



Final Status Survey MARSSIM Evaluation Report
St. Louis Downtown Site Property Plant 6 West Half Survey Unit 6

DATA SUMMARY TABLE

Survey Unit Descriptive Information			
Site:	SLDS	Property:	Plant 6 WH
Survey Unit:	SU-6	Evaluation Result:	Passed
Area (m ²):	1008	Excluded Area (m ²):	84
Soil Sample Planning Information			
MARSSIM Class:	1	MARSSIM DCGL:	1
MARSSIM LBGR:	0.35	Effective St. Dev.:	0.46
MARSSIM Relative Shift:	1.43	Estimate of Min. No. Sys. Samples Required:	11
Soil Sample Summary Information			
No. Sys. Samples Collected:	11	Mean/Median Sys. SOR _N :	0.25/0.17
No. GWS-Based Samples:	14	St. Dev. Systematic SOR _N :	0.26
No. Other Biased Samples:	0	Max. Sample SOR _N :	17.78
No. Samples Below Excav. Surf.:	0	Max. 100m ² SOR _N :	0.68
No. Samples SOR _N >1:	7	No. QC Split/Dup. Samples	2
Ra-226 Contribution to SOR _G (%)	22.6	Th-230 Contribution to SOR _G (%)	25.6
No. Non-rad. Samples	0	Non-rad. Results Greater than RG: (element/RG/Results in mg/kg)	NA
Preliminary Risk and Dose Information			
Preliminary Risk Est.:	1x10 ⁻⁴	Max. Hotspot Risk Est.:	1x10 ⁻⁴
Prelim. Dose Est. (mrem/yr):	22	Max. Hotspot Dose Est. (mrem/yr):	9
Prelim. Risk/Dose at Year:	0	Max. Hotspot Risk/Dose at Year:	0
Structure Survey Summary Information			
Class 1 Structure Area (m ²):	170	Alpha Limit (dpm/100cm ²):	600
Min. No. Sys. F-P Surveys Req.:	40	Max. Alpha Result > RG (dpm/100cm ²):	787
No. Sys. Fixed-Point Surveys:	49	Beta Limit (dpm/100cm ²):	6000
		Max. Beta Result > RG (dpm/100cm ²):	7838
		Max. 1 m ² Avg. Alpha (dpm/100cm ²):	508

SIGNATURES

T. Keeton

6-25-08

Prepared by

Signature

Date

S. Passig

7/2/08

Reviewed by:

Signature

Date

SAIC
From Science to Solutions



US Army Corps
of Engineers

USACE Approved

Signature

Date

TABLE AND FIGURES

- Tables 1a through 1b contain the sample results and SOR_N.
- Table 2 contains the applicable background soil sample results.
- Table 3 contains the Wilcoxon Rank Test for soil samples.
- Tables 4a through 4h contains preliminary, simplified risk and dose estimates.
- Table 5 contains the area-weighted average results for soil areas of 100 m² (if any).
- Table 6 contains the area-weighted average results for structure areas of 1 m² (if any).
- Figure 1 shows the boundary coordinates for the excavation area.
- Figure 2 shows all sample locations and 100 m² areas (if any).
- Figure 3 shows the gamma walkover survey results with all sample locations without labels.
- Other.

PURPOSE AND BACKGROUND

This report documents the preliminary Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) evaluation for the subject survey unit. The evaluation data is on-file as part of the St. Louis Formerly Utilized Site Remedial Action Program (FUSRAP) records/files. The evaluation is performed in order to determine if excavation activities are complete by assessing whether the accessible soil in the survey unit is expected to meet the established criteria for unlimited use and unrestricted exposure. This evaluation is being conducted with un-validated laboratory data. At a later date, a final evaluation using validated data will be conducted and documented in a Post Remedial Action Report and Final Status Survey Evaluation (PRAR/FSSE).

The evaluation was performed in accordance with the following documents. Their requirements are not repeated in this document.

- *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* and its implementing regulations
- *Record of Decision for the St. Louis Downtown Site (SLDS ROD)*
- *Final Status Survey Plan for Accessible Soil within Mallinckrodt Property and the Vicinity Properties, Excluding Plants 1, 2 and the City Property at the St. Louis Downtown Site (SLDS FSSP)*
- *Final Status Survey Plan for Structures and Other Consolidated Material Left in Place at the St. Louis Sites (FSSPCM)*
- *Sampling and Analysis Guide for the St. Louis Sites (SAG)*
- *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*

COMMENTS

The following comments explain how certain requirements were addressed or describe unique conditions that are not contained in the Data Summary Table.

- The random start systematic grid was established to provide about one sample for approximately each 90 m² area in the survey unit.
- The data used in this evaluation was compared to subsurface criteria since the excavation will be backfilled.

- Per the SLDS ROD and 40 CFR 192.12, samples with an SOR_N greater than 1 were averaged with other samples within a 100 m^2 area surrounding the elevated sample in the survey unit. As necessary, biased samples were collected to bound the contamination and to determine the average concentration in the 100 m^2 within the survey unit.
- The 100 m^2 averaging evaluations only take into account data from within the survey unit and previously released survey units. It is possible that data from adjacent survey units (collected at a later date) could cause the remedial goal (RG) not to be met ($\text{over } 100\text{ m}^2$).
- Preliminary residual risk and dose estimates for the survey unit and for elevated hotspots were calculated for the potential maximum exposed individual. The residual dose resulting from the survey unit was calculated for year 0 and year 1000. The Environmental Protection Agency's (EPA) software ProUCL (Version 3.0) was used to determine the 95% upper confidence limit (UCL_{95}) of the mean of all samples collected. The average background concentration is subtracted from the smaller of the UCL_{95} or the maximum detection concentration. The resulting concentration is used with simplified risk and dose assessment tables to provide a preliminary risk and dose estimate. For this simplified risk and dose assessment, all samples are assigned equal area weighting. Equal area weighting over-estimates the risk and dose because biased samples collected based on the gamma walkover survey represent less area than the other samples. A refined risk and dose estimate is normally not prepared until the PRAR/FSSE is prepared, but could be prepared for a MARSSIM Evaluation Report (MER). A refined estimate accounts for areas represented by the samples. For example, results from a biased sample may only represent 3 m^2 of the survey unit, whereas results from a systematic sample may represent 70 m^2 .
- Initially for this MER, the simplified assessment was used which resulted in a result of 3×10^{-4} . Because the initial simplified assessment resulted in a risk greater than 1×10^{-4} a refined risk and dose assessment was completed.
- The structure survey is only of surfaces made available due to excavation within the survey unit. Structures that were surveyed in the survey unit were sheet pile, a sewer pipe, I-beams, concrete and a metal pipe. A summary of the structure survey data is contained in the Data Summary Table. The complete structure survey data evaluation for this survey unit is documented in the Plant 6WH SU-6 Structure MARSSIM Evaluation Report. Permanent Structures such as buildings that are on the property are not included in the evaluation and will be addressed separately.
- There is an inaccessible area in SU-6. This 84 m^2 area is located in the southwest corner of the survey unit. It was inaccessible because any further remediation would compromise the integrity of the adjacent structures.

CONCLUSION

The evaluation of the preliminary data is summarized in the Data Summary Table and discussed in the Comments Section of this MER. The evaluation of the preliminary data indicates that the survey unit meets applicable RGs for unlimited use and unrestricted exposure, and is acceptable for backfill. This conclusion was determined based on the following:

- The systematic samples within the survey unit have an average $SOR_N < 1$.
- Any 100 m^2 averaging evaluation (if any) in the survey unit has an $SOR_N < 1$.
- The preliminary sample data passes the WRS Test.

- The preliminary residual risk and dose estimates for the survey unit and for elevated hotspots (if any) meets the RGs, and
- Structure survey data (if any) meet the appropriate criteria.

Table 1a. Summary of MARSSIM Systematic Data

SLDS Plant 6 West Half SU-6 - Final

Table 1b. Summary of Biased Sample Data

SLDS Plant 6 West Half SU-6 - Final

Table 2. MARSSIM Background Data Summary for SLDS Soils

Statistic	Summary of Background Area Soil Sample Results for Downtown St. Louis							Surface SOR _G (5/5/50)	Subsurface SOR _G (15/15/50)
	Ac-227 (pCi/g)	Pa-231 (pCi/g)	Ra-226 (pCi/g)	Ra-228 (pCi/g)	Th-230 (pCi/g)	Th-232 (pCi/g)	U-238 (pCi/g)		
Mean	0.14	0.89	2.78	0.95	1.94	1.09	1.44	0.82	0.29
Median	0.11	0.98	2.53	0.97	1.66	1.07	1.16	0.76	0.27
St. Dev	0.14	0.76	0.89	0.17	0.76	0.29	0.75	0.21	0.08
Max	0.70	2.34	5.46	1.28	4.15	1.68	3.78	1.48	0.54
Range	0.80	2.55	3.93	0.82	3.19	1.25	3.19	0.95	0.35
No. Samples	32	32	32	32	32	32	32	32	32
SLD00001	0.18	0.62	1.94	0.97	2.07	1.11	1.66	0.67	0.25
SLD00002	-0.03	2.34	2.39	1.03	1.67	1.12	0.61	0.71	0.25
SLD00022	0.36	1.33	2.56	1.17	1.83	1.49	1.38	0.84	0.30
SLD00023	0.29	0.95	2.26	0.76	2.80	1.23	1.17	0.83	0.29
SLD00041	0.16	-0.09	2.48	0.84	1.98	1.13	1.57	0.75	0.27
SLD00042	0.70	-0.02	3.02	1.07	2.24	1.05	1.80	0.85	0.31
SLD00043	0.28	2.07	2.59	0.99	2.69	1.68	1.15	0.90	0.31
SLD00044	0.13	1.65	3.46	1.03	1.16	1.33	0.90	0.98	0.34
SLD00061	0.10	1.23	3.11	1.08	2.67	1.43	1.47	0.94	0.33
SLD00062	0.12	1.36	2.59	1.28	1.91	1.59	0.94	0.85	0.30
SLD00063	0.15	2.12	2.11	1.03	1.61	0.70	0.74	0.64	0.22
SLD00081	0.24	0.98	2.44	0.96	1.47	1.30	1.05	0.77	0.27
SLD00082	0.06	1.19	2.89	1.28	1.97	1.17	1.28	0.86	0.30
SLD00083	0.20	0.98	2.33	0.88	1.94	0.69	0.59	0.65	0.23
SLD00101	0.15	1.01	4.24	0.79	3.05	0.90	3.12	1.09	0.41
SLD00102	0.06	1.42	3.53	0.86	3.11	1.41	2.53	1.04	0.38
SLD00103	0.08	1.30	3.08	0.81	1.46	0.92	1.69	0.83	0.30
SLD00121	0.17	-0.10	3.31	0.87	2.25	1.34	1.84	0.97	0.35
SLD00122	0.09	0.42	2.68	0.85	1.46	0.94	1.13	0.75	0.26
SLD00123	0.23	0.25	3.51	1.02	1.33	0.94	1.17	0.93	0.33
SLD00141	0.16	-0.21	5.46	1.04	4.15	1.56	3.78	1.48	0.54
SLD00142	0.08	0.33	5.30	1.12	3.61	1.04	3.15	1.35	0.49
SLD00143	0.19	0.02	2.33	0.96	1.45	1.02	0.93	0.69	0.24
SLD00144	0.10	0.01	2.04	1.10	1.48	1.25	1.61	0.69	0.25
SLD00161	0.10	0.11	1.53	0.86	1.56	1.01	1.11	0.54	0.19
SLD00162	0.04	2.01	2.07	1.04	1.35	0.86	1.00	0.64	0.23
SLD00181	0.03	1.13	2.24	0.73	1.34	0.78	0.91	0.62	0.22
SLD00201	0.06	1.74	2.40	0.86	1.64	1.08	1.15	0.72	0.26
SLD00202	-0.10	1.73	2.67	0.97	1.62	0.78	1.11	0.75	0.26
SLD00241	0.01	-0.04	2.04	0.46	1.28	0.43	1.70	0.53	0.20
SLD00242	0.07	0.42	2.50	0.89	1.05	0.80	0.92	0.70	0.24
SLD00243	0.03	0.37	1.97	0.65	0.96	0.90	0.86	0.59	0.21

Table 3. WRS Test, Mid-Depth Evaluation Samples

SLDS Plant 6 West Half SU-6 - Final

Table 4a. SLDS Refined Risk and Dose Assessment

Plant 6WH SU-6 MARSSIM Evaluation

INDUSTRIAL WORKER						
1,000 (m ²)						
Year 0 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.12	0.14	0.00	1,000	0.0	0.0E+00
Pa-231	0.25	0.90	0.00	1,000	0.0	0.0E+00
Pb-210 ^e	2.76	2.78	0.00	1,000	0.0	0.0E+00
Ra-226	2.12	2.78	0.00	1,000	0.0	0.0E+00
Ra-228	0.69	0.95	0.00	1,000	0.0	0.0E+00
Th-228 ^e	1.12	0.95	0.17	1,000	0.2	6.1E-07
Th-230	2.57	1.94	0.63	1,000	0.0	1.5E-07
Th-232	1.12	1.09	0.03	1,000	0.0	9.5E-07
U-234 ^e	19.01	1.46	17.55	1,000	0.1	7.6E-07
U-235 ^e	0.87	0.07	0.80	1,000	0.1	1.9E-06
U-238	19.01	1.44	17.57	1,000	0.5	9.0E-06
		Total =		1		1.E-05
Year 1,000 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.12	0.14	0.00	1,000	0.0	0.0E+00
Pa-231	0.25	0.90	0.00	1,000	0.0	0.0E+00
Pb-210 ^e	2.76	2.78	0.00	1,000	0.0	0.0E+00
Ra-226	2.12	2.78	0.00	1,000	0.0	0.0E+00
Ra-228	0.89	0.95	0.00	1,000	0.0	0.0E+00
Th-228 ^e	1.12	0.95	0.17	1,000	0.0	0.0E+00
Th-230	2.57	1.94	0.63	1,000	0.3	6.4E-06
Th-232	1.12	1.09	0.03	1,000	0.1	1.5E-06
U-234 ^e	19.01	1.46	17.55	1,000	0.1	1.1E-06
U-235 ^e	0.87	0.07	0.80	1,000	0.1	9.6E-07
U-238	19.01	1.44	17.57	1,000	0.3	4.4E-06
		Total =		1		1.E-05
^a Either the UCL ₉₅ mean or maximum sample results ^b 1998 MARSSIM Reference Area Sampling ^c UCL ₉₅ - background ^d RME times dose-to-source or risk-to-source ratio ^e Value determined using the relationship in Table 2.15 of the <i>Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site</i>						

Table 4b. SLDS Risk and Dose Assessment

HTZ108621 MARSSIM Evaluation

INDUSTRIAL WORKER						
Year 0 Risk and Dose Estimates for Variable Surface Area 1 (m ²)						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^e (lifetime ⁻¹)
Ac-227	-0.03	0.14	0.00	1	0.0	0.0E+00
Pa-231	-0.30	0.90	0.00	1	0.0	0.0E+00
Pb-210 ^g	2.94	2.78	0.16	1	0.0	1.2E-09
Ra-226	2.27	2.78	0.00	1	0.0	0.0E+00
Ra-228	0.99	0.95	0.04	1	0.0	7.7E-08
Th-228 ^g	1.22	0.95	0.27	1	0.0	1.0E-07
Th-230	2.89	1.94	0.95	1	0.0	2.8E-08
Th-232	1.22	1.09	0.13	1	0.0	4.4E-07
U-234 ^g	133.00	1.46	131.54	1	0.2	8.7E-07
U-235 ^g	6.12	0.07	6.05	1	0.1	1.7E-06
U-238	133.00	1.44	131.56	1	0.5	7.8E-06
Total =					1	1.E-05
Year 1,000 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^e (lifetime ⁻¹)
Ac-227	-0.03	0.14	0.00	1	0.0	0.0E+00
Pa-231	-0.30	0.90	0.00	1	0.0	0.0E+00
Pb-210 ^g	2.94	2.78	0.16	1	0.0	2.6E-23
Ra-226	2.27	2.78	0.00	1	0.0	0.0E+00
Ra-228	0.99	0.95	0.04	1	0.0	0.0E+00
Th-228 ^g	1.22	0.95	0.27	1	0.0	0.0E+00
Th-230	2.89	1.94	0.95	1	0.1	1.0E-06
Th-232	1.22	1.09	0.13	1	0.0	7.1E-07
U-234 ^g	133.00	1.46	131.54	1	0.1	1.0E-06
U-235 ^g	6.12	0.07	6.05	1	0.1	8.8E-07
U-238	133.00	1.44	131.56	1	0.3	3.8E-06
Total =					1	7.E-06

^a Either the UCL₉₅ mean or maximum sample results
^b 1998 MARSSIM Reference Area Sampling
^c UCL₉₅ - background
^d RME times dose-to-source or risk-to-source ratio
^e Value determined using the relationship in Table 2.15 of the *Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site*

Table 4c. SLDS Risk and Dose Assessment

HTZ108622 MARSSIM Evaluation

INDUSTRIAL WORKER 3 (m ³)						
Year 0 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ³)	Dose ^d (mrem/yr)	Risk ^e (lifetime ⁻¹)
Ac-227	0.13	0.14	0.00	3	0.0	0.0E+00
Pa-231	0.64	0.90	0.00	3	0.0	0.0E+00
Pb-210*	3.65	2.78	0.87	3	0.0	9.5E-09
Ra-226	2.81	2.78	0.03	3	0.0	2.1E-07
Ra-228	0.99	0.95	0.04	3	0.0	1.5E-07
Th-228*	0.99	0.95	0.04	3	0.0	3.4E-08
Th-230	0.00	1.94	0.00	3	0.0	0.0E+00
Th-232	0.99	1.09	0.00	3	0.0	0.0E+00
U-234*	303.30	1.46	301.84	3	0.4	2.3E-06
U-235*	13.95	0.07	13.88	3	0.5	8.4E-06
U-238	303.30	1.44	301.86	3	2.3	3.7E-05
Total =					3	5.E-05
Year 1,000 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ³)	Dose ^d (mrem/yr)	Risk ^e (lifetime ⁻¹)
Ac-227	0.13	0.14	0.00	3	0.0	0.0E+00
Pa-231	0.64	0.90	0.00	3	0.0	0.0E+00
Pb-210*	3.65	2.78	0.87	3	0.0	2.1E-22
Ra-226	2.81	2.78	0.03	3	0.0	8.3E-08
Ra-228	0.99	0.95	0.04	3	0.0	0.0E+00
Th-228*	0.99	0.95	0.04	3	0.0	0.0E+00
Th-230	0.00	1.94	0.00	3	0.0	0.0E+00
Th-232	0.99	1.09	0.00	3	0.0	0.0E+00
U-234*	303.30	1.46	301.84	3	0.4	4.2E-06
U-235*	13.95	0.07	13.88	3	0.3	4.3E-06
U-238	303.30	1.44	301.86	3	1.1	1.8E-05
Total =					2	3.E-05

* Either the UCL₉₅ mean or maximum sample results
 ** 1998 MARSSIM Reference Area Sampling
 ^ UCL₉₅ - background
 # RME times dose-to-source or risk-to-source ratio
 * Value determined using the relationship in Table 2.15 of the *Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site*

Table 4d. SLDS Risk and Dose Assessment

HTZ108623 MARSSIM Evaluation

INDUSTRIAL WORKER						
3 (m ²)						
Year 0 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.16	0.14	0.02	3	0.0	2.0E-08
Pa-231	-0.77	0.90	0.00	3	0.0	0.0E+00
Pb-210*	17.28	2.78	14.50	3	0.0	1.6E-07
Ra-226	13.29	2.78	10.51	3	4.8	9.0E-05
Ra-228	0.42	0.95	0.00	3	0.0	0.0E+00
Th-228*	0.30	0.95	0.00	3	0.0	0.0E+00
Th-230	1.17	1.94	0.00	3	0.0	0.0E+00
Th-232	0.30	1.09	0.00	3	0.0	0.0E+00
U-234*	28.90	1.46	27.44	3	0.0	2.1E-07
U-235*	1.33	0.07	1.26	3	0.0	7.6E-07
U-238	28.90	1.44	27.46	3	0.2	3.4E-06
		Total =		5	9.0E-05	
Year 1,000 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.16	0.14	0.02	3	0.0	5.1E-23
Pa-231	-0.77	0.90	0.00	3	0.0	0.0E+00
Pb-210*	17.28	2.78	14.50	3	0.0	3.5E-21
Ra-226	13.29	2.78	10.51	3	1.9	3.5E-05
Ra-228	0.42	0.95	0.00	3	0.0	0.0E+00
Th-228*	0.30	0.95	0.00	3	0.0	0.0E+00
Th-230	1.17	1.94	0.00	3	0.0	0.0E+00
Th-232	0.30	1.09	0.00	3	0.0	0.0E+00
U-234*	28.90	1.46	27.44	3	0.0	3.8E-07
U-235*	1.33	0.07	1.26	3	0.0	3.9E-07
U-238	28.90	1.44	27.46	3	0.1	1.7E-06
		Total =		2	4.0E-05	
<ul style="list-style-type: none"> * Either the UCL₉₅ mean or maximum sample results † 1998 MARSSIM Reference Area Sampling ‡ UCL₉₅ - background § RME times dose-to-source or risk-to-source ratio ¶ Value determined using the relationship in Table 2.15 of the Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site 						

Table 4e. SLDS Risk and Dose Assessment

HTZ108624 MARSSIM Evaluation

INDUSTRIAL WORKER 1 (m ²)						
Year 0 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^e (lifetime ⁻¹)
Ac-227	0.16	0.14	0.02	1	0.0	1.1E-08
Pa-231	0.02	0.90	0.00	1	0.0	0.0E+00
Pb-210*	1.50	2.78	0.00	1	0.0	0.0E+00
Ra-226	1.15	2.78	0.00	1	0.0	0.0E+00
Ra-228	0.77	0.95	0.00	1	0.0	0.0E+00
Th-228*	0.76	0.95	0.00	1	0.0	0.0E+00
Th-230	1.80	1.94	0.00	1	0.0	0.0E+00
Th-232	0.76	1.09	0.00	1	0.0	0.0E+00
U-234*	56.84	1.46	55.38	1	0.1	3.7E-07
U-235*	2.61	0.07	2.54	1	0.0	7.2E-07
U-238	56.84	1.44	55.40	1	0.2	3.3E-06
Total =					0	4.E-06
Year 1,000 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^e (lifetime ⁻¹)
Ac-227	0.16	0.14	0.02	1	0.0	2.9E-23
Pa-231	0.02	0.90	0.00	1	0.0	0.0E+00
Pb-210*	1.50	2.78	0.00	1	0.0	0.0E+00
Ra-226	1.15	2.78	0.00	1	0.0	0.0E+00
Ra-228	0.77	0.95	0.00	1	0.0	0.0E+00
Th-228*	0.76	0.95	0.00	1	0.0	0.0E+00
Th-230	1.80	1.94	0.00	1	0.0	0.0E+00
Th-232	0.76	1.09	0.00	1	0.0	0.0E+00
U-234*	56.84	1.46	55.38	1	0.0	4.3E-07
U-235*	2.61	0.07	2.54	1	0.0	7.2E-07
U-238	56.84	1.44	55.40	1	0.1	1.6E-06
Total =					0	2.E-06

* Either the UCL₉₅ mean or maximum sample results
 ** 1998 MARSSIM Reference Area Sampling
 ^ UCL₉₅ - background
 # RME times dose-to-source or risk-to-source ratio
 * Value determined using the relationship in Table 2.15 of the *Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site*

Table 4f. SLDS Risk and Dose Assessment

HTZ108625 MARSSIM Evaluation

INDUSTRIAL WORKER 1 (m ²)						
Year 0 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.08	0.14	0.00	1	0.0	0.0E+00
Pa-231	0.46	0.90	0.00	1	0.0	0.0E+00
Pb-210*	8.95	2.78	6.17	1	0.0	4.5E-08
Ra-226	6.89	2.78	4.11	1	0.3	1.6E-05
Ra-228	1.05	0.95	0.10	1	0.0	1.7E-07
Th-228*	0.95	0.95	0.00	1	0.0	3.9E-10
Th-230	4.87	1.94	2.93	1	0.0	8.5E-08
Th-232	0.95	1.09	0.00	1	0.0	0.0E+00
U-234*	76.13	1.46	74.67	1	0.1	4.9E-07
U-235*	3.50	0.07	3.43	1	0.1	9.6E-07
U-238	76.13	1.44	74.69	1	0.3	4.4E-06
Total =					1	2.4E-05
Year 1,000 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.08	0.14	0.00	1	0.0	0.0E+00
Pa-231	0.46	0.90	0.00	1	0.0	0.0E+00
Pb-210*	8.95	2.78	6.17	1	0.0	9.9E-22
Ra-226	6.89	2.78	4.11	1	0.3	6.1E-06
Ra-228	1.05	0.95	0.10	1	0.0	0.0E+00
Th-228*	0.95	0.95	0.00	1	0.0	0.0E+00
Th-230	4.87	1.94	2.93	1	0.2	3.2E-06
Th-232	0.95	1.09	0.00	1	0.0	0.0E+00
U-234*	76.13	1.46	74.67	1	0.1	5.8E-07
U-235*	3.50	0.07	3.43	1	0.0	5.0E-07
U-238	76.13	1.44	74.69	1	0.1	2.2E-06
Total =					1	1.4E-05

^a Either the UCL₉₅ mean or maximum sample results
^b 1998 MARSSIM Reference Area Sampling
^c UCL₉₅ - background
^d RME times dose-to-source or risk-to-source ratio
^{*} Value determined using the relationship in Table 2.15 of the *Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site*

Table 4g. SLDS Risk and Dose Assessment

HTZ108627 MARSSIM Evaluation

INDUSTRIAL WORKER 1 (m ²)						
Year 0 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^e (lifetime ⁻¹)
Ac-227	29.35	0.14	29.21	1	3.0	1.5E-05
Pa-231	29.71	0.90	28.81	1	0.5	9.3E-06
Pb-210*	14.25	2.78	11.47	1	0.0	8.3E-08
Ra-226	10.96	2.78	8.18	1	1.7	3.1E-05
Ra-228	1.27	0.95	0.32	1	0.0	5.5E-07
Th-228*	1.27	0.95	0.32	1	0.0	1.2E-07
Th-230	76.27	1.94	74.33	1	0.2	2.2E-06
Th-232	1.27	1.09	0.18	1	0.0	6.1E-07
U-234*	641.60	1.46	640.14	1	0.8	4.2E-06
U-235*	29.51	0.07	29.44	1	0.5	8.3E-06
U-238	641.60	1.44	640.16	1	2.6	3.8E-05
Total =					9	1.E-04
Year 1,000 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^e (lifetime ⁻¹)
Ac-227	29.35	0.14	29.21	1	0.0	3.9E-20
Pa-231	29.71	0.90	28.81	1	1.6	1.1E-05
Pb-210*	14.25	2.78	11.47	1	0.0	1.8E-21
Ra-226	10.96	2.78	8.18	1	0.6	1.2E-05
Ra-228	1.27	0.95	0.32	1	0.0	0.0E+00
Th-228*	1.27	0.95	0.32	1	0.0	0.0E+00
Th-230	76.27	1.94	74.33	1	4.5	8.2E-05
Th-232	1.27	1.09	0.18	1	0.1	9.8E-07
U-234*	641.60	1.46	640.14	1	0.6	5.0E-06
U-235*	29.51	0.07	29.44	1	0.3	4.3E-06
U-238	641.60	1.44	640.16	1	1.3	1.9E-05
Total =					9	1.E-04

* Either the UCL₉₅ mean or maximum sample results
 □ 1998 MARSSIM Reference Area Sampling
 □ UCL₉₅ - background
 □ RME times dose-to-source or risk-to-source ratio
 □ Value determined using the relationship in Table 2.15 of the Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site

Table 4h. SLDS Risk and Dose Assessment

HTZ108628 MARSSIM Evaluation

INDUSTRIAL WORKER 3 (m ²)						
Year 0 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.08	0.14	0.00	3	0.0	0.0E+00
Pa-231	0.13	0.90	0.00	3	0.0	0.0E+00
Pb-210 ^e	1.61	2.78	0.00	3	0.0	0.0E+00
Ra-226	1.24	2.78	0.00	3	0.0	0.0E+00
Ra-228	0.80	0.95	0.00	3	0.0	0.0E+00
Th-228 ^e	0.86	0.95	0.00	3	0.0	0.0E+00
Th-230	1.39	1.94	0.00	3	0.0	0.0E+00
Th-232	0.86	1.09	0.00	3	0.0	0.0E+00
U-234 ^e	132.70	1.46	131.24	3	0.2	1.0E-06
U-235 ^e	6.10	0.07	6.03	3	0.2	3.6E-06
U-238	132.70	1.44	131.26	3	1.0	1.6E-05
					Total = 1	2.E-05
Year 1,000 Risk and Dose Estimates for Variable Surface Area						
Analyte	UCL ₉₅ or Max Result ^a (pCi/g)	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.08	0.14	0.00	3	0.0	0.0E+00
Pa-231	0.13	0.90	0.00	3	0.0	0.0E+00
Pb-210 ^e	1.61	2.78	0.00	3	0.0	0.0E+00
Ra-226	1.24	2.78	0.00	3	0.0	0.0E+00
Ra-228	0.80	0.95	0.00	3	0.0	0.0E+00
Th-228 ^e	0.86	0.95	0.00	3	0.0	0.0E+00
Th-230	1.39	1.94	0.00	3	0.0	0.0E+00
Th-232	0.86	1.09	0.00	3	0.0	0.0E+00
U-234 ^e	132.70	1.46	131.24	3	0.2	1.8E-06
U-235 ^e	6.10	0.07	6.03	3	0.1	1.9E-06
U-238	132.70	1.44	131.26	3	0.5	8.0E-06
					Total = 1	1.E-05

* Either the UCL₉₅ mean or maximum sample results
 □ 1998 MARSSIM Reference Area Sampling
 F UCL₉₅ - background
 R RME times dose-to-source or risk-to-source ratio
 □ Value determined using the relationship in Table 2.15 of the Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site

Table 5. Area-Weighted Average for Sample Results Having an SOR_N Greater Than 1.0

SLDS Plant 6 West Half SU-6 - Final

Sample ID: HTZ108628			
Sample ID	Area (m ²)	SOR _N	Weighted SOR
HTZ108628	2.0	2.63	0.05
HTZ108625	1.0	1.77	0.02
HTZ108632	2.0	0.87	0.02
HTZ108629	2.0	0.48	0.01
SLD110010	93.0	0.06	0.06
			0.00
TOTALS	100.0		0.15

SOR

Sample ID: HTZ108621			
Sample ID	Area (m ²)	SOR _N	Weighted SOR
HTZ108620	1.0	0.25	0.00
HTZ108621	1.0	2.70	0.03
SLD110013	49.0	0.38	0.19
SLD110015	49.0	0.00	0.00
			0.00
TOTALS	100.0		0.22

SOR

Sample ID: HTZ108627			
Sample ID	Area (m ²)	SOR _N	Weighted SOR
HTZ108631	1.0	0.99	0.01
HTZ108623	3.0	1.25	0.04
HTZ108627	1.0	17.78	0.18
SLD110014	47.5	0.68	0.32
SLD110016	47.5	0.27	0.13
			0.00
TOTALS	100.0		0.68

SOR

Sample ID: HTZ108622			
Sample ID	Area (m ²)	SOR _N	Weighted SOR
HTZ108624	1.0	1.11	0.01
HTZ108622	3.0	6.04	0.18
SLD110012	96.0	0.05	0.05
			0.00
			0.00
			0.00
TOTALS	100.0		0.24

SOR

Table 6. 1 m² Area Weighted Results

SLDS Plant 6 West Half SU-6 Final

Weighted Average

Plant 6W Sheetpile I-beam 7					
Sample ID	Area (cm ²)	alpha dpm/100 cm ²	beta dpm/100 cm ²	Weighted Alpha	Weighted Beta
A58	1428	240	1168	34	167
A59	1429	493	1625	70	232
A60	1429	667	1473	95	210
A61	1429	787	1241	112	177
A62	1428	213	747	30	107
A63	1429	493	1081	70	155
A64	1428	53	406	6	58
TOTALS	10000.0			421	dpm/100 cm ²

Weighted Average

Plant 6W Sheetpile West wall					
Sample ID	Area (cm ²)	alpha dpm/100 cm ²	beta dpm/100 cm ²	Weighted Alpha	Weighted Beta
B65	2000	614	5908	163	1182
B66	2000	286	879	57	176
B67	2000	434	2119	87	424
B68	2000	22	2374	4	475
B69	2000	55	538	11	107
TOTALS	10000.0			3222	dpm/100 cm ²

Weighted Average

Plant 6W Sheetpile West wall					
Sample ID	Area (cm ²)	alpha dpm/100 cm ²	beta dpm/100 cm ²	Weighted Alpha	Weighted Beta
C70	2000	698	4114	140	823
C71	2000	137	0	27	0
C72	2000	385	607	77	121
C73	2000	104	0	21	0
C74	2000	187	0	37	0
TOTALS	10000.0			302	dpm/100 cm ²

Weighted Average

Plant 6W Sheetpile West wall					
Sample ID	Area (cm ²)	alpha dpm/100 cm ²	beta dpm/100 cm ²	Weighted Alpha	Weighted Beta
G93	1428	401	2868	57	409
G94	1429	533	1336	76	191
G95	1428	203	1160	29	168
G96	1428	137	1073	20	153
G97	1429	682	3077	97	440
G98	1429	599	1354	86	193
G99	1429	467	2444	67	349
TOTALS	10000.0			32	dpm/100 cm ²

Weighted Average

Plant 6W Sheetpile West wall					
Sample ID	Area (cm ²)	alpha dpm/100 cm ²	beta dpm/100 cm ²	Weighted Alpha	Weighted Beta
H100	2500	148	0	37	0
H101	2500	740	0	185	0
H102	2500	74	0	18	0
H103	2500	185	0	46	0
TOTALS	10000.0			287	dpm/100 cm ²

Table 6. 1 m² Area Weighted Results

SLDS Plant 6 West Half SU-6 Final

Weighted Average

Plant 6 Sheetpile North wall						
Sample ID	Area (cm ²)	alpha dpm/100 cm ²	beta dpm/100 cm ²	Weighted Alpha	Weighted Beta	
D75	1429	479	1482	68	212	
D76	1428	289	918	43	131	
D77	1429	643	2236	92	320	
D78	1429	718	2245	103	321	
D79	1428	289	1009	43	144	
D80	1428	284	738	41	105	
D81	1429	508	1464	73	209	
TOTALS	10000.0			461	1442	dpm/100 cm ²

Weighted Average

Plant 6 Sheetpile North wall						
Sample ID	Area (cm ²)	alpha dpm/100 cm ²	beta dpm/100 cm ²	Weighted Alpha	Weighted Beta	
E82	2000	224	1282	45	256	
E83	2000	553	1382	111	276	
E84	2000	703	1955	141	391	
E85	2000	374	1209	75	242	
E86	2000	120	764	24	153	
TOTALS	10000.0			395	1318	dpm/100 cm ²

Weighted Average

Plant 6 Sheetpile North wall						
Sample ID	Area (cm ²)	alpha dpm/100 cm ²	beta dpm/100 cm ²	Weighted Alpha	Weighted Beta	
F87	1667	523	2055	87	342	
F88	1667	583	1682	97	280	
F89	1667	912	2027	152	338	
F90	1667	508	1373	85	229	
F91	1668	194	809	32	135	
F92	1666	329	645	55	108	
TOTALS	10000.0			508	1432	dpm/100 cm ²

Weighted Average

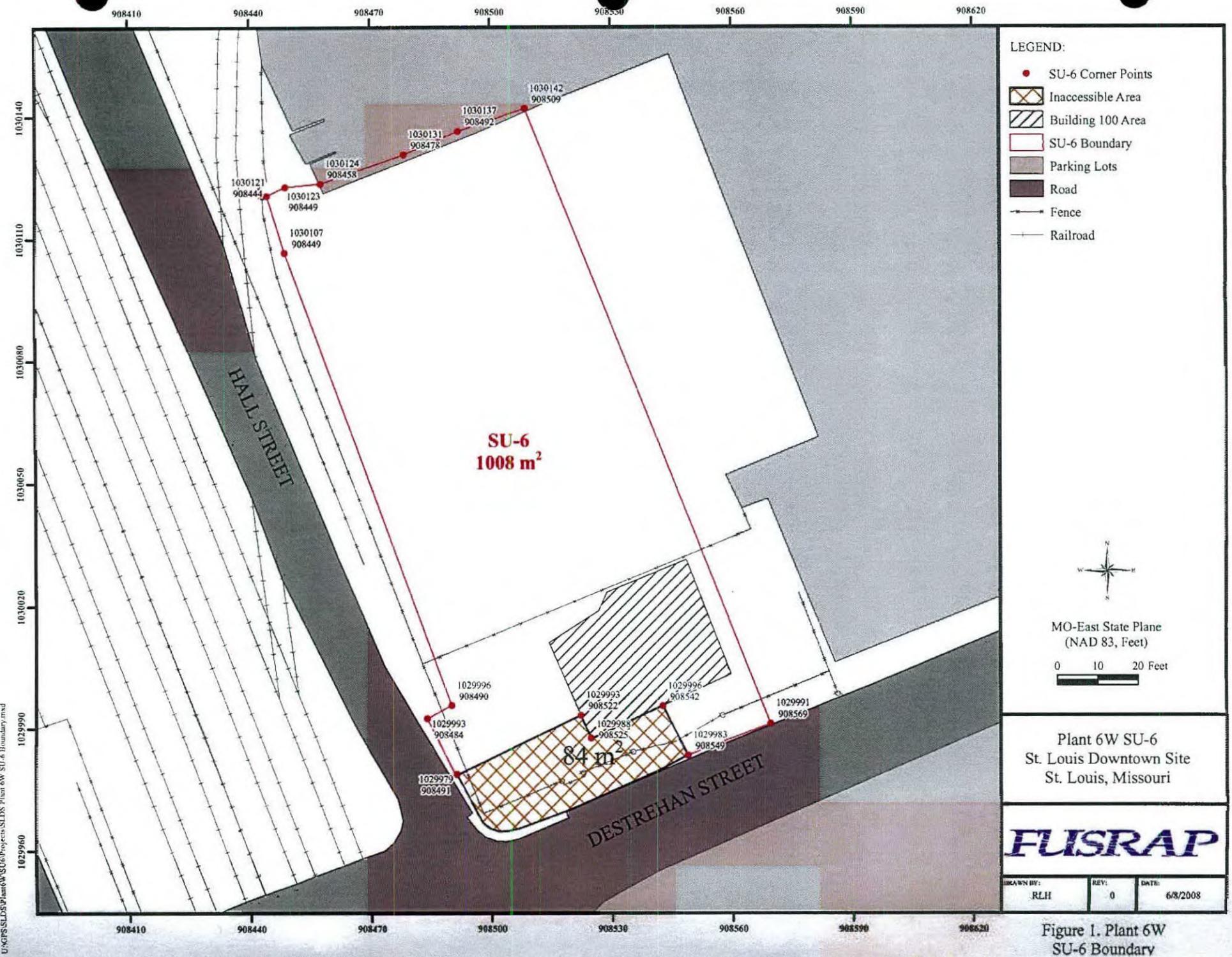
Plant 6W Area 1 on corrugated pipe						
Sample ID	Area (cm ²)	alpha dpm/100 cm ²	beta dpm/100 cm ²	Weighted Alpha	Weighted Beta	
I104	454	0	3749	0	170	
I105	456	97	6632	4	302	
I106	456	70	6671	3	304	
I107	456	149	7397	7	337	
I108	456	70	6972	3	318	
I109	456	83	5998	4	274	
I110	454	110	5163	5	234	
I111	454	110	4622	5	210	
I112	454	70	5403	3	245	
I113	454	57	5635	3	256	
I114	456	18	7838	1	357	
I115	454	57	1353	3	61	
I116	454	123	966	6	44	
I117	454	31	1314	1	60	
I118	454	83	1523	4	69	
I119	454	31	1329	1	60	
I120	454	83	1461	4	66	
I121	454	97	1809	4	87	
I122	454	31	1492	1	68	
I123	454	0	1438	0	65	
I124	454	18	1855	1	84	
I125	454	31	1585	1	72	
TOTALS	10000.0			64	3745	dpm/100 cm ²

Table 6. 1 m² Area Weighted Results

SLDS Plant 6 West Half SU-6 Final

Weighted Average

Sample ID	Area (cm ²)	Plant 6W Area 2 on corrugated pipe		Weighted Alpha	Weighted Beta
		alpha dpm/100 cm ²	beta dpm/100 cm ²		
J126	833	0	4243	0	353
J127	834	0	5357	0	447
J128	834	4	7544	0	629
J129	834	0	5612	0	468
J130	834	18	5357	1	447
J131	833	0	4329	0	361
J132	833	4	3679	0	306
J133	833	18	1368	1	114
J134	833	4	1793	0	149
J135	833	0	1121	0	93
J136	833	4	1268	0	106
J137	833	4	1677	0	140
TOTALS	10000.0			5	3613 dpm/100 cm ²





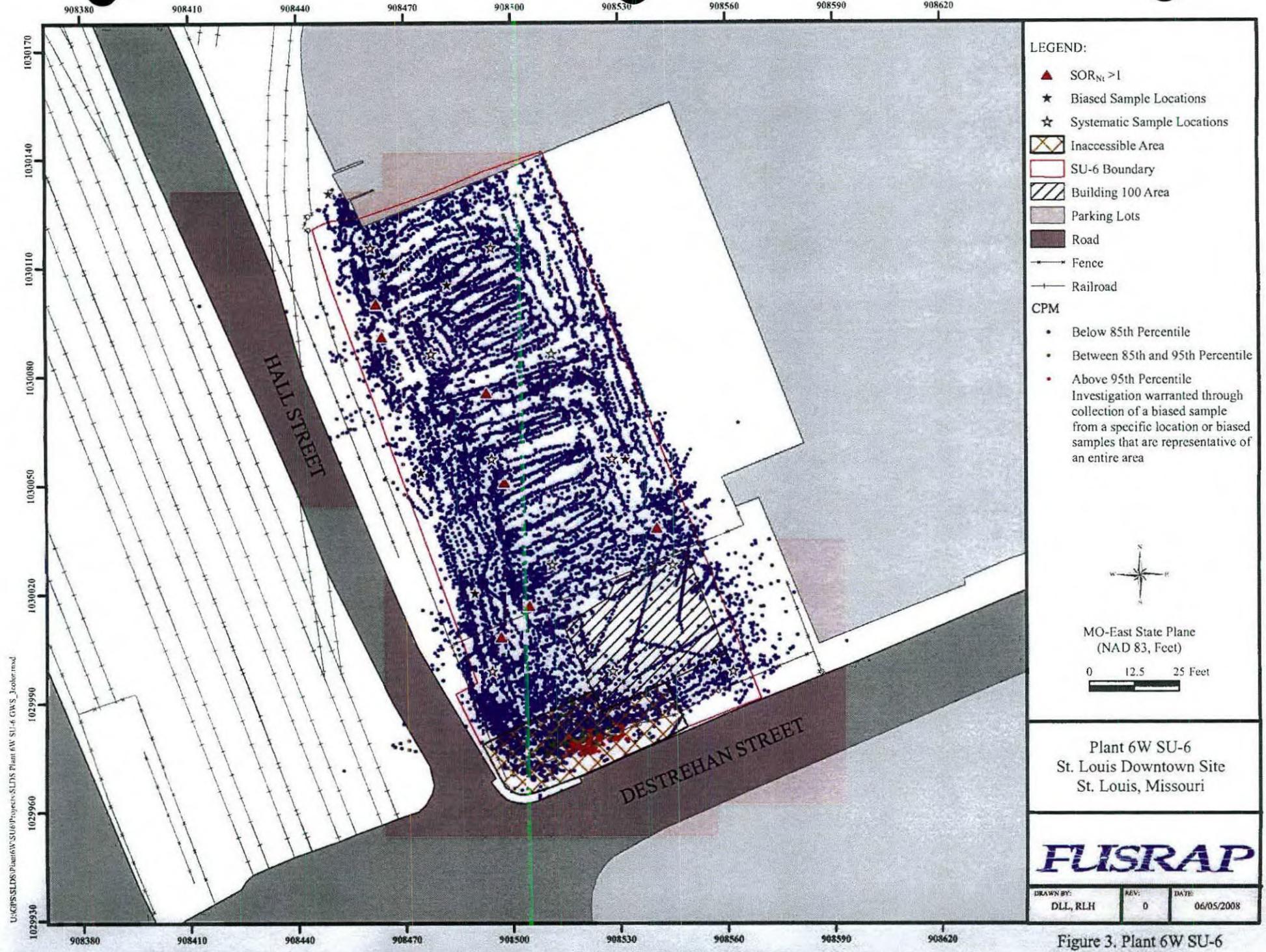


Figure 3, Plant 6W SU-6
Gamma Walkover Survey

SAIC - TOTAL SURFICIAL CONTAMINATION SURVEY DATASHEET [3]

Survey Number: Plant 6 WHT SU-6-04

Page 1 of 1

Legend: (Fill in blank) NA = Smear Location NA = G/A Dose Rate mR/hr μ R/hr

Show numbering of all survey surfaces on the map.

Manual Gamma Walkover Survey of Soil Under Overhead Building SLDS Plant 6W SU6

N

= Supporting Pillars

REMARKS: All numbers 1000x in cpm

TECHNICIAN(S) SIGNATURE/DATE:

15-29-08

/

REVIEWER SIGNATURE/DATE:

16-24-08

AR-111