

Hematite Decommissioning Project	Procedure: HDP-PR-FSS-701, Final Status Survey Plan Development		
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**APPENDIX P-4**

**FSS SAMPLE & MEASUREMENT LOCATIONS & COORDINATES**

<b>Survey Area:</b>	LSA 08	<b>Description:</b>	Technetium SEA Open Land Area
<b>Survey Unit:</b>	14	<b>Description:</b>	Central Open Land Area
<b>Survey Type:</b>	FSS	<b>Classification:</b>	Class 1

Measurement or Sample ID	Surface or CSM	Type	Start Elevation*	End Elevation*	Northing** (Y Axis)	Easting** (X Axis)	Remarks / Notes
L08-14-01-T-R-S-00	Uniform	S	433.3	430.1	864951.4	827527.0	Root 3.5-ft composite
L08-14-02-T-E-S-00	Uniform	S	430.1	429.6	864951.4	827527.0	Excavation 6-inch grab
L08-14-03-T-R-S-00	Uniform	S	431.7	431.4	864915.3	827506.2	Root 0.3-ft composite
L08-14-04-T-E-S-00	Uniform	S	431.4	430.9	864915.3	827506.2	Excavation 6-inch grab
L08-14-05-T-R-S-00	Uniform	S	431.2	430.4	864915.3	827547.8	Root 0.8-ft composite
L08-14-06-T-E-S-00	Uniform	S	430.4	429.9	864915.3	827547.8	Excavation 6-inch grab
L08-14-07-T-E-S-00	Uniform	S	430.5	430.0	864879.2	827485.3	Excavation 6-inch grab
L08-14-08-T-E-S-00	Uniform	S	431.5	431.0	864879.2	827527.0	Excavation 6-inch grab
L08-14-09-T-R-S-00	Uniform	S	431.1	430.5	864879.2	827568.7	Root 0.6-ft composite
L08-14-10-T-E-S-00	Uniform	S	430.5	430.1	864879.2	827568.7	Excavation 6-inch grab
L08-14-11-T-E-S-00	Uniform	S	427.5	427.0	864879.2	827610.3	Excavation 6-inch grab
L08-14-12-T-E-S-00	Uniform	S	431.2	430.7	864843.1	827506.2	Excavation 6-inch grab
L08-14-13-T-E-S-00	Uniform	S	430.8	430.3	864843.1	827547.8	Excavation 6-inch grab
L08-14-14-T-R-S-00	Uniform	S	433.0	430.7	864843.1	827589.5	Root 2.3-ft composite
L08-14-15-T-E-S-00	Uniform	S	430.7	430.2	864843.1	827589.5	Excavation 6-inch grab
L08-14-16-T-R-S-00	Uniform	S	435.3	430.6	864807.0	827568.7	Root 4.4-ft composite
L08-14-17-T-E-S-00	Uniform	S	430.6	430.1	864807.0	827568.7	Excavation 6-inch grab
L08-14-09-T-R-Q-00	Uniform	Q	431.1	430.5	864879.2	827568.7	Root 0.6-ft composite
L08-14-18-T-E-B-00	Uniform	B	431.0	430.5	864896.4	827582.1	Biased 6-inch Sample
L08-14-19-T-R-B-00	Uniform	B	432.1	431.6	864867.0	827651.9	Biased 6-inch Sample
L08-14-20-T-R-B-00	Uniform	B	432.4	431.9	864941.4	827536.4	Sidewall Sample

Green shaded samples are the samples at each sample location, for use in WRS test.

\*Elevations are in feet above mean sea level.  
 \*\* Missouri - East State Plane Coordinates [North American Datum (NAD) 1983]  
 Surface: Floor = F; Wall = W; Ceiling = C; Roof = R  
 CSM: Three-Layer (Surface-Root-Excavation) or Uniform DCGLs used  
 Type: Systematic = S, Biased = B; QC = Q; Investigation = I



**HDP-PR-FSS-721 Final Status Survey Data Evaluation**  
**Step 8.5 Performance of Statistical Tests**

WRS TEST						
SAMPLE ID	AREA (Reference, Survey Unit)	Gross SOF ( $X_{i,ref}$ , $Y_{i,SU}$ ) Step 8.5.3a	ADJUSTED SOF ( $Z_i$ ) Step 8.5.3b	RANKS Step 8.5.3d	REFERENCE AREA RANKS	
9574-SS-140910-01-01	Reference	1.31	2.310	47	47	
9574-SS-140910-01-02	Reference	1.18	2.179	38	38	
9574-SS-140910-01-03	Reference	1.06	2.064	33	33	
9574-SS-140910-01-04	Reference	1.10	2.101	34	34	
9574-SS-140910-01-05	Reference	1.29	2.293	46	46	
9574-SS-140910-01-07	Reference	1.34	2.339	48	48	
9574-SS-140910-01-08	Reference	1.15	2.154	37	37	
9574-SS-140910-01-09	Reference	1.18	2.182	39	39	
9574-SS-140910-01-10	Reference	1.23	2.227	44	44	
9574-SS-140910-01-11	Reference	1.38	2.380	49	49	
9574-SS-140910-01-12	Reference	1.05	2.055	32	32	
9574-SS-140910-01-13	Reference	0.94	1.941	22	22	
9574-SS-140910-01-14	Reference	1.12	2.119	35	35	
9574-SS-140910-01-15	Reference	1.15	2.152	36	36	
9574-SS-140910-01-16	Reference	1.03	2.028	29	29	
9574-SS-140910-01-17	Reference	0.44	1.443	16	16	
9574-SS-140910-01-18	Reference	1.19	2.188	41	41	
9574-SS-140910-01-20	Reference	0.76	1.757	19	19	
9574-SS-140910-01-21	Reference	1.02	2.023	28	28	
9574-SS-140910-01-22	Reference	1.02	2.018	27	27	
9574-SS-140910-01-23	Reference	1.00	2.002	24	24	
9574-SS-140910-01-24	Reference	0.87	1.873	21	21	
9574-SS-140910-01-25	Reference	1.04	2.040	31	31	
9574-SS-140910-01-26	Reference	0.96	1.959	23	23	
9574-SS-140910-01-27	Reference	1.20	2.204	42	42	
9574-SS-140910-01-28	Reference	1.01	2.007	26	26	
9574-SS-140910-01-29	Reference	1.22	2.223	43	43	
9574-SS-140910-01-30	Reference	1.03	2.035	30	30	
9574-SS-140910-01-31	Reference	1.00	2.005	25	25	
9574-SS-140910-01-32	Reference	0.86	1.865	20	20	
9574-SS-140910-01-33	Reference	1.24	2.238	45	45	
9574-SS-140910-01-34	Reference	1.19	2.185	40	40	
L08-14-01-T-R-S-00	Survey Unit	1.17	1.167	5	0	
L08-14-02-T-E-S-00	Survey Unit	1.29	1.289	10	0	No WRS test necessary
L08-14-03-T-R-S-00	Survey Unit	1.63	1.633	18	0	No WRS test necessary
L08-14-04-T-E-S-00	Survey Unit	1.33	1.333	12	0	Perform WRS test
L08-14-05-T-R-S-00	Survey Unit	1.19	1.187	7	0	No WRS test necessary
L08-14-06-T-E-S-00	Survey Unit	1.45	1.452	17	0	No WRS test necessary
L08-14-07-T-E-S-00	Survey Unit	1.36	1.359	13	0	Perform WRS test
L08-14-08-T-E-S-00	Survey Unit	1.32	1.324	11	0	No WRS test necessary
L08-14-09-T-R-S-00	Survey Unit	1.42	1.422	15	0	No WRS test necessary
L08-14-10-T-E-S-00	Survey Unit	1.17	1.170	6	0	No WRS test necessary
L08-14-11-T-E-S-00	Survey Unit	1.20	1.205	8	0	No WRS test necessary
L08-14-12-T-E-S-00	Survey Unit	1.23	1.230	9	0	No WRS test necessary
L08-14-13-T-E-S-00	Survey Unit	1.38	1.383	14	0	No WRS test necessary
L08-14-14-T-R-S-00	Survey Unit	0.77	0.767	1	0	No WRS test necessary
L08-14-15-T-E-S-00	Survey Unit	1.15	1.154	3	0	No WRS test necessary
L08-14-16-T-R-S-00	Survey Unit	0.93	0.929	2	0	No WRS test necessary
L08-14-17-T-E-S-00	Survey Unit	1.16	1.157	4	0	No WRS test necessary
<b>Rank Sums</b>				1225	1070	
<b># Reference Area Measurements</b>				m	32	
<b># Survey Unit Measurements</b>				n	17	
<b>Total Number of Measurements Step 8.5.3c</b>				N	49	
<b>(1-<math>\alpha</math>) percentile of a standard normal distribution (MARSSIM Pg. I-10)</b>				z	1.645	
<b>WRS Critical Value (MARSSIM Pg. I-10, Eq. I.1)</b>				CV	879	

Step 8.5.1

Min adjusted bkg SOF  
1.44

No WRS test necessary  
No WRS test necessary  
Perform WRS test  
No WRS test necessary  
No WRS test necessary  
Perform WRS test  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary  
No WRS test necessary

W, Step 8.5.3e

$\alpha = 0.05$

TEST: **PASS** Step 8.5.3f

**HDP-PR-FSS-701 Final Status Survey Plan Development**  
**Appendix P-1 Step 8. Calculate the Number of Samples in the Statistical Population**

Uniform DCGL Criteria Evaluation	
N/2 Value Verification	
Isotope(s)	<b>SOF (Ra/Tc/Th/Iso U)</b>
St. Dev.	0.14
DCGL <sub>SOF</sub>	1
LBGR (Mean)	0.23
Shift	0.77
Relative Shift ( $\Delta/\sigma$ )	5.46
MARSSIM Table 5.1 ( $P_r$ )	1.000000
N	12
N + 20%	14.4
N/2	8
FSS N/2	11
Verification Check	<b>SUFFICIENT MEASUREMENTS</b>

"N/2" Corresponds to the number of survey unit measurement locations required for the WRS Test

**MARSSIM Table 5.1**

$\Delta/\sigma$	$P_r$
0.1	0.528182
0.2	0.556223
0.3	0.583985
0.4	0.611335
0.5	0.638143
0.6	0.664290
0.7	0.689665
0.8	0.714167
0.9	0.737710
1.0	0.760217
1.1	0.781627
1.2	0.801892
1.3	0.820978
1.4	0.838864
1.5	0.855541
1.6	0.871014
1.7	0.885299
1.8	0.898420
1.9	0.910413
2.0	0.921319
2.25	0.944167
2.5	0.961428
2.75	0.974067
3.0	0.983039
3.5	0.993329
4.0	0.997658
4.01	1.000000

**MARSSIM Table 5.2,  $\alpha = 0.05$ ,  $\beta = 0.10$**

$\alpha$ (or $\beta$ )	$Z_{1-\alpha}$ (or $Z_{1-\beta}$ )
0.005	2.576
0.01	2.326
0.015	2.241
0.025	1.960
0.05	1.645
0.10	1.282
0.15	1.036
0.2	0.842
0.25	0.674
0.30	0.524

$\alpha$   
 $\beta$

Hematite Decommissioning Project	Procedure: HDP-PR-FSS-703, Final Status Survey Quality Control										
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**FORM HDP-PR-FSS-703-1  
FIELD DUPLICATE SAMPLE ASSESSMENT**

Survey Unit No.:	LSA 08-14				Survey Unit Description:	Central Open Land Area							
Sample ID	Field Duplicate Sample ID	Radionuclide	Sample (pCi/g)		Field Duplicate Sample (pCi/g)		Average Activity ( $\bar{x}$ ) (pCi/g)	Nuclide DCGL (pCi/g)	Statistic <sup>2</sup>	Warning Limit	Control Limit	Statistic Exceeds Limit? (Y/N)	
			Activity ( $x_i$ )	MDC	Activity ( $x_i$ )	MDC							
L08-14-09-T-R-S-00	L08-14-09-T-R-Q-00	Ra-226	1.2	0.0791	1.24	0.0805	1.220	1.9	0.04	0.269	0.403	N	
L08-14-09-T-R-S-00	L08-14-09-T-R-Q-00	Tc-99	2.36	0.232	1.71	0.226	2.035	25.1	0.65	3.552	5.321	N	
L08-14-09-T-R-S-00	L08-14-09-T-R-Q-00	Th-232	1.34	0.119	1.3	0.161	1.320	2.0	0.040	0.283	0.424	N	
L08-14-09-T-R-S-00	L08-14-09-T-R-Q-00	U-234 <sup>1</sup>	3.477	N/A	2.027	N/A	2.752	195.4	1.450	27.649	41.425	N	
L08-14-09-T-R-S-00	L08-14-09-T-R-Q-00	U-235	0.192	0.154	0.107	0.268	0.150	51.6	NA	7.301	10.939	NA	
L08-14-09-T-R-S-00	L08-14-09-T-R-Q-00	U-238	0.748	0.794	1.17	0.945	0.959	168.8	NA	23.885	35.786	NA	

Comments:

- U-234 is inferred, no MDC available.
- Duplicate assessment is not necessary if the result of either sample is < MDC.

Performed by: Thomas Yardy \_\_\_\_\_

Reviewed by: Clark Evers \_\_\_\_\_

Date: \_\_\_\_\_

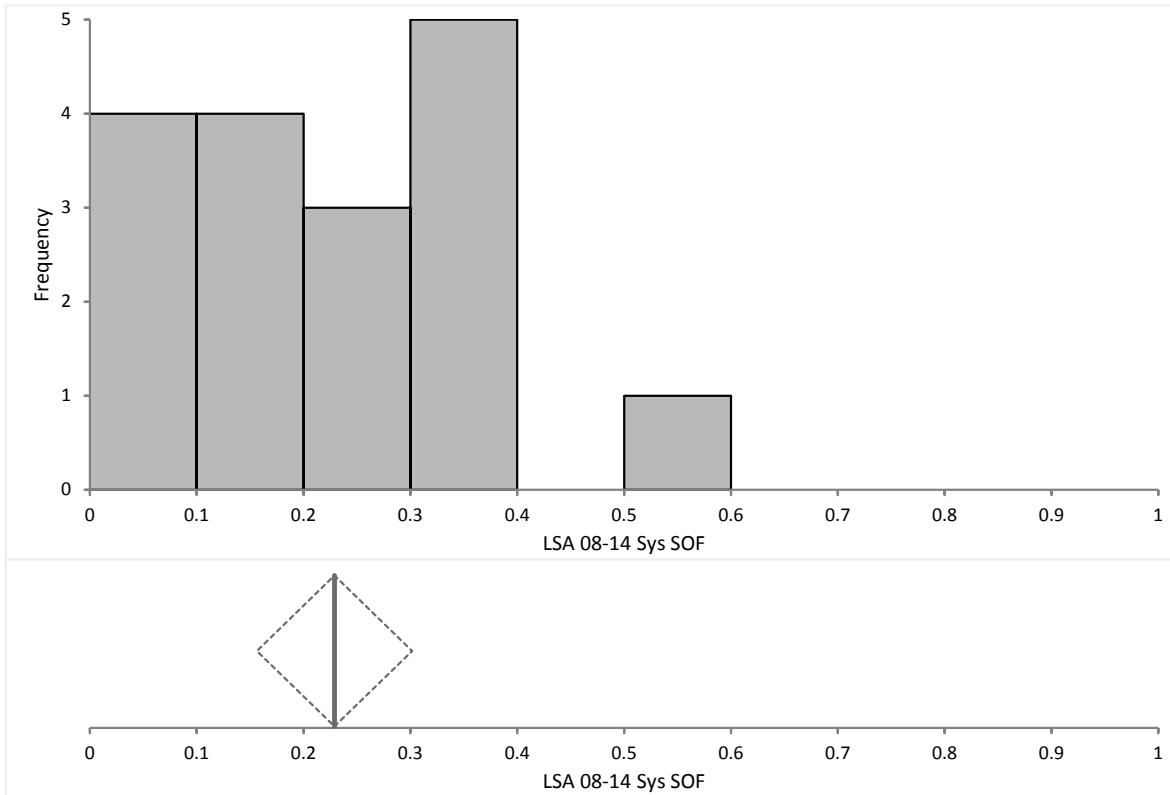
Date: \_\_\_\_\_

Quality Record

LSA 08-14 Sys SOF

0.2  
0.2  
0.6  
0.3  
0.2  
0.4  
0.3  
0.3  
0.4  
0.1  
0.1  
0.2  
0.3  
0.0  
0.1  
0.1  
0.1

Descriptives



N   17	
LSA 08-14 Sys SOF	Mean   0.23   95% CI   0.16 to 0.30   Mean SE   0.034   SD   0.14   Variance   0.02   Skewness   0.8   Kurtosis   0.38
LSA 08-14 Sys SOF	Minimum   0.04   1st quartile   0.11   Median   0.21   95.1% CI   0.11 to 0.32   3rd quartile   0.33   Maximum   0.6   IQR   0.22