

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

Survey Area:	LSA 12	Description:	Laydown Area, Plant Soils SEA
Survey Unit:	02	Description:	Class 2 Laydown Land Area in "Area 13"
Survey Type:	FSS	Classification:	Class 2

Measurement or Sample ID	Surface or CSM	Type	Start Elevation*	End Elevation*	Northing** (Y Axis)	Easting** (X Axis)	Remarks / Notes
L12-02-01-P-S-S-00	Uniform	S	431.7	431.2	865876	828158	Surface 6-inch grab
L12-02-02-P-R-S-00	Uniform	S	431.2	426.8	865876	828158	Root 59-inch composite
L12-02-04-P-S-S-00	Uniform	S	430.8	430.4	865815	828051	Surface 6-inch grab
L12-02-05-P-R-S-00	Uniform	S	430.4	425.9	865815	828051	Root 59-inch composite
L12-02-07-P-S-S-00	Uniform	S	431.7	431.2	865815	828122	Surface 6-inch grab
L12-02-08-P-R-S-00	Uniform	S	431.2	426.7	865815	828122	Root 59-inch composite
L12-02-10-P-S-S-00	Uniform	S	431.0	430.5	865815	828193	Surface 6-inch grab
L12-02-11-P-R-S-00	Uniform	S	430.5	426.1	865815	828193	Root 59-inch composite
L12-02-13-P-S-S-00	Uniform	S	430.7	430.2	865754	828016	Surface 6-inch grab
L12-02-14-P-R-S-00	Uniform	S	430.2	425.7	865754	828016	Root 59-inch composite
L12-02-16-P-S-S-00	Uniform	S	430.4	429.9	865754	828158	Surface 6-inch grab
L12-02-17-P-R-S-00	Uniform	S	429.9	425.5	865754	828158	Root 59-inch composite
L12-02-19-P-S-S-00	Uniform	S	430.6	430.1	865754	828229	Surface 6-inch grab
L12-02-20-P-R-S-00	Uniform	S	430.1	425.6	865754	828229	Root 59-inch composite
L12-02-22-P-S-S-00	Uniform	S	430.7	430.2	865692	828193	Surface 6-inch grab
L12-02-23-P-R-S-00	Uniform	S	430.2	425.8	865692	828193	Root 59-inch composite
L12-02-01-P-S-Q-00	Uniform	Q	431.7	431.2	865876	828158	Surface 6-inch grab
L12-02-11-P-R-Q-00	Uniform	Q	430.5	426.1	865815	828193	Surface 6-inch grab
L12-02-25-P-S-B-00	Uniform	B	430.7	430.2	865664.5	828226.7	Biased 6-inch grab

Green shaded samples are the topmost 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 = 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	38	38	
9574-SS-140910-01-02	Reference	1.18	2.179	29	29	
9574-SS-140910-01-03	Reference	1.06	2.064	24	24	
9574-SS-140910-01-04	Reference	1.10	2.101	25	25	
9574-SS-140910-01-05	Reference	1.29	2.293	37	37	
9574-SS-140910-01-07	Reference	1.34	2.339	39	39	
9574-SS-140910-01-08	Reference	1.15	2.154	28	28	
9574-SS-140910-01-09	Reference	1.18	2.182	30	30	
9574-SS-140910-01-10	Reference	1.23	2.227	35	35	
9574-SS-140910-01-11	Reference	1.38	2.380	40	40	
9574-SS-140910-01-12	Reference	1.05	2.055	23	23	
9574-SS-140910-01-13	Reference	0.94	1.941	13	13	
9574-SS-140910-01-14	Reference	1.12	2.119	26	26	
9574-SS-140910-01-15	Reference	1.15	2.152	27	27	
9574-SS-140910-01-16	Reference	1.03	2.028	20	20	
9574-SS-140910-01-17	Reference	0.44	1.443	9	9	
9574-SS-140910-01-18	Reference	1.19	2.188	32	32	
9574-SS-140910-01-20	Reference	0.76	1.757	10	10	
9574-SS-140910-01-21	Reference	1.02	2.023	19	19	
9574-SS-140910-01-22	Reference	1.02	2.018	18	18	
9574-SS-140910-01-23	Reference	1.00	2.002	15	15	
9574-SS-140910-01-24	Reference	0.87	1.873	12	12	
9574-SS-140910-01-25	Reference	1.04	2.040	22	22	
9574-SS-140910-01-26	Reference	0.96	1.959	14	14	
9574-SS-140910-01-27	Reference	1.20	2.204	33	33	
9574-SS-140910-01-28	Reference	1.01	2.007	17	17	
9574-SS-140910-01-29	Reference	1.22	2.223	34	34	
9574-SS-140910-01-30	Reference	1.03	2.035	21	21	
9574-SS-140910-01-31	Reference	1.00	2.005	16	16	
9574-SS-140910-01-32	Reference	0.86	1.865	11	11	
9574-SS-140910-01-33	Reference	1.24	2.238	36	36	
9574-SS-140910-01-34	Reference	1.19	2.185	31	31	
L12-02-01-P-S-S-00	Survey Unit	1.21	1.210	8	0	Step 8.5.1 Min adjusted bkg SOF 1.44
L12-02-04-P-S-S-00	Survey Unit	1.12	1.121	7	0	No WRS test necessary
L12-02-07-P-S-S-00	Survey Unit	1.10	1.097	6	0	No WRS test necessary
L12-02-10-P-S-S-00	Survey Unit	0.99	0.986	3	0	No WRS test necessary
L12-02-13-P-S-S-00	Survey Unit	1.08	1.082	5	0	No WRS test necessary
L12-02-16-P-S-S-00	Survey Unit	0.93	0.935	1	0	No WRS test necessary
L12-02-19-P-S-S-00	Survey Unit	1.05	1.047	4	0	No WRS test necessary
L12-02-22-P-S-S-00	Survey Unit	0.97	0.973	2	0	No WRS test necessary
Rank Sums				820	784	W, Step 8.5.3e
# Reference Area Measurements				m	32	
# Survey Unit Measurements				n	8	
Total Number of Measurements Step 8.5.3c				N	40	
(1-α) percentile of a standard normal distribution (MARSSIM Pg. I-10)				z	1.645	$\alpha = 0.05$
WRS Critical Value (MARSSIM Pg. I-10, Eq. I.1)				CV	705	

TEST: **PASS** Step 8.5.3f

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Appendix B.1 Step 8. Calculate the Number of Samples in the Statistical Population

Uniform DCGL Criteria Evaluation	
N/2 Value Verification	
Isotope(s)	SOF (Ra/Tc/Th/Iso U)
St. Dev.	0.08
DCGL _{SOF}	1
LBGR (Mean)	0.09
Shift	0.91
Relative Shift (Δ/σ)	11.65
MARSSIM Table 5.1 (P_r)	1.000000
N	12
N + 20%	14.4
N/2	8
FSS N/2	8
Verification Check	SUFFICIENT MEASUREMENTS

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

MARSSIM Table 5.1

Δ/σ	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, $\alpha = 0.05$, $\beta = 0.10$

α (or β)	$Z_{1-\alpha}$ (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

α
 β

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**FORM HDP-PR-FSS-703-1
FIELD DUPLICATE SAMPLE ASSESSMENT**

Survey Unit No.:	LSA 12-02				Survey Unit Description:	Class 2 Laydown Land Area in "Area 13"						
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 ²	Warning Limit	Control Limit	Statistic Exceeds Limit? (Y/N)
			Activity (x_i)	MDC	Activity (x_i)	MDC						
L12-02-01-P-S-S-00	L12-02-01-P-S-Q-00	Ra-226	1.1	0.0801	0.956	0.0723	1.028	1.9	0.144	0.269	0.403	N
L12-02-01-P-S-S-00	L12-02-01-P-S-Q-00	Tc-99	0.171	0.245	-0.00733	0.244	0.082	25.1	NA	3.552	5.321	NA
L12-02-01-P-S-S-00	L12-02-01-P-S-Q-00	Th-232	1.18	0.155	0.916	0.142	1.048	2.0	0.264	0.283	0.424	N
L12-02-01-P-S-S-00	L12-02-01-P-S-Q-00	U-234 ¹	4.440	N/A	1.280	N/A	2.860	195.4	3.160	27.649	41.425	N
L12-02-01-P-S-S-00	L12-02-01-P-S-Q-00	U-235	0.244	0.219	-0.144	0.676	0.050	51.6	NA	7.301	10.939	NA
L12-02-01-P-S-S-00	L12-02-01-P-S-Q-00	U-238	1.23	0.869	1.28	0.911	1.255	168.8	0.050	23.885	35.786	N

Comments:

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

Performed by: _____

Reviewed by: _____

Date: _____

Date: _____

Quality Record

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FIELD DUPLICATE SAMPLE ASSESSMENT**

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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 ²	Warning Limit	Control Limit	Statistic Exceeds Limit? (Y/N)
			Activity (x_i)	MDC	Activity (x_i)	MDC						
L12-02-11-P-R-S-00	L12-02-11-P-R-Q-00	Ra-226	0.882	0.0899	1.06	0.0572	0.971	1.9	0.178	0.269	0.403	N
L12-02-11-P-R-S-00	L12-02-11-P-R-Q-00	Tc-99	-0.0174	0.249	-0.017	0.243	-0.017	25.1	NA	3.552	5.321	NA
L12-02-11-P-R-S-00	L12-02-11-P-R-Q-00	Th-232	0.913	0.13	1.2	0.131	1.057	2.0	0.287	0.283	0.424	Y
L12-02-11-P-R-S-00	L12-02-11-P-R-Q-00	U-234 ¹	2.724	N/A	0.729	N/A	1.727	195.4	1.995	27.649	41.425	N
L12-02-11-P-R-S-00	L12-02-11-P-R-Q-00	U-235	0.147	0.605	-0.113	0.51	0.017	51.6	NA	7.301	10.939	NA
L12-02-11-P-R-S-00	L12-02-11-P-R-Q-00	U-238	1.18	0.918	0.729	0.793	0.955	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: _____

Reviewed by: _____

Date: _____

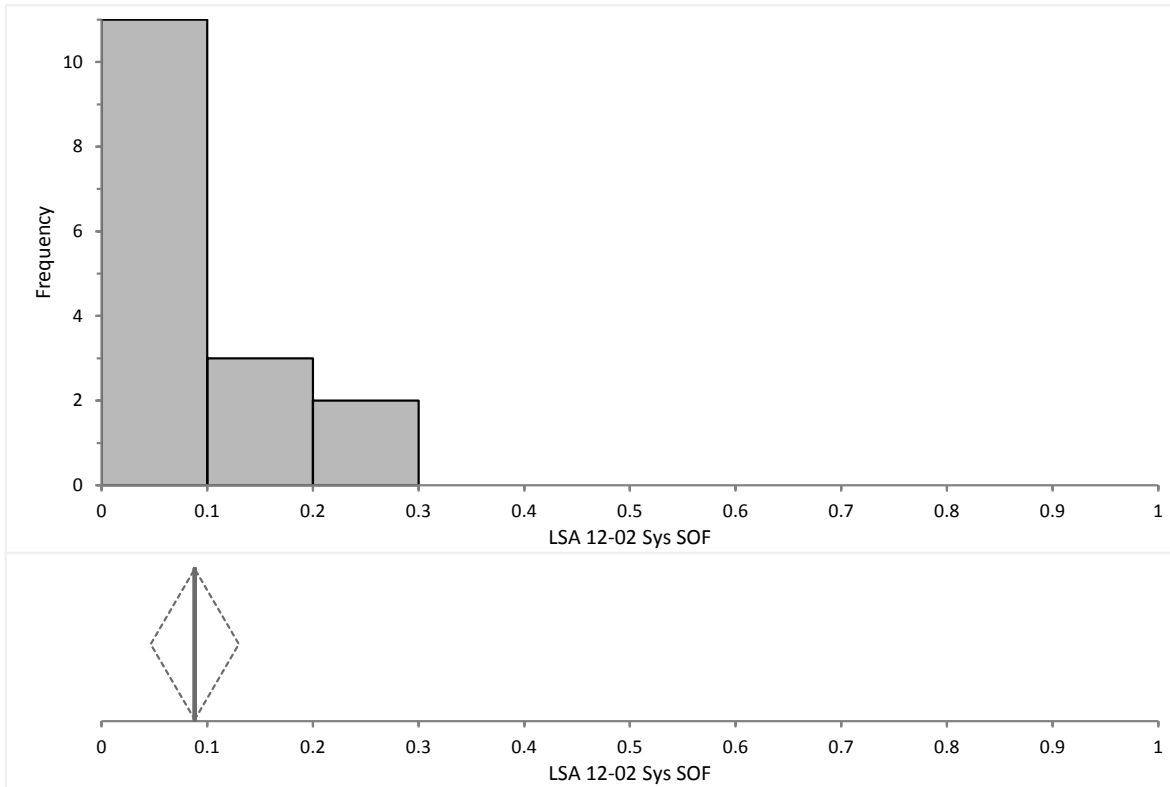
Date: _____

Quality Record

LSA 12-02 Sys SOF

0.1
0.0
0.1
0.2
0.1
0.0
0.0
0.0
0.0
0.1
0.0
0.1
0.1
0.1
0.1
0.0
0.3

Descriptives



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	Mean	95% CI	Mean SE	SD	Variance	Skewness	Kurtosis
LSA 12-02 Sys SOF	0.09	0.05 to 0.13	0.020	0.08	0.01	1.5	2.24
	Minimum	1st quartile	Median	97.87% CI	3rd quartile	Maximum	IQR
LSA 12-02 Sys SOF	0.02	0.03	0.06	0.03 to 0.13	0.13	0.3	0.10