Appendix B

Unistrut
Survey Design

ORIGINAL

FirstEnergy Corp.

SNEC CALCULATION COVER SHEET

CALCULATION DESCRIPTION

Calculation Number	Revision Number	Effective Date	Page Number
E900-04-004	0	4/15/04	1 of 9

Subject

CV TUNNEL UNISTRUT 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/** B. Brosey	Date	4/15/04
Technical Reviewer	**P. Donnachie/** P. Donnachie	Date	4/15/04
Additional Review	**A. Paynter/** A. Paynter	Date	4/16/04
Additional Review		Date	
SNEC Management Approval		Date	

1.0 PURPOSE

1.1 The purpose of this calculation is to develop a survey design for remnants of CV Tunnel unistrut embedded in the SNEC CV Steam Tunnel ceiling and walls. The total length of the remaining unistrut sections is approximately 70.5 feet.

1.2 This survey effort may be performed in conjunction with the CV Tunnel concrete re-survey effort.

2.0 SUMMARY OF RESULTS

The following information should be used to develop a survey request for this survey design. If remediation actions are taken as a result of this survey, this survey design must be revised.

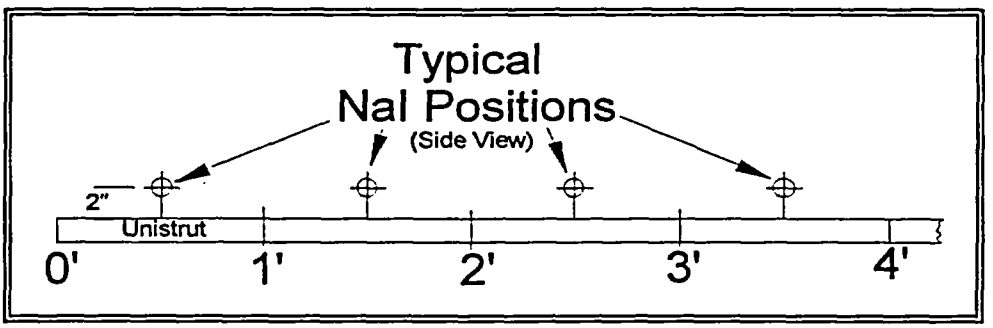
2.1 NaI Survey Work

2.1.1 No scanning of unistrut is required by this survey design.

2.1.2 Static measurements at a fixed distance over segments of unistrut shall be performed using a ***2"D by 2"L NaI detector*** with a Cs-137 window setting. The Cs-137 window shall straddle the Cs-137 energy peak at 662 keV IAW the applicable calibration sheet (see example of Attachment 1-1).

2.1.3 The NaI instrument conversion factor/efficiency shall be no less than ***176 cpm/uR/h***.

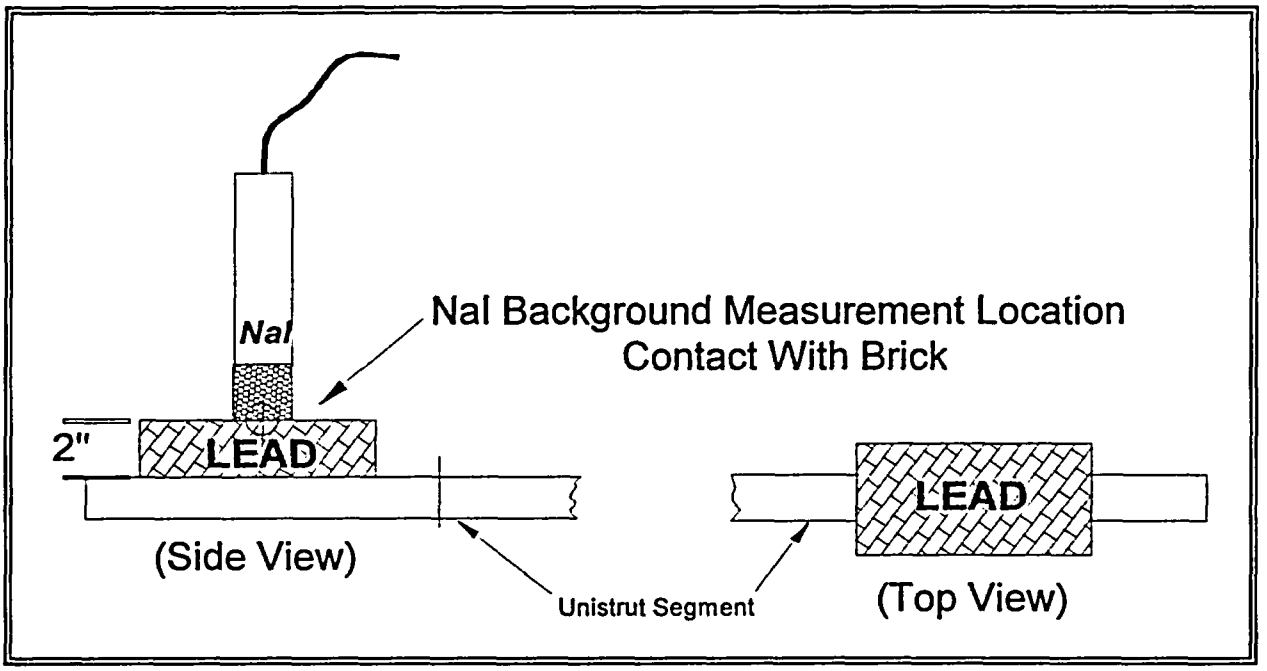
2.1.4 ***Static measurements shall be made 2"*** from unistrut locations (see below). Whenever possible, each measurement shall be centered in the middle of a one (1) foot section (). Segments less than 1 foot in length should be surveyed separately at an estimated center position. Record the length of these shorter segments. Note when a segment contains concrete estimate how full the channel is..



2.1.5 A ***two (2) minute count time*** shall be employed. An integrated 2 minute count shall be recorded at one (1) foot increments IAW site procedures. Measurements shall be made over the entire length of the unistrut sections.

2.1.6 Background measurements shall be made by covering a segment of unistrut with a 2" thick lead brick and then placing the probe against the lead at the center of the brick (see following diagram).

2.1.7 A ten (10) minute count time shall be employed for all background measurements.



2.1.8 ***At least three*** background measurements should be made on each wall and ceiling area in the CV Tunnel area. These measurements should be approximately evenly spaced along the Tunnel length (a total of 9 background measurements). Document all results

NOTE

Background measurements require the handling of lead bricks. Use caution when positioning these objects to ensure a safe work area. It is recommended that a jig, or custom holder be used to position lead for each background measurement.

2.1.9 All survey points shall be clearly marked and sequentially numbered.

2.1.10 Each two minute integrated counting result (at all locations) shall be recorded IAW site procedures.

2.1.11 Other instruments of the type specified in Section 2.1.2 above may be used during the FSS but must demonstrate an efficiency at or above 176 cpm/uR/h for Cs-137.

2.1.12 Some starting points may need to be adjusted to accommodate obstructions within the tunnel area. Contact the SR coordinator to report any difficulties encountered when laying out measurement points.

2.1.13 The following are the applicable effective DCGLw values:

Surface DCGLw (dpm/100 cm^2)	Volumetric DCGLw (pCi/g)
GA = 27,479 (20,609 A.L.)	Cs-137 = 6.32 (4.74 A.L.)

GA = Gross Activity

A.L. = Administrative Limit is 75% of the actual DCGLw value.

2.1.14 The MDCstatic Cs-137 surface value is **2215 dpm/100 cm^2**. The ***gross activity concentration*** is as follows: 2215 dpm/100 cm^2 Cs-137/0.992 (Cs-137 fraction) = ***2233 dpm/100 cm^2***.

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 Plan SNEC Facility License Termination Plan, Rev 3.

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

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

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

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

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

3.9 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 Waste Treatment , C & A and SSGS Footprint areas. The only remaining section still in tact extends from the SSGS footprint East approximately 40 feet toward the CV area. The CV Tunnel diagram is shown on Attachments 2-1 and 2-2.

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.
Shonka Research Associates (SRA) initially surveyed the CV Tunnel concrete surface using a large area GFPC detector array. Remediation was performed to reduce the residual volumetric concentration of Cs-137 and lower the general area exposure rate. However, little was done to reduce the contamination present in/on unistrut sections. Since the unistrut did not appear to contain contamination levels above the effective surface DCGLw,

it was decided that this component could be surveyed and allowed to remain in the collapsed CV Tunnel structure.

4.2 Inspection of the concrete surface was conducted IAW Reference 3-6. There is approximately 70.5 feet of unistrut remaining which is embedded in the floor and wall areas of this structure (see Attachment 9-1 to 9-3). The majority of this length is not filled with concrete or other materials that would alter the MicroShield modeling effort (see Attachment 3-1 to 3-2).

4.3 MicroShield modeling considers a one foot segment of unistrut as a volume contaminated object. The results are then assumed to be a surface contamination and are averaged over the entire surface area of a one foot section.

4.4 The sample data base used to determine the effective radionuclide mix for the CV Pipe Tunnel area has been drawn from previous samples that were assayed at off-site laboratories. This list is shown as Attachment 4-1 and 4-6, and includes five (5) analysis results that are thought most applicable. Review of the data indicates eight radionuclides have not been positively identified at any concentration. These radionuclides have been removed from the data set and are not be considered further. Radionuclides removed include H-3, Am-241, Pu-238, Pu-239, Pu-241, C-14, Ni-63 and Eu-152.

Inspection of the data also shows that Cs-137 is by far the predominant radioactive contaminant found in this area. Sr-90 on the other hand, was positively identified in only one (1) sample. Co-60 was identified as a positive contaminant in only two (2) samples.

The re-assessment of the radionuclide mix for the CV Tunnel area was transmitted to the US NRC for concurrence. The current applicable volumetric and surface limit DCGLw values were determined to be as follows (from Attachment 4-1 to 4-6):

Surface DCGLw (dpm/100 cm^2)	Volumetric DCGLw (pCi/g)
GA = 27,479 (20,609 A.L.)	Cs-137 = 6.32 (4.74 A.L.)

GA = Gross Activity

A.L. = Administrative Limit is 75% of the actual DCGLw value.

4.5 The NaI MDCstatic calculation is determined on the basis of a 2 minute sample count time combined with a 10 background count time. The MicroShield modeled unistrut section is assumed to have a homogeneous composition such that the weight per foot of unistrut divided by the volume of the outer profile yields a mean density of ~1.77 g/cc. The unistrut diagram is shown on Attachment 5-1.

4.6 The resulting range of general area background values in the survey unit using the 44-10 probe is a 99 to ~175 cpm (see Attachment 6-1 and 6-3). Then mean background value is 132 cpm. The resulting volumetric MDCstatic value is ~8.651 pCi/g Cs-137 and the surface MDCstatic value is 2215 dpm/100 cm^2 for Cs-137 (see Attachment 7-1 and 7-2). A series of reasonably conservative assumptions must be made to interpret the data – they are:

4.6.1 The contamination is a surface deposit and thus the surface MDCstatic value is the correct MDC to be used for unistrut sections.

4.6.2 It is assumed that there is no concrete fill or other materials present in the channel of the unistrut.

4.6.3 The actual surface area of a one foot section of unistrut is about 866 cm^2. For purposes of this calculation, the activity is assumed to be evenly dispersed over this area and the result will be reported per 100 cm^2.

4.6.4 The entire unistrut area is 866 cm^2/ft x 70.5 feet = 61,053 cm^2 or ~6.1 m^2. The CV Tunnel unistrut will be considered one (1) survey unit.

4.6.5 The MDCstatic Cs-137 surface value is 2215 dpm/100 cm^2. The gross activity concentration is as follows: 2215 dpm/100 cm^2 Cs-137/0.992 (Cs-137 fraction) = 2233 dpm/100 cm^2. If all the activity is assumed to be present on only the exposed side of the unistrut (the non-embedded side), the MDCstatic value is twice this surface value or 4466 dpm/100 cm^2. This is well below the actual administrative limit for this area of 20,609 dpm/100 cm^2. Since the total area of unistrut is only 6.8 m^2 at the most and one half of this value if only the exposed side is considered, an area factor between 2 and 3.4 could be applied (Co-60). Thus the actual DCGLw limit for unistrut could be as high as 2.62 x 20,609 = ~54,000 dpm/100 cm^2 (see Attachment 8-1).

4.7 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 3.6), is included as Attachment 9-1 to 9-3.

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

4.10 The survey design checklist is listed in Exhibit 2.

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 an example of a typical calibration data from one typical NaI radiation detector that may be used for this survey effort.

6.2 **Attachment 2-1** and **2-2**, are diagrams that depict and locate this survey area.

6.3 **Attachment 3-1** and **3-2**, is a MicroShield model of a one foot section of unistrut used to determine the exposure rate from a 1 pCi/cc Cs-137 source term.

6.4 **Attachment 4-1** to **4-6**, is the US NRC concurred sample listing for this area.

6.5 **Attachment 5-1**, is a cross-sectional diagram of unistrut.

6.6 **Attachment 6-1** to **6-3**, is the SR-106 post-remediation survey results for the CV Tunnel.

6.7 **Attachment 7-1** to **7-2**, is the MDCstatic results for a modeled section of unistrut.

6.8 **Attachment 8-1**, is area factor estimate for the Unistrut sections.

6.9 **Attachment 9-1** to **9-3**, is the site inspection report for this survey unit.

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. E900-04-004	Location Codes SS22-5 (Unistrut)		
ITEM	**REVIEW FOCUS**	**Status (Circle One)**	**Reviewer Initials & Date**
1	Has a survey design calculation number been assigned and is a survey design summary description provided?	(Yes), N/A	4/15/04
2	Are drawings/diagrams adequate for the subject area (drawings should have compass headings)?	(Yes), N/A	4/15/04
3	Are boundaries properly identified and is the survey area classification clearly indicated?	(Yes), N/A	4/15/04
4	Has the survey area(s) been properly divided into survey units IAW EXHIBIT 10	(Yes), N/A	4/15/04
5	Are physical characteristics of the area/location or system documented?	(Yes), N/A	4/15/04
6	Is a remediation effectiveness discussion included?	(Yes), N/A	4/15/04
7	Have characterization survey and/or sampling results been converted to units that are comparable to applicable DCGL values?	(Yes), N/A	4/15/04
8	Is survey and/or sampling data that was used for determining survey unit variance included?	(Yes), N/A	4/15/04
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)	4/15/04
10	Are applicable survey and/or sampling data that was used to determine variability included?	Yes, (N/A)	4/15/04
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)	4/15/04
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)	4/15/04
13	Are all necessary supporting calculations and/or site procedures referenced or included?	(Yes), N/A	4/15/04
14	Has an effective DCGLw been identified for the survey unit(s)?	(Yes), N/A	4/15/04
15	Was the appropriate $DCGL_{EMC}$ included in the survey design calculation?	(Yes), N/A	4/15/04
16	Has the statistical tests that will be used to evaluate the data been identified?	(Yes), N/A	4/15/04
17	Has an elevated measurement comparison been performed (Class 1 Area)?	Yes, (N/A)	4/15/04
18	Has the decision error levels been identified and are the necessary justifications provided?	(Yes), N/A	4/15/04
19	Has scan instrumentation been identified along with the assigned scanning methodology?	(Yes), N/A	4/15/04
20	Has the scan rate been identified, and is the MDCscan adequate for the survey design?	(Yes), N/A	4/15/04
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)	4/15/04
22	Is survey instrumentation calibration data included and are detection sensitivities adequate?	(Yes), N/A	4/15/04
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	4/15/04
24	Are investigation levels and administrative limits adequate, and are any associated actions clearly indicated?	(Yes), N/A	4/15/04
25	For sample analysis, have the required MDA values been determined.?	Yes, (N/A)	4/15/04
26	Has any special sampling methodology been identified other than provided in Reference 6.3?	Yes, (N/A)	4/15/04

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

EXAMPLE

LUDLUM MODEL 44-10 HIGH VOLTAGE PLATEAU DATA SHEET
(Detector peaked using Cs137 #019454 5uCi button)

Serial Number: 196021

HIGH VOLTAGE	SOURCE (10 second count)
700	37,380
701	39,576
702	40,089
703	41,493
704	42,325
705	**42,859**
706	42,756
707	41,336
708	40,700
709	N/A
710	N/A
711	N/A

Detector Parameters for Peaking

Parameter	Setting	Comments
Threshold (10mV/100)	612	Peaked for Cs^{137} at 662keV
Window (On)	100	
High Voltage	705	
CPM/mR	221,028	

FWHM values performed with Threshold = 642 and Window = 40

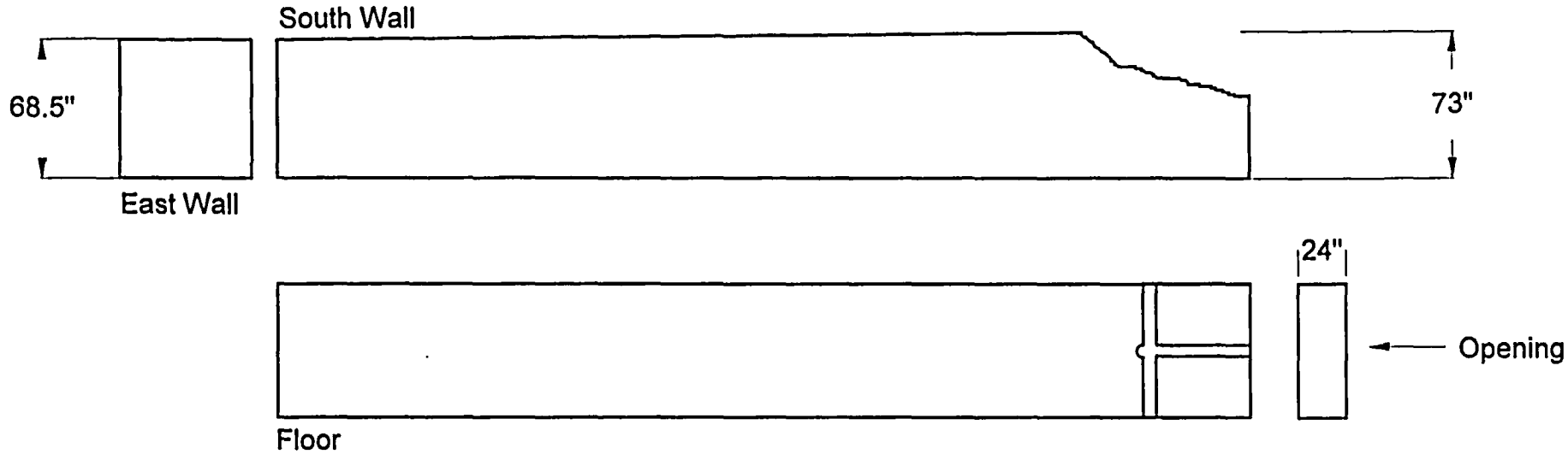
FWHM = $\frac{685 - 605}{662} \times 100\%$	12.1%

Detector peaked for Cs^{137} using Ludlum peaking procedure and threshold setting of 612 and window setting of 100 as requested by John Duskin. 2350-1 #117566 calibration due 01/22/04 used for peaking 44-10 detector.

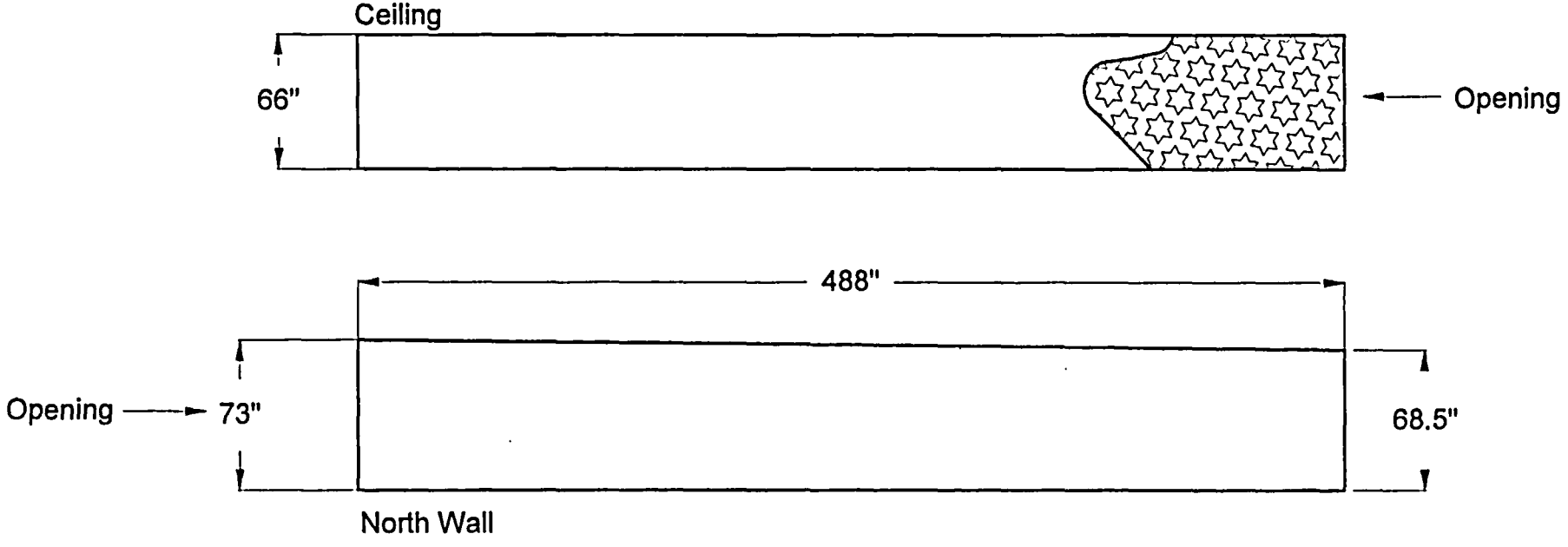
Performed By: _____ **Date:** 7/22/03

Reviewed By: _____ **Date:** 9-18-03

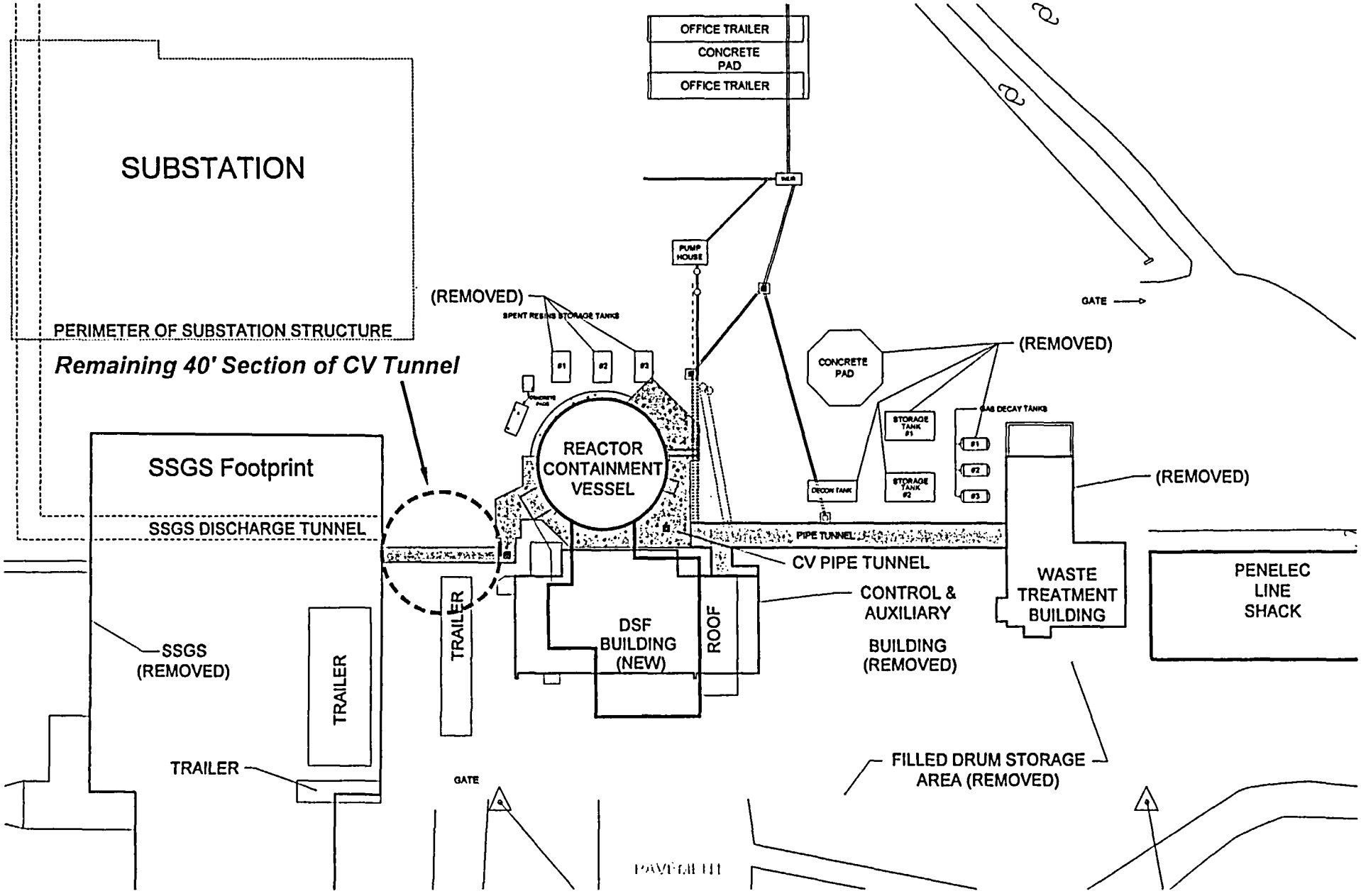
ATTACHMENT 1.1



CV Tunnel



ATTACHMENT 2.1



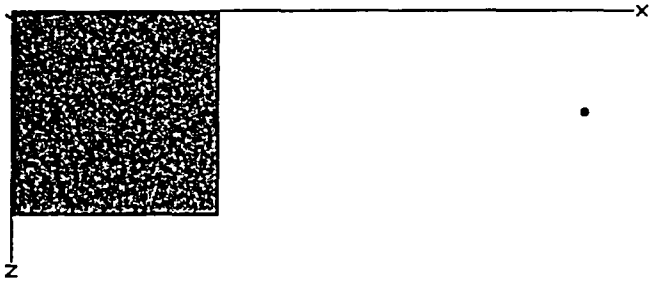
ATTACHMENT 2 - 2

MicroShield v5.05 (5.05-00121)
GPU Nuclear

Page : 1
DOS File : UNISTRUT.MS5
Run Date: March 30, 2004
Run Time: 10:52:05 AM
Duration : 00:00:20

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

Case Title: Unistrut
Description: 1 Foot Section of Unistrut - 564 uCi of Cs-137 per ft.
Geometry: 13 - Rectangular Volume



Source Dimensions

Length	4.3 cm	1.7 in
Width	4.3 cm	1.7 in
Height	30.48 cm	1 ft

Dose Points

	X	Y	Z
# 1	11.92022 cm	15.24 cm	2.15011 cm
	4.7 in	6.0 in	0.8 in

Shields

Shield Name	Dimension	Material	Density
Source	34.395 in³	Iron	1.771
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Ba-137m	5.3354e-004	1.9741e+007	9.4662e-001	3.5025e+004
Cs-137	5.6400e-004	2.0868e+007	1.0007e+000	3.7024e+004

Buildup
The material reference is : Source

Integration Parameters

X Direction	40
Y Direction	40
Z Direction	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	4.087e+05	1.499e-01	1.540e-01	1.249e-03	1.283e-03
0.0322	7.541e+05	2.895e-01	2.975e-01	2.330e-03	2.394e-03
0.0364	2.744e+05	1.688e-01	1.751e-01	9.588e-04	9.947e-04
0.6616	1.776e+07	4.795e+03	5.886e+03	9.296e+00	1.141e+01

Value used

ATTACHMENT 3.1

DOS File : UNISTRUT.MS5
Run Date: March 30, 2004
Run Time: 10:52:05 AM
Duration : 00:00:20

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:	1.920e+07	4.796e+03	5.887e+03	9.301e+00	1.142e+01

ATTACHMENT 3 - 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 4 . 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 4.2

TABLE 1 - Data Listing (pCi/g)

														Decay Date
														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
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 Shaded Background = Positive Result
	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

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

25.0 mrem/y TEDE Limit

SAMPLE ID(s)⇒ CV Tunnel

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

ATTACHMENT 4 i 5

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

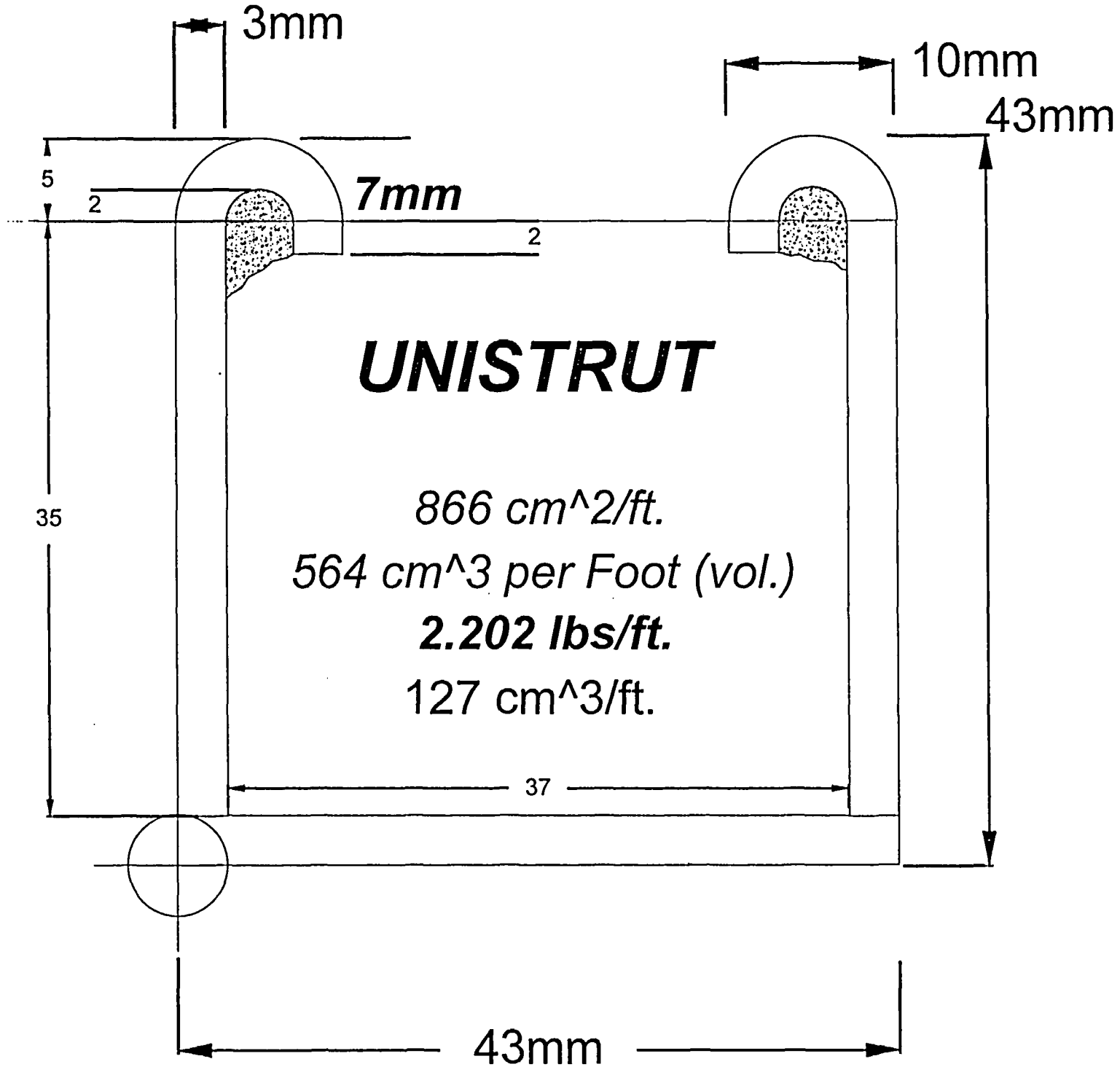
Cs-137 Limit		Cs-137 Administrative Limit	
6.32	pCi/g	4.74	pCi/g

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 4 - 6



ATTACHMENT 5.1

INFORMATION ONLY

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-106	AREA/LOCATION	CV Steam Pipe Tunnel
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

RESULTS SUMMARY FOR SR-106

SR-106 was issued to obtain NaI detector scan measurements of CV Steam Pipe Tunnel surfaces. The data will indicate whether remediation is complete. The SR required the following radiological measurements:

- Surface Scan Measurements for Gamma Activity Using a NaI Detector – perform a scan survey representative of the entire tunnel to include approx. 50% of total surface area. Focus on previously known contamination areas. Scan at a rate not exceeding 5 cm per second at a distance not exceeding 2 inches. Established action level is 200 gross cpm.

- Variability Study Using the LM 2350-1 with a GFPC – obtain at least 20 unbiased measurement pairs using a GFPC. Perform 1-minute counts spaced throughout the entire tunnel and include a combination of floors, walls, and ceiling surfaces. The detector will be held on contact with surface.

- Variability Study Using the LM 2350-1 NaI Detector – obtain at least 20 unbiased measurements using a NaI Detector. Perform 1-minute counts spaced throughout the entire tunnel and include a combination of floors, walls, and ceiling surfaces. The detector shall be within 2 inches of the surface.

- Loose Surface Contamination (Smear Survey) – obtain at least 20 smears spaced throughout the entire tunnel and include a combination of floors, walls, and ceiling surfaces.

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

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

ATTACHMENT 1 - 9

1. Summary of Results

A. Surface Scan Measurements Using a NaI Detector

Approximately 63% of the tunnel surfaces were scanned.

Results: all areas indicated activity <action level except for 6 areas. Static measurements performed on these areas indicated <action level.

B. Static Measurements Using a GFPC Detector

Twenty-two unbiased measurement pairs were obtained.

Results: The range of static measurement pairs' difference was from 8 to 220 ncpm. The highest unshielded reading, taken at F.P #17, was 431 cpm. Unshielded readings ranged from 237 to 431 cpm.

C. Static Measurements Using a NaI Detector

Twenty-three unbiased measurements were obtained.

Results: The range of measurement results was from 99 to 175 gross cpm.

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-106	AREA/LOCATION	CV Steam Pipe Tunnel
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

D. Loose Surface Contamination Survey

Twenty-three unbiased smears were obtained.

Results: The smears indicated <MDA (166 dpm, Beta-gamma and 13.5 dpm, Alpha). Theses smears were composited and the gamma analysis indicated <1.6 E –5 uCi/smear group Cs-137.

E. Result Summary Table

The following table lists the survey/smear locations with the static measurement and smear results:

Survey Point / Smear Location	44-10 Detector Result (gross cpm)	23-68B Detector Unshielded Reading (cpm)	Smear Results (ncpm/100 cm^2)	
			Beta-gamma	Alpha
1	111	304	3	0
2	123	337	-6	0
3	144	313	-2	0
4	132	288	2	0
5	131	338	1	0
6	174	316	-2	0
7	157	244	-8	0
8	110	362	-4	0
9	125	301	-1	0
10	116	missed	0	0
11	116	318	-3	0
12	115	298	1	0
13	99	266	3	0
14	157	237	-7	0
15	120	304	1	0
16	155	322	-3	0
17	175	431	8	0
18	110	323	2	0
19	122	316	1	0
20	133	398	2	0
21	113	391	-2	0
22	155	398	-3	0
23	137	401	-7	0
MEAN	131.74	327.5		
2-Sigma Uncertainty	42.9	102.6		
MIN	99	237.0		
MAX	175	431.0		
MEDIAN	125	317.0		

SURVEY REQUEST CONTINUATION SHEET			
SR NUMBER	SR-106	AREA/LOCATION	CV Steam Pipe Tunnel
SPECIFIC SAMPLING / SURVEY INSTRUCTIONS OR COMMENTS			

F. Quality Control (QC) Measurements and Comparisons

- **Scan, Static measurements and smears** were obtained. This percentage meets the 5% requirement and the QC static measurements meet the applicable acceptance criteria (20%) established in Section 4.6 of E900-IMP-4520.04.

2. Discrepancies and Exceptions

The technician performing the 23-68B survey inadvertently missed the unshielded static measurement of survey point #10.

3. Final Summary:

Based on the results of the surveys performed under this SR, the CV Steam Tunnel indicates residual activity below the acceptable release limits.

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

NaI Static Measurement MDC Calculation [redacted]

Use when Background Count Time ≠ Sample Count Time

$B := 1320$ $T_{SB} := 2$ $T_B := 10$ $MSO := 1.141 \cdot 10^{1}$ $CF := 176080$

$Ci := 5.64 \cdot 10^{-4}$

$K := CF \cdot \frac{MSO}{(Ci \cdot 2.22 \cdot 10^{12})}$ $K = 1.605 \cdot 10^{-3}$ $Mass := 998.83$

$Area := 866$

$R_B := \frac{B}{T_B}$ *Background counting rate*

$L_C := 2.33 \cdot \sqrt{B}$ *Calculation of critical level (page 6-34 of MARSSIM)*

$L_C = 84.7$ *Critical level*

$L_C + B = 1.4 \cdot 10^{3}$ *Any count above this value should be regarded at being greater than background (page 6-37 of MARSSIM).*

$L_D := 3 + 4.65 \cdot \sqrt{B}$

$L_D = 171.943$ *Detection limit*

$$MDC := \frac{\left[3 + 3.29 \cdot \sqrt{R_B \cdot T_{SB} \cdot \left(1 + \frac{T_{SB}}{T_B}\right)}\right]}{K \cdot T_{SB}}$$

$MDC = 1.918 \cdot 10^{4}$ *dpm* $\frac{MDC \cdot 100}{Area} = 2.215 \cdot 10^{3}$ $\frac{dpm}{100}\ cm^2$

$\frac{MDC}{2.22} = 8.641 \cdot 10^{3}$ ***Results in pCi*** $\frac{\left(\frac{MDC}{2.22}\right)}{Mass} = 8.651$ $\frac{pCi}{g}$

ATTACHMENT 7.1

where:

Area = area in square centimeters
B = background count in time T_B (counts)
CF = conversion factor for instrument calibration (cpm/mR/h)
K = instrument efficiency and other correction factors used to convert to appropriate units
L_C = critical level (counts)
L_D = detection limit (counts)
Mass = modeled volume in grams
MDC = minimum detectable concentration (dpm or pCi)
MSO = MicroShield output in mR/h per uCi/cc or uCi/cm^2
R_B = background count rate (cpm)
T_{SB} = sample count time (in minutes)
T_B = background count time (in minutes)

AF INTERPOLATOR

Radionuclide	3
Co-60	

Area Factors For Structural Surfaces

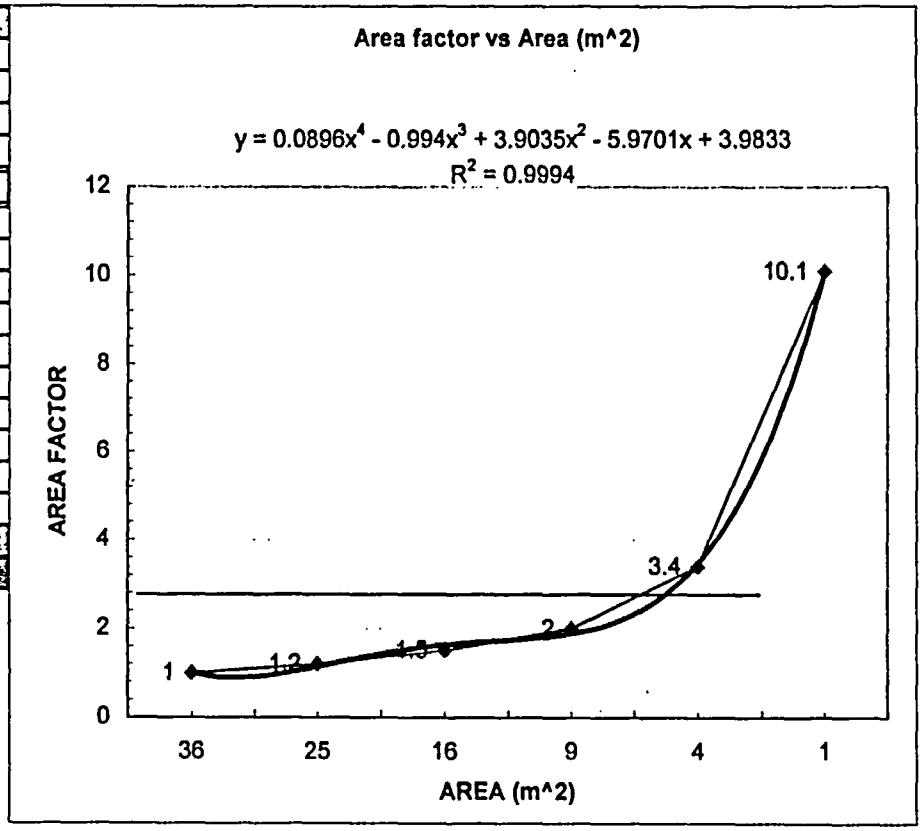
	Nuclide	Square Meters 36	25	16	9	4	1
1	Am-241	1	1.5	2.3	4.1	9.2	36.2
2	C-14	1	1.4	2.2	4	8.9	35.9
3	Co-60	1	1.2	1.5	2	3.4	10.1
4	Cs-137	1	1.2	1.5	2.2	3.7	11.2
5	Eu-152	1	1.2	1.5	2.1	3.5	10.7
6	H-3	1	1.4	2.2	4	8.9	35.8
7	Ni-63	1	1.4	2.2	4	9	35.3
8	Pu-238	1	1.4	2.3	4	9.1	36.9
9	Pu-239	1	1.4	2.2	4	9	35.4
10	Pu-241	1	1.4	2.2	4	9	34.8
11	Sr-90	1	1.4	2.2	3.9	8.8	34.7

NOTE: Used where DCGL is in dpm/100 cm^2

Area Factor ⇒	1	1.2	1.5	2	3.4	10.1
Area (m^2) ⇒	36	25	16	9	4	1

	Point 1	Point 2	Input Area	Projected Area Factor
Area (m^2) ⇒	9	4	6.8	2.62

	Point 1	Point 2	Input AF	Projected Area
Area Factor ⇒	2	3.4	2.62	6.79



ATTACHMENT 8.1

ORIGINAL

Exhibit 1
Survey Unit Inspection Check Sheet

SECTION 1 - SURVEY UNIT INSPECTION DESCRIPTION

Survey Unit #	SS22-1, 2, 3		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 components.

4/12/04

Survey Unit Inspector (print/sign)	G. Houtz /	Date	4/12/04
Survey Designer (print/sign)		Date	

INFORMATION ONLY

ATTACHMENT 9-1

ORIGINAL

EXHIBIT 3
Surface Measurement Test Area (SMTA) Data Sheet

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 /	Date	1120		

SECTION 3 - MEASUREMENT RESULTS

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

1 0.21	7 1.44	13 2.97	19 2.28	25 1.05	31 2.5
2 1.58	8 1.0	14 1.44	20 1.09	26 0.95	32 1.35
3 2.3	9 1.42	15 1.03	21 1.47	27 1.25	33 1.32
4 2.94	10 4.82	16 1.18	22 2.31	28 1.48	34 1.32
5 1.99	11 9.11	17 1.91	23 1.62	29 0.44	35 1.94
6 0.74	12 1.71	18 1.4	24 1.37	30 2.63	36 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

ATTACHMENT 9-2

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 /	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.

INFORMATION ONLY

ATTACHMENT 9-3