inspector	G. Houtz	Date	4/8/04	Time	1100

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	G. Houtz	Date	4/8/04	Time	1120
Survey Unit Inspector Approval	G. Houtz / [signature]		Date	1100	

SECTION 3 - MEASUREMENT RESULTS

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

1 0	7 0	13 0	19 0	25 0	31 0
2 0	8 0	14 0	20 0	26 0	32 0
3 0	9 0	15 0	21 0	27 0	33 0
4 0	10 0	16 0	22 0	28 0	34 0
5 0	11 0	17 0	23 0	29 0	25 0
6 0	12 0	18 0	24 0	30 0	36 0

Average Measurement - 1.86 mm

Comments

- Wall surfaces are smooth except for areas disturbed by scabbling, core boring, and the removal of uni-strut.
- East end has steel plate installed with bracing anchored into floor. Plate installed within the plane of the walls, therefore obstructs survey.
- Some wall areas are not accessible currently. Steel plate blocks access.
- Uni-strut at far west end has concrete filler in three locations. Length is 3', depths between 1.5 to 2". Total length of uni-strut in tunnel is 70'-6". Uni-strut depth is 2".
- Ceiling surfaces are smooth except for form separation crack roughly mid-point of tunnel length. Depth is 0.5 ".

Additional Measurements Required

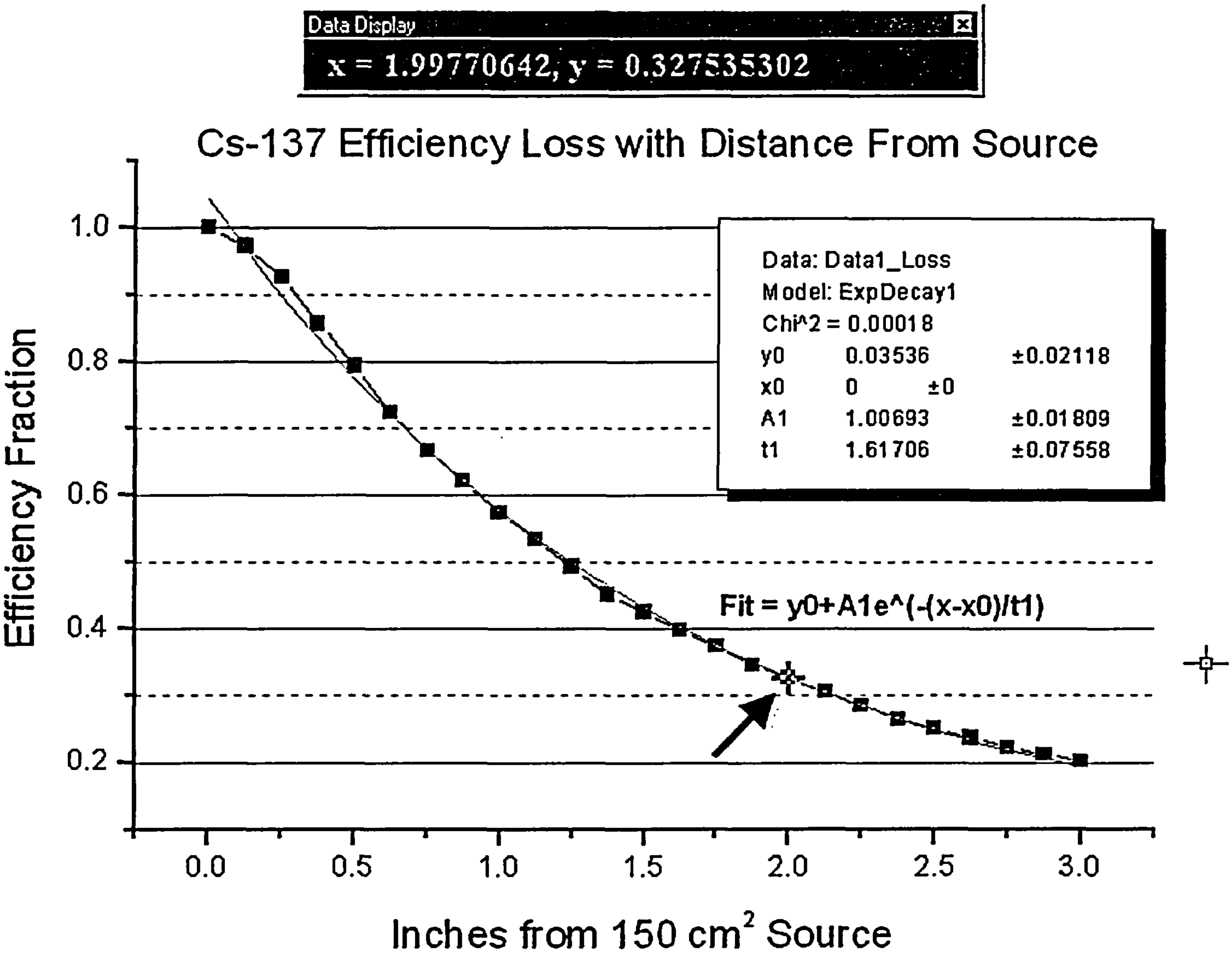
NORTH WALL
- 7 (seven) vertically installed uni-struts 1' length spaced 6' on center along ceiling line.
- 7 (seven) vertically installed uni-struts 1' length spaced 6' on center along floor line.
- 2 (two) 3" core boreholes. Depth is 2".
- 1 (one) steel plate installed at east end. Poses special survey considerations.

SOUTH WALL
- 7 (seven) vertically installed uni-struts 5' length spaced 6' on center (top at ceiling line).
- 1 (one) trough 7' length x 8" high x 3" depth (middle of wall at floor line).
- 1 (one) trough 4' length x 16" high x 3" depth (west end at floor line).
- 1 (one) trough 16" length x 10" high x 2" depth (west end at floor line).
- 1 (one) chiseled hole 30" high x 1' wide (far west end at uni-strut removal location)

CEILING
- Form separation crack located mid-point. Depth is 0.5'
- 5 (five) north-south oriented Uni-struts 4' length spaced 6' on center.

ATTACHMENT 6 - 8

1



ATTACHMENT 7-1

Site Report

Site Summary

Site Name: CV TUNNEL & SEAL CHAMBERS 1 & 2

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	20,609	No	36	1
				25	1.2
				16	1.5
				9	2
				4	3.4
				1	10.1
				0.25	10.1

BHB
6/28/04

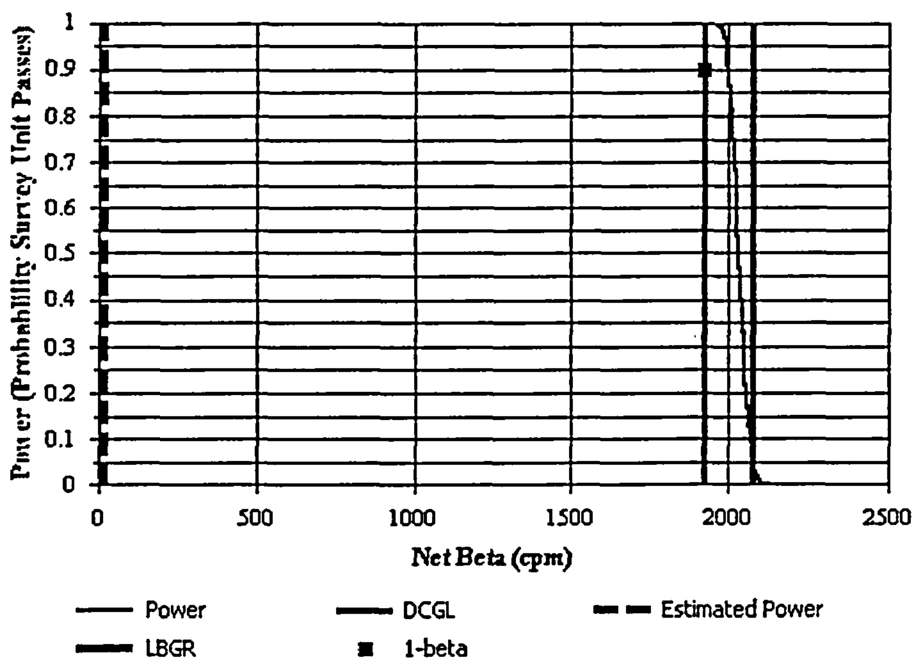
ATTACHMENT 8 - 1

Building Surface Survey Plan

Survey Plan Summary

Site:	CV TUNNEL & SEAL CHAMBERS 1 & 2		
Planner(s):	BHB		
Survey Unit Name:	CV PIPE TUNNEL FLOOR		
Comments:	SS22-1		
Area (m²):	21	Classification:	1
Selected Test:	WRS	Estimated Sigma (cpm):	51.3
DCGL (cpm):	2,077	Sample Size (N/2):	8
LBGR (cpm):	1,925	Estimated Conc. (cpm):	22
Alpha:	0.050	Estimated Power:	1.00
Beta:	0.100	EMC Sample Size (N):	8

Prospective Power Curve



ATTACHMENT 8 - 2

Building Surface Survey Plan

Contaminant Summary

Contaminant	DCGLw (dpm/100 cm²)
Gross Activity	20,609

Beta Instrumentation Summary

Gross Beta DCGLw (dpm/100 cm²): 20,609
Total Efficiency: 0.08
Gross Beta DCGLw (cpm): 2,077

ID	Type	Mode	Area (cm²)
22	GFPC	Beta	126

Contaminant	Energy[1]	Fraction[2]	Inst. Eff.	Surf. Eff.	Total Eff.
Gross Activity	187.87	1.0000	0.48	0.16	0.0776

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

Gross Survey Unit Mean (cpm): 328 ± 51 (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	837

ATTACHMENT 8 - 3

COMPASS - DQO Wizard for Building Surface Assessment

Elevated Measurement Comparison (EMC) for Beta

Follow the order of each tab below to perform the EMC.

1) Enter Scanning Instrument Efficiencies | 2) Enter Scan MDC Parameters | **3) View EMC Results**

Scan MDC Required per Contaminant

Contaminant	DCGLw*	Area Factor	Scan MDC Required*
Gross Activity	20,609	6.53	134,577

Statistical Design

N/2:	8
Bounded Area (m^2):	2.6
Area Factor:	6.53
DCGLw*:	20,609
Scan MDC Required*:	134,577

Hot Spot Design

Actual Scan MDC*:	1,653
Area Factor:	N/A
Bounded Area (m^2):	N/A
Post-EMC N/2:	8

* dpm/100 cm^2

COMPASS

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

OK

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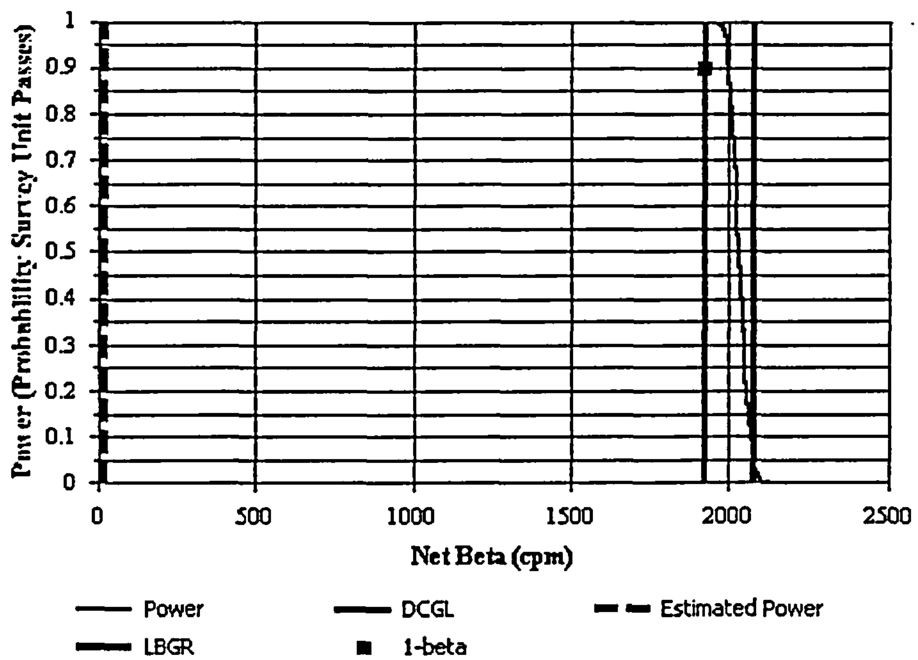
ATTACHMENT 8 - 4

Building Surface Survey Plan

Survey Plan Summary

Site:	CV TUNNEL & SEAL CHAMBERS 1 & 2		
Planner(s):	BHB		
Survey Unit Name:	CV PIPE TUNNEL WALLS		
Comments:	SS22-2		
Area (m^2):	48	Classification:	1
Selected Test:	WRS	Estimated Sigma (cpm):	51.3
DCGL (cpm):	2,077	Sample Size (N/2):	8
LBGR (cpm):	1,925	Estimated Conc. (cpm):	22
Alpha:	0.050	Estimated Power:	1.00
Beta:	0.100	EMC Sample Size (N):	8

Prospective Power Curve



ATTACHMENT 8 - 5

Building Surface Survey Plan

Contaminant Summary

Contaminant	DCGLw (dpm/100 cm²)
Gross Activity	20,609

Beta Instrumentation Summary

Gross Beta DCGLw (dpm/100 cm²): 20,609
Total Efficiency: 0.08
Gross Beta DCGLw (cpm): 2,077

ID	Type	Mode	Area (cm²)
22	GFPC	Beta	126

Contaminant	Energy[1]	Fraction[2]	Inst. Eff.	Surf. Eff.	Total Eff.
Gross Activity	187.87	1.0000	0.48	0.16	0.0776

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

Gross Survey Unit Mean (cpm): 328 ± 51 (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	837

ATTACHMENT 8 . 6

COMPASS - DQO Wizard for Building Surface Assessment

Elevated Measurement Comparison (EMC) for Beta

Follow the order of each tab below to perform the EMC.

1) Enter Scanning Instrument Efficiencies | 2) Enter Scan MDC Parameters | **3) View EMC Results**

Scan MDC Required per Contaminant

Contaminant	DCGLw*	Area Factor	Scan MDC Required*
Gross Activity	20,609	2.84	58,530

Statistical Design

N/2:	8
Bounded Area (m^2):	6.0
Area Factor:	2.84
DCGLw*:	20,609
Scan MDC Required*:	58,530

Hot Spot Design

Actual Scan MDC*:	1,653
Area Factor:	N/A
Bounded Area (m^2):	N/A
Post-EMC N/2:	8

* dpm/100 cm^2

COMPASS

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

OK

☑ Enable Trainin[g]

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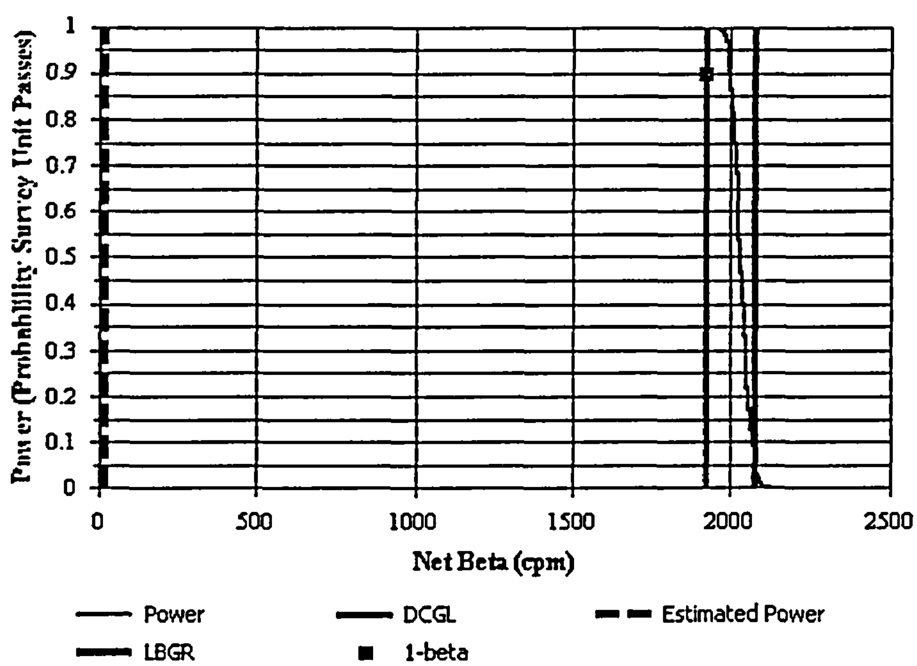
ATTACHMENT 8 - 7

Building Surface Survey Plan

Survey Plan Summary

Site:	CV TUNNEL & SEAL CHAMBERS 1 & 2		
Planner(s):	BHB		
Survey Unit Name:	CV PIPE TUNNEL CEILING		
Comments:	SS22-3		
Area (m^2):	16	Classification:	1
Selected Test:	WRS	Estimated Sigma (cpm):	51.3
DCGL (cpm):	2,077	Sample Size (N/2):	8
LBGR (cpm):	1,925	Estimated Conc. (cpm):	22
Alpha:	0.050	Estimated Power:	1.00
Beta:	0.100	EMC Sample Size (N):	8

Prospective Power Curve



ATTACHMENT 6 - 8

Building Surface Survey Plan

Contaminant Summary

Contaminant	DCGLw (dpm/100 cm²)
Gross Activity	20,609

Beta Instrumentation Summary

Gross Beta DCGLw (dpm/100 cm²): 20,609
Total Efficiency: 0.08
Gross Beta DCGLw (cpm): 2,077

ID	Type	Mode	Area (cm²)
22	GFPC	Beta	126

Contaminant	Energy[1]	Fraction[2]	Inst. Eff.	Surf. Eff.	Total Eff.
Gross Activity	187.87	1.0000	0.48	0.16	0.0776

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

Gross Survey Unit Mean (cpm): 328 ± 51 (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	837

ATTACHMENT 8 . 9

COMPASS - DQO Wizard for Building Surface Assessment

Elevated Measurement Comparison (EMC) for Beta

Follow the order of each tab below to perform the EMC.

1) Enter Scanning Instrument Efficiencies | 2) Enter Scan MDC Parameters | **3) View EMC Results**

Scan MDC Required per Contaminant

Contaminant	DCGLw*	Area Factor	Scan MDC Required*
Gross Activity	20,609	7.87	162,193

Statistical Design

N/2: 8

Bounded Area (m^2): 2.0

Area Factor: 7.87

DCGLw*: 20,609

Scan MDC Required*: 162,193

Hot Spot Design

Actual Scan MDC*: 1,653

Area Factor: N/A

Bounded Area (m^2): N/A

Post-EMC N/2: 8

* dpm/100 cm²

COMPASS

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

OK

☑ Enable Trainin

v1.0.0

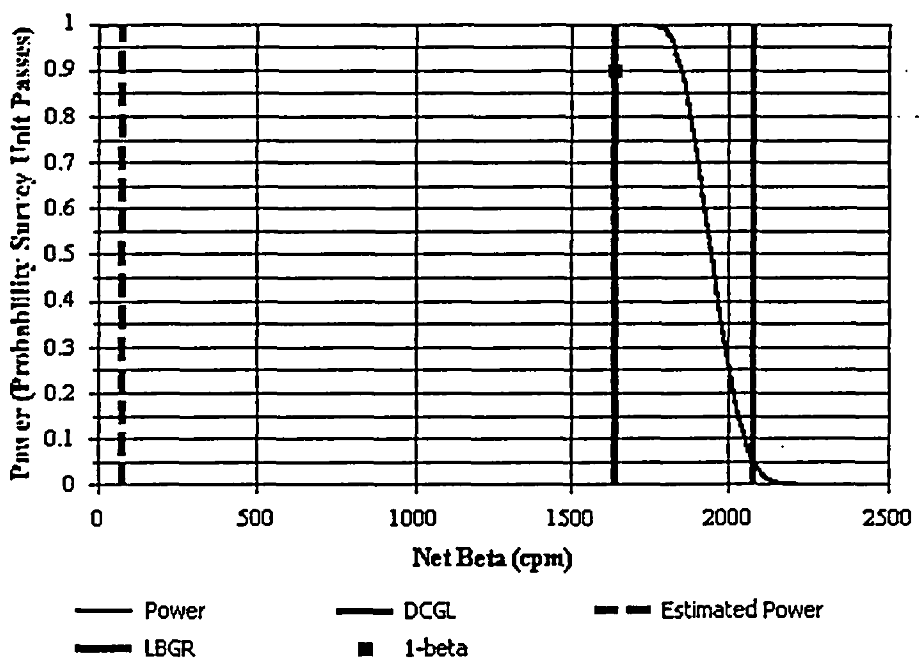
ATTACHMENT 8 - 10

Building Surface Survey Plan

Survey Plan Summary

Site:	CV TUNNEL & SEAL CHAMBERS 1 & 2		
Planner(s):	BHB		
Survey Unit Name:	Walls Around Top of Seal Chamber 1 & 2		
Comments:	SS17-2		
Area (m^2):	50	Classification:	2
Selected Test:	WRS	Estimated Sigma (cpm):	147
DCGL (cpm):	2,077	Sample Size (N/2):	8
LBGR (cpm):	1,640	Estimated Conc. (cpm):	76
Alpha:	0.050	Estimated Power:	1.00
Beta:	0.100		

Prospective Power Curve



ATTACHMENT 8 - 11

Building Surface Survey Plan

Contaminant Summary

Contaminant	DCGLw (dpm/100 cm²)
Gross Activity	20,609

Beta Instrumentation Summary

Gross Beta DCGLw (dpm/100 cm²): 20,609
Total Efficiency: 0.08
Gross Beta DCGLw (cpm): 2,077

ID	Type	Mode	Area (cm²)
22	GFPC	Beta	126

Contaminant	Energy[1]	Fraction[2]	Inst. Eff.	Surf. Eff.	Total Eff.
Gross Activity	187.87	1.0000	0.48	0.16	0.0776

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

Gross Survey Unit Mean (cpm): 382 ± 147 (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	837

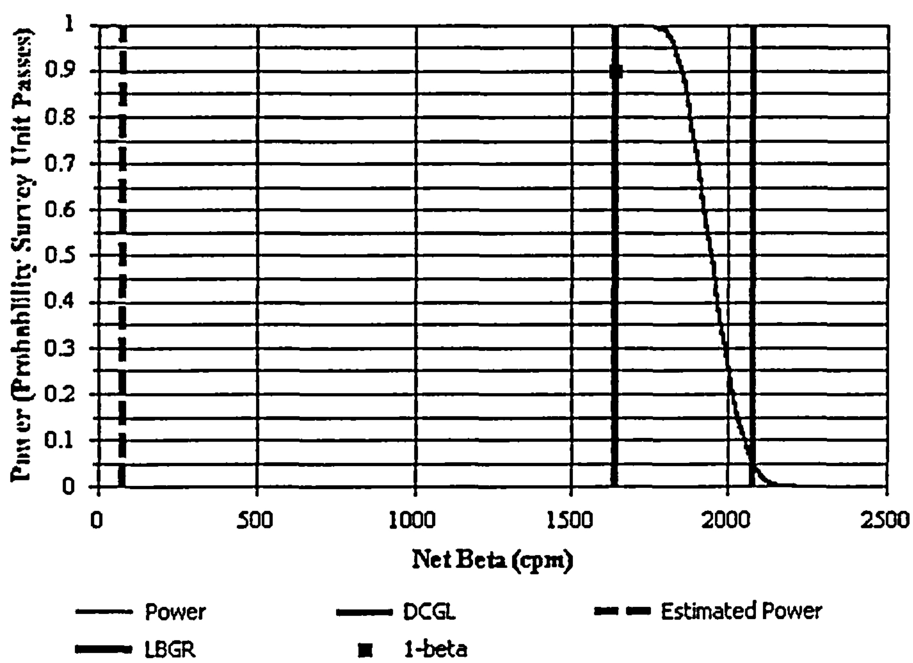
ATTACHMENT 8 - 12

Building Surface Survey Plan

Survey Plan Summary

Site:	CV TUNNEL & SEAL CHAMBERS 1 & 2		
Planner(s):	BHB		
Survey Unit Name:	Top of Seal Chamber 1 &2		
Comments:	SS18-2		
Area (m²):	43	Classification:	1
Selected Test:	WRS	Estimated Sigma (cpm):	147
DCGL (cpm):	2,077	Sample Size (N/2):	8
LBGR (cpm):	1,640	Estimated Conc. (cpm):	76
Alpha:	0.050	Estimated Power:	1.00
Beta:	0.100	EMC Sample Size (N):	8

Prospective Power Curve



ATTACHMENT 8 - 13

Building Surface Survey Plan

Contaminant Summary

Contaminant	DCGLw (dpm/100 cm²)
Gross Activity	20,609

Beta Instrumentation Summary

Gross Beta DCGLw (dpm/100 cm²): 20,609
Total Efficiency: 0.08
Gross Beta DCGLw (cpm): 2,077

ID	Type	Mode	Area (cm²)
22	GFPC	Beta	126

Contaminant	Energy[1]	Fraction[2]	Inst. Eff.	Surf. Eff.	Total Eff.
Gross Activity	187.87	1.0000	0.48	0.16	0.0776

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

Gross Survey Unit Mean (cpm): 382 ± 147 (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	837

ATTACHMENT 8 . 14

COMPASS - DQO Wizard for Building Surface Assessment

Elevated Measurement Comparison (EMC) for Beta

Follow the order of each tab below to perform the EMC.

1) Enter Scanning Instrument Efficiencies | 2) Enter Scan MDC Parameters | **3) View EMC Results**

Scan MDC Required per Contaminant

Contaminant	DCGLw*	Area Factor	Scan MDC Required*
Gross Activity	20,609	3.01	62,033

Statistical Design

N/2:	8
Bounded Area (m^2):	5.4
Area Factor:	3.01
DCGLw*:	20,609
Scan MDC Required*:	62,033

Hot Spot Design

Actual Scan MDC*:	1,653
Area Factor:	N/A
Bounded Area (m^2):	N/A
Post-EMC N/2:	8

* dpm/100 cm^2

COMPASS

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

OK

☑ Enable Trainin

v1.0.0

ATTACHMENT 8 - 15

CV TUNNEL - VARIABILITY

43-68B				SR-0106		BHB
No.	Counts	Count Time (sec)	Mode	Designator		Unshielded
1	304	60	SCL	Unshielded	β	304
2	337	60	SCL	Unshielded	β	337
3	313	60	SCL	Unshielded	β	313
4	288	60	SCL	Unshielded	β	288
5	338	60	SCL	Unshielded	β	338
6	316	60	SCL	Unshielded	β	316
7	244	60	SCL	Unshielded	β	244
8	362	60	SCL	Unshielded	β	362
9	301	60	SCL	Unshielded	β	301
11	318	60	SCL	Unshielded	β	318
12	298	60	SCL	Unshielded	β	298
13	266	60	SCL	Unshielded	β	266
14	237	60	SCL	Unshielded	β	237
15	304	60	SCL	Unshielded	β	304
16	322	60	SCL	Unshielded	β	322
17	431	60	SCL	Unshielded	β	431
18	323	60	SCL	Unshielded	β	323
19	316	60	SCL	Unshielded	β	316
20	398	60	SCL	Unshielded	β	398
21	391	60	SCL	Unshielded	β	391
22	398	60	SCL	Unshielded	β	398
23	401	60	SCL	Unshielded	β	401

Minimum ⇒	**2.37E+02**
Maximum ⇒	**4.31E+02**
Median ⇒	**3.17E+02**
Mean ⇒	**3.28E+02**
Sigma ⇒	**5.13E+01**

ATTACHMENT 9 - 1

SEAL CHAMBER VARIABILITY

43-68B							SR-120	BHB
No.	Counts	Count Time (sec)	Mode	Designator			Shielded	Unshielded
1	206	60	SCL	Shielded	β			255
2	255	60	SCL	Unshielded	β		206	
3	209	60	SCL	Shielded	β			328
4	328	60	SCL	Unshielded	β		209	
5	232	60	SCL	Shielded	β			385
6	385	60	SCL	Unshielded	β		232	
7	205	60	SCL	Shielded	β			333
8	333	60	SCL	Unshielded	β		205	
9	223	60	SCL	Shielded	β			268
10	268	60	SCL	Unshielded	β		223	
11	209	60	SCL	Shielded	β			263
12	263	60	SCL	Unshielded	β		209	
13	155	60	SCL	Shielded	β			267
14	267	60	SCL	Unshielded	β		155	
15	170	60	SCL	Shielded	β			260
16	260	60	SCL	Unshielded	β		170	
17	326	60	SCL	Shielded	β			477
18	477	60	SCL	Unshielded	β		326	
19	372	60	SCL	Shielded	β			451
20	451	60	SCL	Unshielded	β		372	
21	540	60	SCL	Shielded	β			590
22	590	60	SCL	Unshielded	β		540	
23	529	60	SCL	Shielded	β			705
24	705	60	SCL	Unshielded	β		529	
						Minimum ⇒	1.55E+02	2.55E+02
						Maximum ⇒	5.40E+02	7.05E+02
						Median ⇒	2.16E+02	3.31E+02
						Mean ⇒	2.81E+02	3.82E+02
						Sigma ⇒	1.33E+02	1.47E+02

ATTACHMENT 9.2

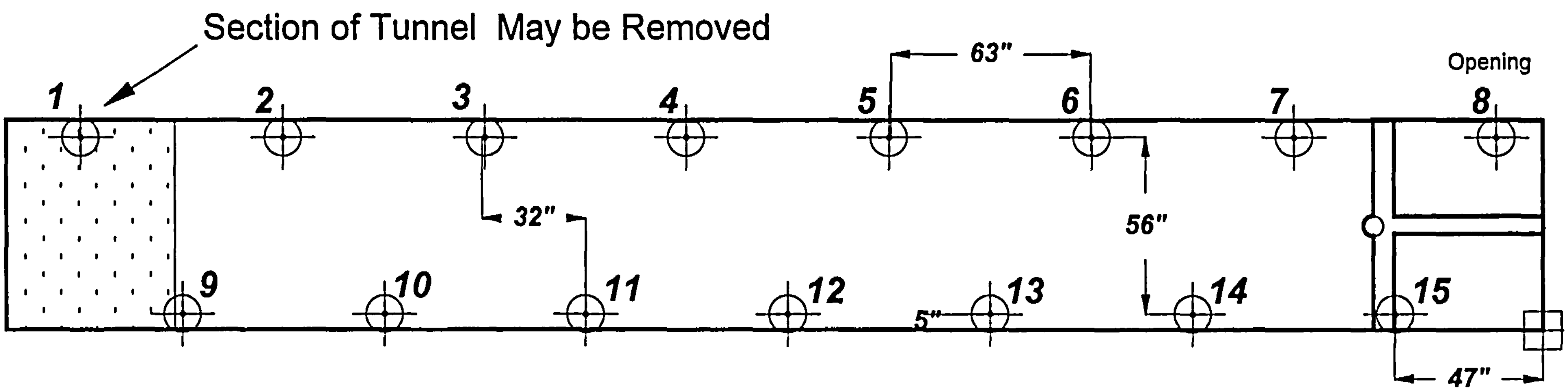
Williamsburg Concrete Background Measurements

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(cpm) ⇒*	*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		

	Shielded	Unshielded
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

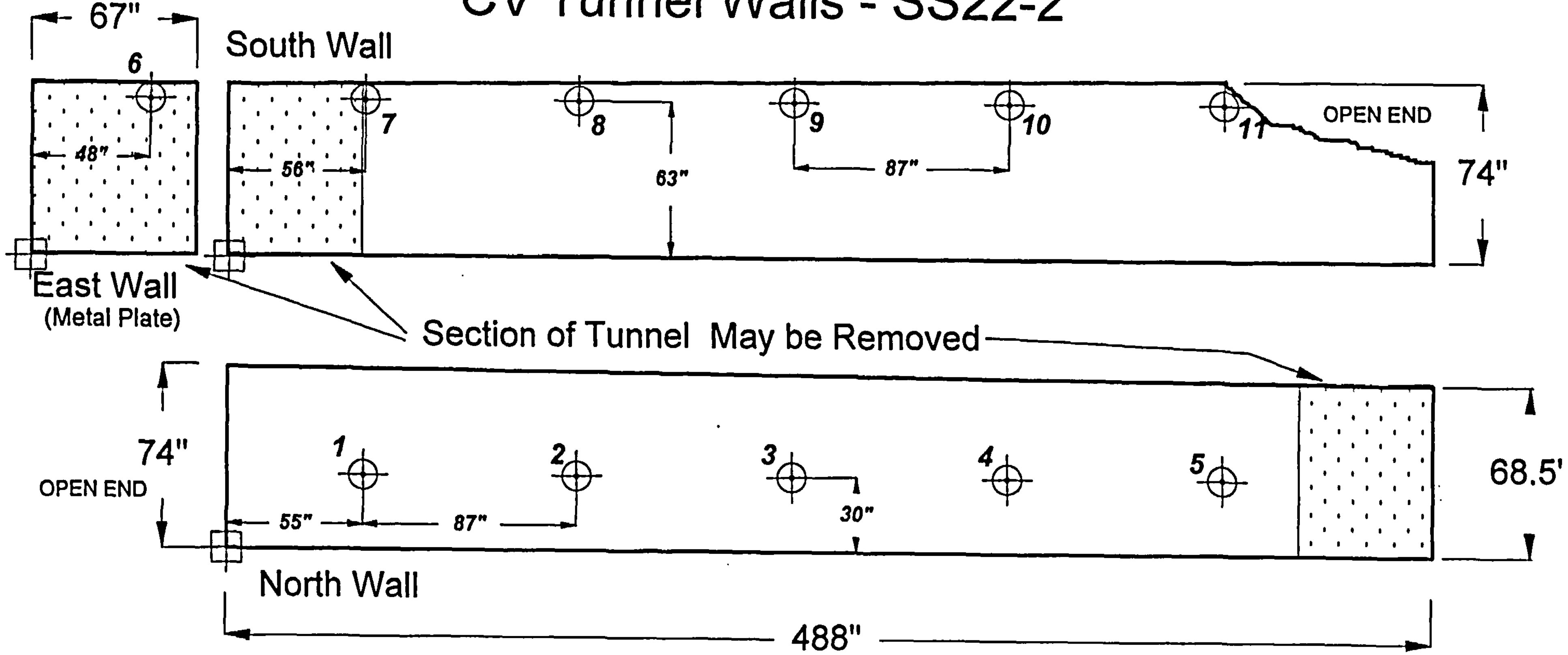
ATTACHMENT 10 - 1

CV Tunnel Floor - SS22-1



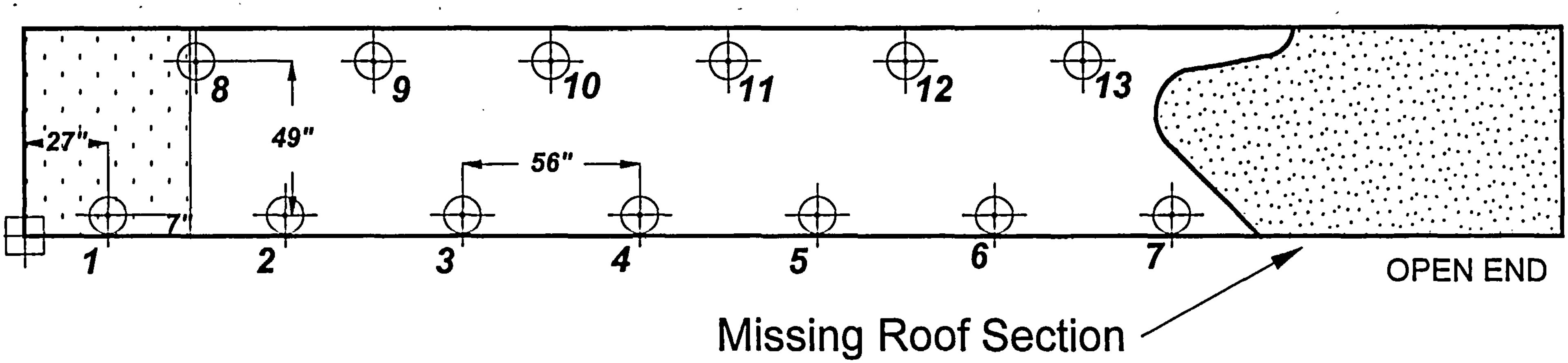
ATTACHMENT 11 - 1

CV Tunnel Walls - SS22-2



ATTACHMENT 11 - 2

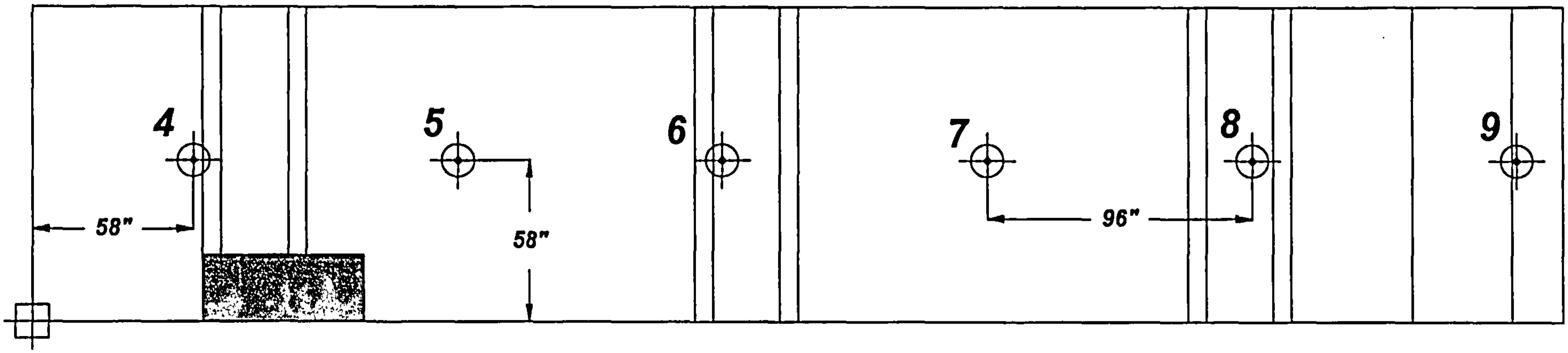
CV Tunnel Ceiling - SS22-3

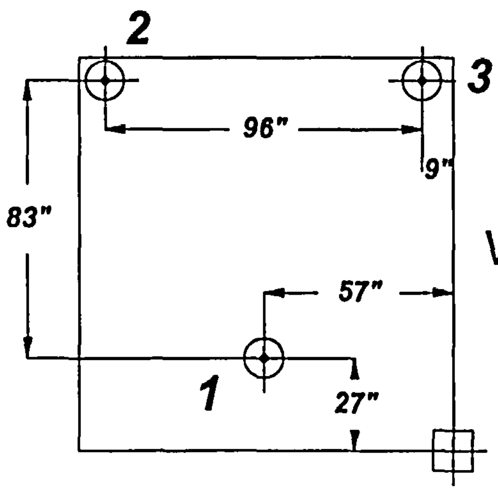


ATTACHMENT 11 . 3

TOP OF SEAL CHAMBER 1 & 2

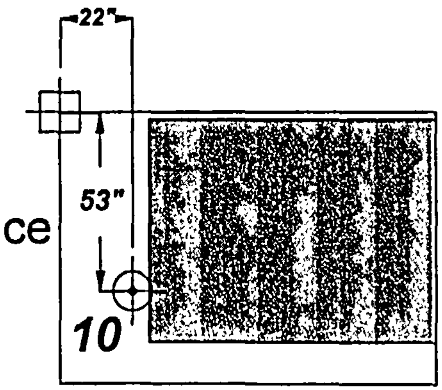
North Wall ***SS17-2***





SS17-2
West Wall

SS17-2
CV Tunnel Entrance

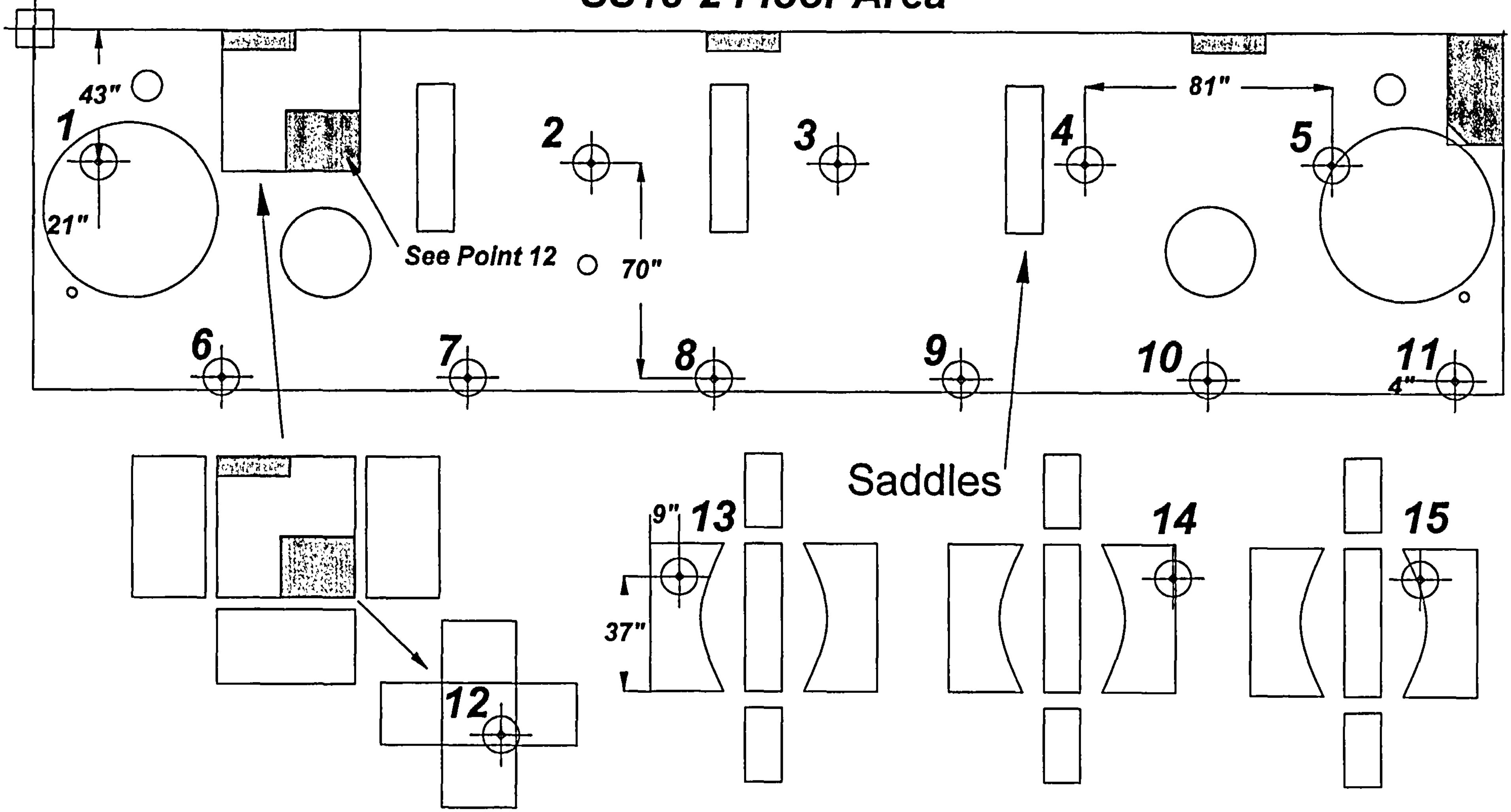


Lower Left Hand Corner Facing Surface

ATTACHMENT 11 - 4

TOP OF SEAL CHAMBER 1 & 2

SS18-2 Floor Area



ATTACHMENT 11 . 5