



DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
8945 LATTY AVENUE
BERKELEY, MISSOURI 63134

REPLY TO
ATTENTION OF:

April 22, 2002

Formerly Utilized Sites Remedial Action Program

SUBJECT: Vicinity Property 24

Mr. Steven L. Goldenberg
Golden Management, Inc.
401 N. Lindbergh Blvd., Suite 330
St. Louis, MO 63141

Dear Mr. Goldenberg:

As discussed, please find enclosed the data depicting the current radiological status of your property located at 8893 Frost Avenue in Berkeley, Missouri with the U.S. Army Corps of Engineers (USACE) Draft Final Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) analyses. The attached data shows that soils remaining on your property are below the cleanup criteria specified in the Engineering Evaluation/Cost Analysis (EE/CA) for the Proposed Decontamination in the Vicinity of the Hazelwood Interim Storage Site (HISS), dated March 1992. The property at 8893 Frost Avenue, designated as VP-24c for the purposes of final status survey, meets the release criteria established in the EE/CA. A copy of the finalized final status survey report for this property will be forwarded to you at a later date. The additional analytical data required to support your developmental project will be provided in approximately one week.

A copy of this letter and data will be provided to Mr. Walter Shiffren of Shiffren & Associates, Mr. Eric Gilstrap of Missouri Department of Natural Resources (Federal Facilities Section) and Mr. Hugh Murell of Missouri Department of Natural Resources (Voluntary Cleanup Section). If you have any questions, please contact Ms. Jacqueline Mattingly at (314) 260-3924 immediately.

Sincerely,

Sharon R. Cotner
FUSRAP Program Manager

**St. Louis Airport Site
Vicinity Property-24
Survey Unit 1 – Class 1 Area
Preliminary MARSSIM Evaluation**

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Prepared by

4-22-02
Date

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4-22-02
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USACE Approved

22 Apr 02
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**St. Louis Airport Site
MARSSIM Evaluation
Vicinity Property-24 Survey Unit 1**

Introduction

The following is the preliminary MARSSIM evaluation of Vicinity Property-24, Survey Unit 1 at the St. Louis Airport Site location to determine whether the unit meets the established release criterion.

This evaluation is being conducted with unvalidated laboratory data in an effort to make a timely decision on backfilling the survey unit. Once all validated data has been received, a formal evaluation will be conducted and documented. Consideration should be given to using validated data only for those survey units at or near criterion.

To determine if Survey Unit 1 meets the established criterion, the following must occur:

1. Evaluate if enough samples were collected based on actual survey unit data after remediation.
2. Calculate Sum-of-Ratios (SOR) for each sample analyzed.
3. Evaluate areas of elevated activity against the elevated measurement criterion (EMC) established for the survey unit.
4. Calculate the area weighted average of the data for the unit to determine if below the DCGL_w (i.e., SOR = 1).
5. Perform the Wilcoxon Rank Sum (WRS) test for contaminants present in background.
6. Calculate the dose and residual risk of the survey unit including hotspots for comparison to the applicable guidelines.

VP-24, Survey Unit 1 is approximately 165 m² in size and has initially been classified as a Class 1 survey area in accordance with MARSSIM guidance. A total of 13 systematic samples were taken from this area. Samples were analyzed for area contaminants of concern – Ra-226, Ra-228, Th-230, Th-232, and U-238 – and other radionuclides in the natural uranium and thorium chains. Results of this data are summarized in Table 1.

Survey Unit 1 samples include those identified as SVP69714 – SVP69717, SVP69719 -- SVP69724, SVP69590, SVP69993, and SVP69994. Sample locations and corresponding identification numbers are shown in the attached figure.

The final walkover survey did not locate any areas of elevated radiological activity.

1. Determination of Statistical Data Point Requirements

The following calculations are being performed using the actual data collected from VP-24, Survey Unit 1 to determine if an adequate number of samples were collected to perform the Wilcoxon Rank Sum statistical test:

Δ/σ = Relative Shift

$\Delta = DCGL_w - LBGR$

From the initial survey design specifications, $DCGL_w = 1.0$ and the $LBGR = 0.5$.

$$\sigma_{\text{overall}} = [(\sigma_{Ra-226}/DCGL_{Ra-226})^2 + (\sigma_{Th-230}/DCGL_{Th-230})^2 + (\sigma_{U-238}/DCGL_{U-238})^2]^{1/2}$$

The values used for σ_i were calculated from the population of 13 systematic samples collected from Survey Unit 1. These values are as follows (in pCi/g):

$$\sigma_{Ra-226} = 0.15 \quad \sigma_{Th-230} = 3.39 \quad \sigma_{U-238} = 0.31$$

This results in calculated $\sigma_{\text{overall}} = 0.23$. The new relative shift calculated using actual VP-24 data after remediation is 2.2.

From Table 5-3 in the MARSSIM, the required number of samples for the WRS test using a relative shift of 2.2 and Type I error set at 0.05 and a Type II error set at 0.2 is 8. The actual number of systematic samples collected from Survey Unit 1 was 13, therefore an adequate number of samples were obtained for the WRS test.

2. SOR Calculations

The equations used to calculate the sample SOR for the subsurface samples is as follows:

$$SOR_G = (\text{higher of Th-230}_G \text{ or Ra-226}_G)/15 \text{ pCi/g} + (\text{higher of Th-232}_G \text{ or Ra-228}_G)/15 \text{ pCi/g} + (U-238)_G/50 \text{ pCi/g}$$

$$SOR_N = (\text{higher of Th-230}_N \text{ or Ra-226}_N)/15 \text{ pCi/g} + (\text{higher of Th-232}_N \text{ or Ra-228}_N)/15 \text{ pCi/g} + (U-238)_N/50 \text{ pCi/g}$$

Average background values for calculating net radionuclide concentrations were developed from 37 subsurface soil samples collected in the North County reference area.

Average values for this population are as follows: Th-230 = 1.83 pCi/g, Ra-226 = 1.15 pCi/g, Th-232 = 1.15 pCi/g, Ra-228 = 1.04 pCi/g, and U-238 = 1.27 pCi/g. A summary of the reference area data is presented in Table 2.

The resulting SOR calculations (i.e., SOR_G and SOR_N) for each discrete sample are provided in Table 3. The average SOR_N for VP-24 Class 1, Survey Unit 1 is 0.11.

3. Elevated Measurement Criteria Evaluation

All samples with an $SOR > 1.0$ after subtracting background (i.e., SOR_N) will be evaluated against the following elevated measurements criteria (EMC):

1. Have a $SOR < 6.0$ for an area of $< 10 \text{ m}^2$.
2. Have a $SOR < 4.0$ for an area of $> 10 \text{ m}^2$.

There were no samples in this survey unit with an $SOR > 1.0$ after subtracting background.

4. Compliance with 40 CFR 192 ARAR 100 m^2 Area Averaging

40 CFR 192.12 requires that the residual radioactive material concentration of Ra-226 in land averaged over any 100 m^2 shall not exceed the background level by greater than 5 pCi/g averaged over the first 15 cm of soil and 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.

To show compliance with this provision, any sample in the survey unit exceeding an $SOR_N > 1.0$ will be averaged with other samples within the 100 m^2 area surrounding the elevated sample. If no samples fall within this area, additional samples will be collected for the sole purpose of determining the average concentration in the 100 m^2 surrounding the elevated sample.

There were no samples in this survey unit with an $SOR > 1.0$ after subtracting background.

5. Wilcoxon Rank Sum (WRS) Test

To evaluate a survey unit using the WRS test, a similar number of samples from a background reference area are required. As previously stated, 37 subsurface soil reference area data points are available for North County properties.

The appropriate critical value for a survey unit with 37 reference area samples and 13 survey unit samples is calculated as follows:

$$\text{Critical value} = [m(n+m+1)/2] + z[nm(n+m+1)/12]^{1/2}$$

Where:

- m = number of reference area samples
- n = number of survey unit samples
- z = 1.645 for $\alpha = 0.05$

Critical Value for VP-24, Survey Unit 1:

$$\text{Critical value} = [37(13+37+1)/2] + 1.645[13(37)(13+37+1)/12]^{1/2}$$

$$\text{Critical value} = 1017$$

Table 4 provides the results of the WRS Test for VP-24, Survey Unit 1. The Reference Area Ranks (W_r) value calculated is 1184. Since this value exceeds the critical value calculated above, the hypothesis (H_0) that VP-24, Survey Unit 1 exceeds the release criterion can be rejected.

6. Residual Dose

The residual dose from the survey unit including hotspots was calculated for the potential maximum exposed individual. The residual dose resulting from VP-24 Survey Unit 1 at Year 0 and Year 1000 was calculated using the 95% UCL from the population of all samples collected as shown on Table 1b. UCL values for a normal and log-normal distribution were calculated. The UCL value was highest, in most cases, for a log-normal distribution and therefore was used as a conservative approach. The results of these calculations are in Table 5. The calculations result in a maximum dose for the survey unit of 1.3 mrem/yr at Year 1000.

Conclusions

Vicinity Property 24, Class 1 Survey Unit 1 meets the release criteria and may be backfilled.

Table 1a - Vicinity Property 24 Excavation, Class 1, Survey Unit 1 Systematic Sample Data (Data in pCi/g)

Sample	Area (m ²)	Th-230	Ln trans	Ra-226	Ln trans	Th-232	Ln trans	Ra-228	Ln trans	U-238	Ln trans	Ac-227	Ln trans	Pa-231	Ln trans	Subsurface SOR _d	
SVP69590	2.6	1.88	0.62	1.15	0.14	1.02	0.02	1.02	0.02	1.45	0.37	0.20	-1.60	-0.05		0.23	
SVP69714	2.6	14.17	2.65	1.37	0.31	1.19	0.17	0.68	-0.13	1.63	0.49	0.26	-1.34	-0.07		1.07	
SVP69715	2.6	2.25	0.81	1.29	0.25	0.68	-0.36	0.93	-0.08	1.30	0.26	0.17	-1.79	0.66	-0.41	0.26	
SVP69716	2.6	3.99	1.38	1.38	0.31	1.45	0.37	0.91	-0.10	1.50	0.41	0.20	-1.59	-0.18	0.39		
SVP69717	2.6	2.20	0.79	1.44	0.37	0.73	-0.31	0.94	-0.08	1.85	0.81	0.08	-2.51	0.54	-0.81	0.28	
SVP69994	2.6	1.73	0.55	1.07	0.07	0.96	-0.02	0.91	-0.10	0.87	-0.14	0.48	-0.73	0.91	-0.10	0.20	
SVP69719	2.8	3.14	1.14	1.41	0.35	0.97	-0.03	1.01	0.01	1.00	0.00	0.17	-1.79	-0.08		0.32	
SVP69720	2.6	1.32	0.28	1.36	0.30	1.88	0.63	0.96	-0.05	1.47	0.38	0.26	-1.38	0.07	-2.82	0.21	
SVP69721	2.6	2.09	0.74	1.39	0.33	0.84	-0.16	0.95	-0.05	1.01	0.01	0.31	-1.16	0.45	-0.81	0.25	
SVP69722	2.6	1.38	0.31	1.26	0.23	0.76	-0.28	0.97	-0.03	1.49	0.40	0.27	-1.32	0.56	-0.58	0.20	
SVP69723	2.6	1.76	0.58	1.44	0.37	1.38	-0.32	0.99	-0.02	0.93	-0.07	0.10	-2.34	-0.08		0.23	
SVP69724	2.8	2.49	0.91	1.25	0.22	0.57	-0.58	0.93	-0.07	1.04	0.04	0.30	-1.20	0.13	-2.06	0.27	
SVP69993	2.6	3.28	1.18	0.95	-0.05	1.65	0.50	0.93	-0.07	1.50	0.40	0.53	-0.84	0.84	-0.17	0.31	
Mean	x	3.20	0.82	1.29	0.25	1.08	0.02	0.95	-0.05	1.31	0.24	0.26	-1.49	0.29	-0.92	0.33	Mean
Median		2.20	0.79	1.36	0.30	0.98	-0.02	0.94	-0.08	1.45	0.37	0.28	-1.38	0.13	-0.80	0.26	Median
Standard Deviation	s	3.39	0.81	0.15	0.13	0.40	0.38	0.04	0.04	0.31	0.24	0.13	0.54	0.39	0.92	0.23	Standard Deviation
Number of samples	n	13	13	13	13	13	13	13	13	13	13	13	13	13	8	13	Number of samples

Table 1b - VP-24 Excavation, Class 1, Survey Unit 1 - All Data (gross radionuclide concentrations in pCi/g)

<u>Sample</u>	<u>Area (m²)</u>	<u>Th-230</u>	<u>Ln trans</u>	<u>Ra-226</u>	<u>Ln trans</u>	<u>Th-232</u>	<u>Ln trans</u>	<u>Ra-228</u>	<u>Ln trans</u>	<u>U-238</u>	<u>Ln trans</u>	<u>Ac-227</u>	<u>Ln trans</u>	<u>Pa-231</u>	<u>Ln trans</u>	<u>SOR_{Geohazards}</u>
SVP69590	12.6	1.86	0.62	1.15	0.14	1.02	0.02	1.02	0.02	1.45	0.37	0.20	-1.60	-0.05	-0.05	0.23
SVP69714	12.6	14.17	2.65	1.37	0.31	1.19	0.17	0.88	-0.13	1.63	0.49	0.26	-1.34	-0.07	-0.07	1.07
SVP69715	12.6	2.25	0.81	1.29	0.25	0.68	-0.38	0.93	-0.08	1.30	0.26	0.17	-1.79	0.66	-0.41	0.26
SVP69716	12.6	3.99	1.38	1.36	0.31	1.45	0.37	0.91	-0.10	1.50	0.41	0.20	-1.59	-0.18	-0.41	0.39
SVP69717	12.6	2.20	0.79	1.44	0.37	0.73	-0.31	0.94	-0.06	1.85	0.61	0.08	-2.51	0.54	-0.61	0.28
SVP69994	12.6	1.73	0.55	1.07	0.07	0.98	-0.02	0.91	-0.10	0.87	-0.14	0.48	-0.73	0.91	-0.10	0.20
SVP69719	12.6	3.14	1.14	1.41	0.35	0.97	-0.03	1.01	0.01	1.00	0.00	0.17	-1.79	-0.08	-0.08	0.32
SVP69720	12.6	1.32	0.28	1.36	0.30	1.88	0.63	0.96	-0.05	1.47	0.38	0.26	-1.36	0.07	-2.62	0.21
SVP69721	12.6	2.09	0.74	1.39	0.33	0.84	-0.18	0.95	-0.05	1.01	0.01	0.31	-1.16	0.45	-0.81	0.25
SVP89722	12.6	1.36	0.31	1.26	0.23	0.76	-0.28	0.97	-0.03	1.49	0.40	0.27	-1.32	0.56	-0.58	0.20
SVP69723	12.6	1.76	0.56	1.44	0.37	1.38	0.32	0.99	-0.02	0.93	-0.07	0.10	-2.34	-0.06	-0.06	0.23
SVP69724	12.6	2.49	0.91	1.25	0.22	0.57	-0.56	0.93	-0.07	1.04	0.04	0.30	-1.20	0.13	-2.06	0.27
SVP69993	12.6	3.26	1.18	0.95	-0.05	1.65	0.50	0.93	-0.07	1.50	0.40	0.53	-0.64	0.84	-0.17	0.31
Mean	x	3.20	0.92	1.29	0.25	1.08	0.02	0.95	-0.05	1.31	0.24	0.26	-1.49	0.29	-0.92	0.33
Median		2.20	0.79	1.36	0.30	0.98	-0.02	0.94	-0.06	1.45	0.37	0.26	-1.36	0.13	-0.60	0.26
Standard Deviation	s	3.39	0.61	0.15	0.13	0.40	0.36	0.04	0.04	0.31	0.24	0.13	0.54	0.39	0.92	0.23
Number of samples	n	13	13	13	13	13	13	13	13	13	13	13	13	13	8	13
Student t _(n-1) test		1.771		1.782		1.782		1.782		1.782		1.782		1.782		Student t _(n-1) test
Student H _(n,s) test		2.414		1.843		2.028		1.775		1.927		2.271		3.420		Student H _(n,s) test
UCL (normal)		4.86		1.38		1.28		0.87		1.46		0.32		0.48		UCL (normal)
UCL (log)		4.64		1.38		1.35		0.97		1.50		0.37		2.00		UCL (log)

Table 2 -- MARSSIM Background Data Summary for North County Subsurface Soils

Statistic	Th-230 (pCi/g)	Ra-226 (pCi/g)	Th-232 (pCi/g)	Ra-228 (pCi/g)	U-238 (pCi/g)	Ac-227 (pCi/g)	Pa-231 (pCi/g)	SORG (15/15/50)
Mean	1.83	1.15	1.15	1.04	1.27	0.21	0.15	0.23
Median	1.73	1.29	1.15	1.09	1.28	0.16	0.18	0.23
St. Dev	0.57	0.31	0.35	0.14	0.34	0.24	0.35	0.05
Range	1.91	0.99	1.43	0.52	1.36	0.98	1.58	0.19
No. Samples	37	37	37	37	37	37	37	37
SLA04171	1.77	0.77	1.52	0.89	0.71	0.66	0.29	0.23
SLA04175	1.55	0.60	0.80	0.90	0.75	0.09	0.18	0.18
SLA04190	2.34	0.85	0.53	0.84	0.81	0.57	0.21	0.23
SLA04301	1.29	1.25	0.99	1.09	2.04	-0.11	0.71	0.20
SLA04303	1.81	1.39	1.28	1.18	1.40	0.32	-0.05	0.23
SLA04305	2.07	1.51	1.32	1.15	1.10	-0.01	0.34	0.25
SLA04307	1.75	1.45	1.47	1.04	1.66	0.05	0.75	0.25
SLA04309	1.59	1.29	1.02	1.10	1.86	0.05	0.27	0.22
SLA04311	1.23	1.55	0.81	1.24	1.37	-0.03	0.38	0.21
SLA04313	1.60	1.40	1.25	1.10	1.12	0.24	-0.43	0.21
SLA04315	2.00	1.50	1.50	1.09	0.97	0.62	0.31	0.25
SLA04317	2.70	1.40	1.51	1.14	1.08	0.00	0.39	0.30
SLA04319	2.32	1.42	1.86	1.21	1.47	0.14	0.19	0.31
SLA04321	1.45	1.32	1.67	1.11	1.58	0.00	-0.45	0.24
SLA04323	2.73	1.31	0.64	1.17	1.04	0.14	-0.16	0.28
SLA04325	1.27	1.38	1.18	1.19	1.72	0.17	0.46	0.21
SLA04327	1.42	1.33	1.22	1.13	1.32	0.23	-0.11	0.20
SLA04329	2.18	1.22	1.42	1.03	1.26	0.35	-0.24	0.27
SLA04331	1.33	1.29	1.45	1.20	1.25	0.03	0.25	0.21
SLA04333	1.49	1.44	1.15	1.12	1.29	0.01	0.51	0.20
SLA04335	1.50	1.44	0.74	1.16	1.28	-0.16	-0.40	0.20
SLA04337	1.89	1.12	0.90	1.12	1.75	0.20	-0.19	0.24
SLA04339	1.73	1.21	1.64	1.09	1.05	0.25	0.23	0.25
SLA04341	2.24	1.30	1.02	1.06	1.66	0.09	-0.21	0.25
SLA04343	1.48	1.29	0.84	1.09	1.50	0.10	0.06	0.20
SLA04345	2.65	1.30	1.96	1.08	1.72	0.27	0.16	0.34
SLA04347	2.77	1.30	1.37	1.21	1.28	0.19	0.12	0.30
SLA04349	1.86	1.17	1.19	0.98	1.01	0.07	0.49	0.22
SLA04172	1.43	0.89	1.28	1.02	1.32	0.74	1.13	0.21
SLA04176	0.98	0.60	1.06	0.80	0.89	0.16	0.10	0.15
SLA04191	2.69	0.90	0.77	0.92	0.94	0.82	-0.21	0.26
SLA04173	1.28	0.80	0.76	0.87	0.89	0.46	0.53	0.16
SLA04177	1.21	0.64	0.96	0.84	1.35	0.18	0.28	0.17
SLA04192	2.89	0.91	0.66	1.08	0.68	0.36	0.12	0.28
SLA04174	1.24	0.56	0.93	0.72	1.01	0.15	-0.02	0.16
SLA04178	1.09	0.61	0.86	0.74	1.26	0.01	-0.39	0.16
SLA04193	2.87	0.74	1.15	0.92	1.72	0.51	-0.03	0.30

Table 3 - VP-24 Excavation, Class 1, Survey Unit 1 SOR Values (Data in pCi/g)

Sample	Th-230_G	Th-230_{Nsubsurface}	Ra-226_G	Ra-226_{Nsubsurface}	U-238_G	U-238_{Nsubsurface}	Subsurface SOR_G	Subsurface SOR_N		
SVP69590	1.86	0.03	1.15	0.00	1.45	0.18	0.23	0.01		
SVP69714	14.17	12.34	1.37	0.22	1.63	0.36	1.07	0.84		
SVP69715	2.25	0.42	1.29	0.14	1.30	0.03	0.26	0.04		
SVP69716	3.99	2.16	1.36	0.21	1.50	0.23	0.39	0.16		
SVP69717	2.20	0.37	1.44	0.29	1.85	0.58	0.28	0.06		
SVP69994	1.73	0.00	1.07	0.00	0.87	0.00	0.20	0.00		
SVP69719	3.14	1.31	1.41	0.26	1.00	0.00	0.32	0.10		
SVP69720	1.32	0.00	1.36	0.21	1.47	0.20	0.21	0.02		
SVP69721	2.09	0.26	1.39	0.24	1.01	0.00	0.25	0.03		
SVP69722	1.36	0.00	1.26	0.11	1.49	0.22	0.20	0.01		
SVP69723	1.76	0.00	1.44	0.29	0.93	0.00	0.23	0.02		
SVP69724	2.49	0.66	1.25	0.10	1.04	0.00	0.27	0.05		
SVP69993	3.26	1.43	0.95	0.00	1.50	0.23	0.31	0.10		
Mean	3.20	1.46	1.29	0.16	1.31	0.15	#	0.33	0.11	Mean
Median	2.20	0.37	1.36	0.21	1.45	0.18	#	0.26	0.04	Median
StDev	3.39	3.34	0.15	0.11	0.31	0.18	#	0.23	0.23	StDev
Sample #	13	13	13	13	13	13	0	13	13	Sample #

Table 4 - VP-24 Excavation, Class 1, Survey Unit 1 WRS Test

Sample	<u>SORgross</u>	Area	Adjusted Data	Ranks	Reference Area Ranks (Wr)
SLA04171	0.23	R	1.23	33	33
SLA04172	0.21	R	1.21	26	26
SLA04173	0.16	R	1.16	16	16
SLA04174	0.16	R	1.16	17	17
SLA04175	0.18	R	1.18	19	19
SLA04176	0.15	R	1.15	14	14
SLA04177	0.17	R	1.17	18	18
SLA04178	0.16	R	1.16	15	15
SLA04190	0.23	R	1.23	32	32
SLA04191	0.26	R	1.26	42	42
SLA04192	0.28	R	1.28	44	44
SLA04193	0.30	R	1.30	48	48
SLA04301	0.20	R	1.20	20	20
SLA04303	0.23	R	1.23	34	34
SLA04305	0.25	R	1.25	39	39
SLA04307	0.25	R	1.25	38	38
SLA04309	0.22	R	1.22	30	30
SLA04311	0.21	R	1.21	29	29
SLA04313	0.21	R	1.21	28	28
SLA04315	0.25	R	1.25	40	40
SLA04317	0.30	R	1.30	47	47
SLA04319	0.31	R	1.31	49	49
SLA04321	0.24	R	1.24	36	36
SLA04323	0.28	R	1.28	45	45
SLA04325	0.21	R	1.21	25	25
SLA04327	0.20	R	1.20	23	23
SLA04329	0.27	R	1.27	43	43
SLA04331	0.21	R	1.21	27	27
SLA04333	0.20	R	1.20	22	22
SLA04335	0.20	R	1.20	24	24
SLA04337	0.24	R	1.24	35	35
SLA04339	0.25	R	1.25	37	37
SLA04341	0.25	R	1.25	41	41
SLA04343	0.20	R	1.20	21	21
SLA04345	0.34	R	1.34	50	50
SLA04347	0.30	R	1.30	46	46
SLA04349	0.22	R	1.22	31	31
SVP69590	0.23	S	0.23	4	
SVP69714	1.07	S	1.07	13	
SVP69715	0.26	S	0.26	7	
SVP69716	0.39	S	0.39	12	
SVP69717	0.28	S	0.28	9	
SVP69994	0.20	S	0.20	1	
SVP69719	0.32	S	0.32	11	
SVP69720	0.21	S	0.21	3	
SVP69721	0.25	S	0.25	6	
SVP69722	0.20	S	0.20	2	
SVP69723	0.23	S	0.23	5	
SVP69724	0.27	S	0.27	8	
SVP69993	0.31	S	0.31	10	

Sum = 1265 1184

Number of Reference= 37
Number of Systematics= 13

WRS Critical Value= 1017.876

Table 5 - Vicinity Property 24 Excavation Class 1 Dose Assessment

INDUSTRIAL WORKER 10,000 (m ²)						INDUSTRIAL WORKER 300 (m ²)						
Year 0.0 Dose and Risk Estimates for 10,000 m ² Surface Area						Year 0.0 Dose and Risk Estimates for Variable Surface Area						
Analyte	UCL ₉₅ (pCi/g) ^a	Background ^b	RME (pCi/g) ^c	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)	Analyte	UCL ₉₅ (pCi/g) ^a	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.37	0.21	0.16	0.1	4.3E-07	Ac-227	0.37	0.21	0.16	300	0.1	3.9E-07
Pa-231	2.00	0.15	1.85	0.2	2.5E-06	Pa-231	2.00	0.15	1.85	300	0.1	2.2E-06
Pb-210	1.38	1.15	0.23	0.0	1.7E-08	Pb-210	1.38	1.15	0.23	300	0.0	5.1E-09
Ra-226	1.38	1.15	0.23	0.5	6.6E-06	Ra-226	1.38	1.15	0.23	300	0.4	6.0E-06
Ra-228	1.04	1.04	0.00	0.0	0.0E+00	Ra-228	1.04	1.04	0.00	300	0.0	0.0E+00
Th-228	1.04	1.04	0.00	0.0	0.0E+00	Th-228	1.04	1.04	0.00	300	0.0	0.0E+00
Th-230	4.64	1.83	2.81	0.0	4.7E-07	Th-230	4.64	1.83	2.81	300	0.0	4.1E-07
Th-232	1.35	1.15	0.20	0.0	5.3E-06	Th-232	1.35	1.15	0.20	300	0.0	4.8E-06
U-234	1.52	1.29	0.23	0.0	1.7E-09	U-234	1.52	1.29	0.23	300	0.0	8.0E-10
U-235	0.07	0.06	0.01	0.0	1.2E-08	U-235	0.07	0.06	0.01	300	0.0	1.1E-08
U-238	1.50	1.27	0.23	0.0	6.7E-08	U-238	1.50	1.27	0.23	300	0.0	6.0E-08
			Total =	0.739	1.538E-05				Total =	0.598	1.392E-05	
Year 0 Dose and Risk Estimates for 10,000 m ² Surface Area						Year 1,000 Dose and Risk Estimates for Variable Surface Area						
Analyte	UCL ₉₅ (pCi/g) ^a	Background ^b	RME (pCi/g) ^c	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)	Analyte	UCL ₉₅ (pCi/g) ^a	Background ^b	RME (pCi/g) ^c	Area (m ²)	Dose ^d (mrem/yr)	Risk ^d (lifetime ⁻¹)
Ac-227	0.37	0.21	0.16	0.0	1.7E-24	Ac-227	0.37	0.21	0.16	300	0.0	1.5E-24
Pa-231	2.00	0.15	1.85	0.0	2.4E-07	Pa-231	2.00	0.15	1.85	300	0.0	2.2E-07
Pb-210	1.38	1.15	0.23	0.0	1.0E-22	Pb-210	1.38	1.15	0.23	300	0.0	3.1E-23
Ra-226	1.38	1.15	0.23	0.0	4.0E-07	Ra-226	1.38	1.15	0.23	300	0.0	3.6E-07
Ra-228	1.04	1.04	0.00	0.0	0.0E+00	Ra-228	1.04	1.04	0.00	300	0.0	0.0E+00
Th-228	1.04	1.04	0.00	0.0	0.0E+00	Th-228	1.04	1.04	0.00	300	0.0	0.0E+00
Th-230	4.64	1.83	2.81	0.8	1.2E-05	Th-230	4.64	1.83	2.81	300	0.7	1.1E-05
Th-232	1.35	1.15	0.20	0.6	8.3E-06	Th-232	1.35	1.15	0.20	300	0.5	7.5E-06
U-234	1.52	1.29	0.23	0.0	2.4E-09	U-234	1.52	1.29	0.23	300	0.0	2.1E-09
U-235	0.07	0.06	0.01	0.0	4.5E-10	U-235	0.07	0.06	0.01	300	0.0	4.2E-10
U-238	1.50	1.27	0.23	0.0	2.4E-09	U-238	1.50	1.27	0.23	300	0.0	2.2E-09
			Total =	1.468	2.108E-05				Total =	1.312	1.909E-05	

^a Estimates of concentrations using site database to calculate UCL₉₅ or maximum values

^b 1998 MARSSIM Reference Area Sampling

^c UCL₉₅ - background

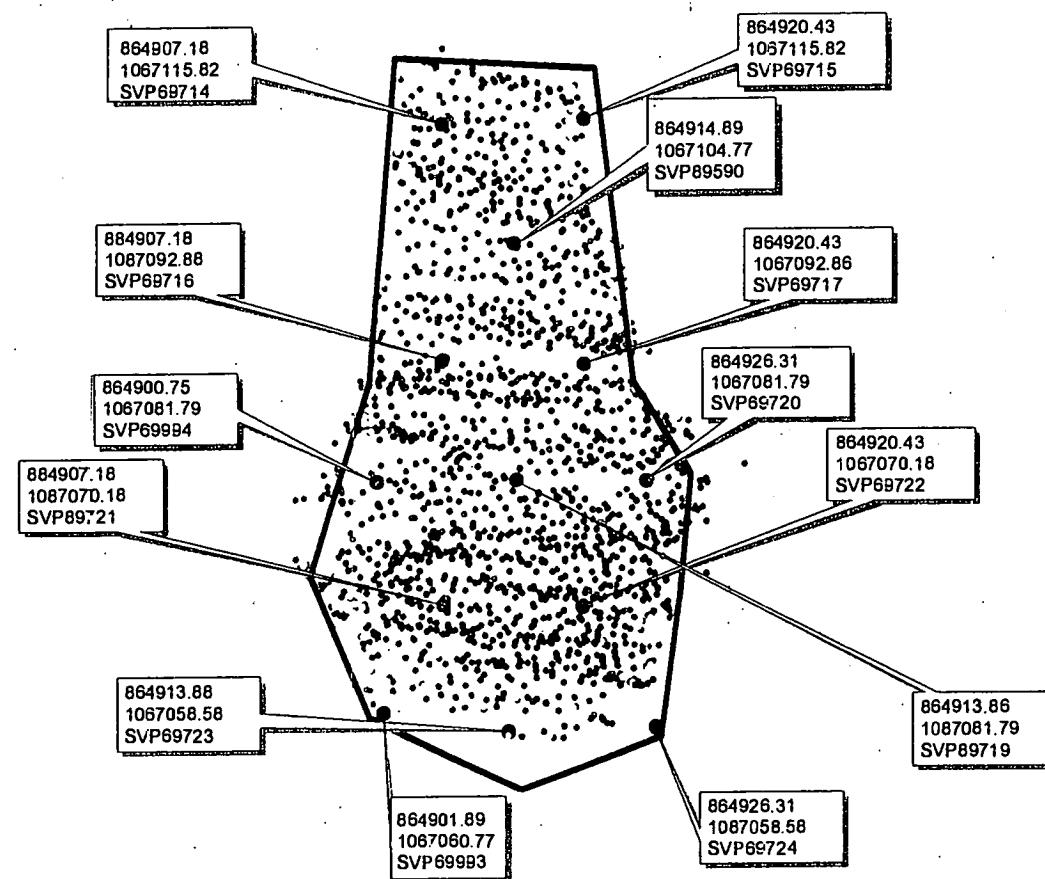
^d RME times dose-to-source or risk-to-source ratio

^a Estimates of concentrations using site database to calculate UCL₉₅ or maximum values

^b 1998 MARSSIM Reference Area Sampling

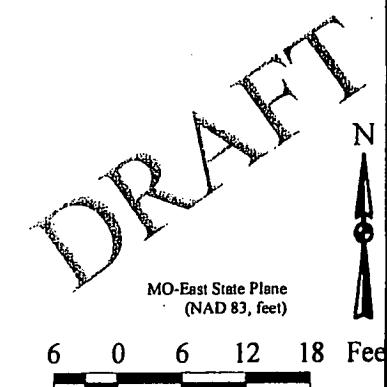
^c UCL₉₅ - background

^d RME times dose-to-source or risk-to-source ratio



Legend:

- CPM
- 0 - 9000
 - 9000 - 11000
 - 11000 - 13000
 - 13000 - 71000
 - Class I Sample Location
 - Property Boundaries/ROWs



Vp-24 Class 1 Sample Locations
North County
St. Louis, Missouri

FUSRAP

DRAWN BY: Eric Danielson REV'D: DATE: 4/22/02

Figure 1 Class 1 Sample Locations

FUSRAP Document Management System

Year ID

Further Info?

Operating Unit

Site

Area

MARKS Number

Primary Document Type

Secondary Document Type

Subject or Title

Transmittal of Radiological Data Package Showing that Soils Remaining on VP-24c are Below the Cleanup Criteria Specified in the EE/CA for Decontamination of Properties in the Vicinity of HISS

Author/Originator

Company

Date

Recipient(s)

Company (-ies)

Version

Original's Location

Document Format

Confidential File?

Comments

Include in which AR(s)?

SAIC number

- North County
- Madison
- Downtown
- Iowa

Bechtel ID

ETL

Filed in Volume

