

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 08	Description:	Technetium SEA Open Land Area
Survey Unit:	08	Description:	Central Open Land Area
Survey Type:	FSS	Classification:	Class 1

Measurement or Sample ID	Surface or CSM	Type	Start Elevation*	End Elevation*	Northing** (Y Axis)	Easting** (X Axis)	Remarks / Notes
L08-08-01-T-E-S-00	Uniform	S	432.3	431.8	864954.0	827312.0	Excavation 6-inch grab
L08-08-02-T-E-S-00	Uniform	S	426.5	426.0	864954.0	827359.0	Excavation 6-inch grab
L08-08-03-T-E-S-00	Uniform	S	429.5	429.0	864913.0	827288.0	Excavation 6-inch grab
L08-08-04-T-E-S-00	Uniform	S	431	430.5	864913.0	827336.0	Excavation 6-inch grab
L08-08-05-T-E-S-00	Uniform	S	430	429.5	864913.0	827383.0	Excavation 6-inch grab
L08-08-06-T-E-S-00	Uniform	S	427.9	427.4	864872.0	827312.0	Excavation 6-inch grab
L08-08-07-T-R-S-00	Uniform	S	435.4	432.4	864872.0	827359.0	Root 3.0-ft composite
L08-08-08-T-E-S-00	Uniform	S	432.4	431.9	864872.0	827359.0	Excavation 6-inch grab
L08-08-09-T-R-S-00	Uniform	S	435.1	432.2	864872.0	827406.0	Root 2.9-ft composite
L08-08-10-T-E-S-00	Uniform	S	432.2	431.7	864872.0	827406.0	Excavation 6-inch grab
L08-08-07-T-R-Q-00	Uniform	Q	435.4	432.4	864872.0	827359.0	Lab QA Duplicate
L08-08-11-T-E-B-00	Uniform	B	434.0	434.0	864858.8	827383.5	6-inch Sidewall Sample
L08-08-12-T-E-B-00	Uniform	B	430.0	429.5	864901.1	827304.2	Biased 6-inch Sample
L08-08-13-T-E-B-00	Uniform	B	430.2	429.7	864898.9	827307.7	Biased 6-inch Sample
L08-08-14-T-E-B-00	Uniform	B	435.1	434.6	864883.0	827354.6	Biased 6-inch Sample
L08-08-15-T-E-B-00	Uniform	B	434.9	434.4	864885.3	827358.1	Biased 6-inch 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	40	40
9574-SS-140910-01-02	Reference	1.18	2.179	31	31
9574-SS-140910-01-03	Reference	1.06	2.064	26	26
9574-SS-140910-01-04	Reference	1.10	2.101	27	27
9574-SS-140910-01-05	Reference	1.29	2.293	39	39
9574-SS-140910-01-07	Reference	1.34	2.339	41	41
9574-SS-140910-01-08	Reference	1.15	2.154	30	30
9574-SS-140910-01-09	Reference	1.18	2.182	32	32
9574-SS-140910-01-10	Reference	1.23	2.227	37	37
9574-SS-140910-01-11	Reference	1.38	2.380	42	42
9574-SS-140910-01-12	Reference	1.05	2.055	25	25
9574-SS-140910-01-13	Reference	0.94	1.941	15	15
9574-SS-140910-01-14	Reference	1.12	2.119	28	28
9574-SS-140910-01-15	Reference	1.15	2.152	29	29
9574-SS-140910-01-16	Reference	1.03	2.028	22	22
9574-SS-140910-01-17	Reference	0.44	1.443	10	10
9574-SS-140910-01-18	Reference	1.19	2.188	34	34
9574-SS-140910-01-20	Reference	0.76	1.757	12	12
9574-SS-140910-01-21	Reference	1.02	2.023	21	21
9574-SS-140910-01-22	Reference	1.02	2.018	20	20
9574-SS-140910-01-23	Reference	1.00	2.002	17	17
9574-SS-140910-01-24	Reference	0.87	1.873	14	14
9574-SS-140910-01-25	Reference	1.04	2.040	24	24
9574-SS-140910-01-26	Reference	0.96	1.959	16	16
9574-SS-140910-01-27	Reference	1.20	2.204	35	35
9574-SS-140910-01-28	Reference	1.01	2.007	19	19
9574-SS-140910-01-29	Reference	1.22	2.223	36	36
9574-SS-140910-01-30	Reference	1.03	2.035	23	23
9574-SS-140910-01-31	Reference	1.00	2.005	18	18
9574-SS-140910-01-32	Reference	0.86	1.865	13	13
9574-SS-140910-01-33	Reference	1.24	2.238	38	38
9574-SS-140910-01-34	Reference	1.19	2.185	33	33
L08-08-01-T-E-S-00	Survey Unit	1.27	1.271	3	0
L08-08-02-T-E-S-00	Survey Unit	1.02	1.023	1	0
L08-08-03-T-E-S-00	Survey Unit	1.22	1.219	2	0
L08-08-04-T-E-S-00	Survey Unit	1.28	1.281	5	0
L08-08-05-T-E-S-00	Survey Unit	1.29	1.290	6	0
L08-08-06-T-E-S-00	Survey Unit	1.37	1.369	9	0
L08-08-07-T-R-S-00	Survey Unit	1.27	1.272	4	0
L08-08-08-T-E-S-00	Survey Unit	1.31	1.313	7	0
L08-08-09-T-R-S-00	Survey Unit	1.35	1.346	8	0
L08-08-10-T-E-S-00	Survey Unit	1.63	1.626	11	0
Rank Sums				903	847
# Reference Area Measurements				m	32
# Survey Unit Measurements				n	10
Total Number of Measurements Step 8.5.3c				N	42
(1-α) percentile of a standard normal distribution (MARSSIM Pg. I-10)				z	1.645
WRS Critical Value (MARSSIM Pg. I-10, Eq. I.1)				CV	744

Step 8.5.1
Min adjusted bkg SOF
1.44
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
Perform WRS test

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)	SOF (Ra/Tc/Th/Iso U)
St. Dev.	0.13
DCGL _{SOF}	1
LBGR (Mean)	0.25
Shift	0.75
Relative Shift (Δ/σ)	5.70
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 08-08				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 ²	Warning Limit	Control Limit	Statistic Exceeds Limit? (Y/N)
			Activity (x_i)	MDC	Activity (x_i)	MDC						
L08-08-07-T-R-S-00	L08-08-07-T-R-Q-00	Ra-226	1.12	0.076	1.17	0.09	1.145	1.9	0.05	0.269	0.403	N
L08-08-07-T-R-S-00	L08-08-07-T-R-Q-00	Tc-99	2.14	0.225	1.56	0.228	1.850	25.1	0.58	3.552	5.321	N
L08-08-07-T-R-S-00	L08-08-07-T-R-Q-00	Th-232	1.17	0.133	1.01	0.097	1.090	2.0	0.160	0.283	0.424	N
L08-08-07-T-R-S-00	L08-08-07-T-R-Q-00	U-234 ¹	0.900	N/A	3.078	N/A	1.989	195.4	2.178	27.649	41.425	N
L08-08-07-T-R-S-00	L08-08-07-T-R-Q-00	U-235	0.0396	0.248	0.167	0.25	0.103	51.6	NA	7.301	10.939	NA
L08-08-07-T-R-S-00	L08-08-07-T-R-Q-00	U-238	1.23	0.888	1.18	0.888	1.205	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: Thomas Yardy _____

Reviewed by: Clark Evers _____

Date: _____

Date: _____

Quality Record

LSA 08-08 Sys SOF

0.2

0.0

0.2

0.2

0.2

0.3

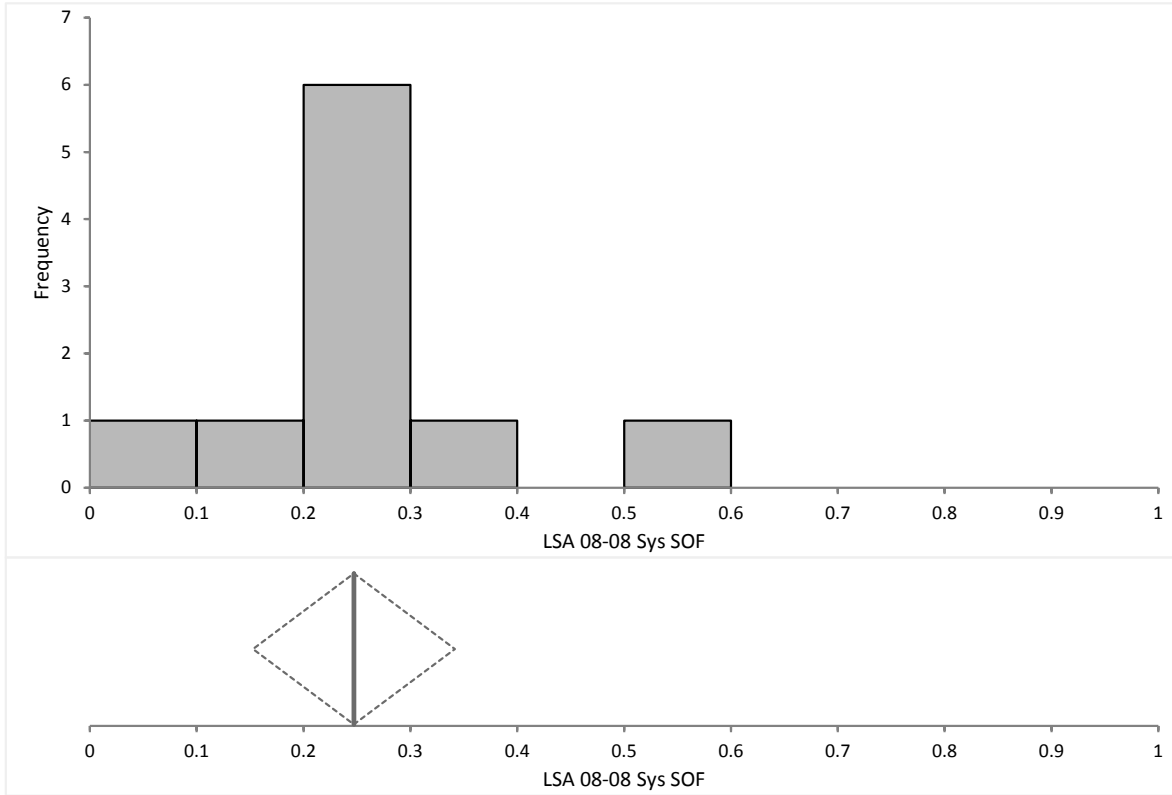
0.2

0.2

0.3

0.6

Descriptives



N | 10

	Mean	95% CI	Mean SE	SD	Variance	Skewness	Kurtosis
LSA 08-08 Sys SOF	0.25	0.15 to 0.34	0.042	0.13	0.02	1.4	4.02
	Minimum	1st quartile	Median	97.85% CI	3rd quartile	Maximum	IQR
LSA 08-08 Sys SOF	0.05	0.20	0.22	0.16 to 0.31	0.28	0.6	0.08