

Hematite Decommissioning Project	Procedure: HDP-PR-FSS-701, Final Status Survey Plan Development		
	Westinghouse Proprietary Class 3	Revision: 6	Appendix P-4, Page 1 of 1

APPENDIX P-4

FSS SAMPLE & MEASUREMENT LOCATIONS & COORDINATES

Survey Area:	LSA 11	Description:	Plant Open Land Area
Survey Unit:	01	Description:	Northeast Site Creek in "Area 9"
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
L11-01-01-B-S-S-00	Uniform	S	427.0	426.5	865441.0	827549.0	Surface 6-inch grab
L11-01-02-B-R-S-00	Uniform	S	426.5	422.0	865441.0	827549.0	Root 4.4-ft composite
L11-01-04-B-S-S-00	Uniform	S	423.9	423.4	865334.0	827611.0	Surface 6-inch grab
L11-01-05-B-R-S-00	Uniform	S	423.4	419.0	865334.0	827611.0	Root 4.4-ft composite
L11-01-07-B-R-S-00	Uniform	S	424.1	420.5	865227.0	827672.0	Root 3.6-ft composite
L11-01-08-B-E-S-00	Uniform	S	420.5	420.0	865227.0	827672.0	Excavation 6-inch grab
L11-01-09-B-S-S-00	Uniform	S	422.7	422.2	865227.0	827796.0	Surface 6-inch grab
L11-01-10-B-R-S-00	Uniform	S	422.2	417.7	865227.0	827796.0	Root 4.4-ft composite
L11-01-12-B-S-S-00	Uniform	S	422.2	421.7	865227.0	827920.0	Surface 6-inch grab
L11-01-13-B-R-S-00	Uniform	S	421.7	417.3	865227.0	827920.0	Root 4.4-ft composite
L11-01-15-B-S-S-00	Uniform	S	420.9	420.4	865227.0	828043.0	Surface 6-inch grab
L11-01-16-B-R-S-00	Uniform	S	420.4	415.9	865227.0	828043.0	Root 4.4-ft composite
L11-01-18-B-R-S-00	Uniform	S	422.8	421.9	865119.0	827734.0	Root 0.9-ft composite
L11-01-19-B-E-S-00	Uniform	S	421.9	421.4	865119.0	827734.0	Excavation 6-inch grab
L11-01-20-B-R-S-00	Uniform	S	421.4	419.4	865119.0	827858.0	Root 2-ft composite
L11-01-21-B-E-S-00	Uniform	S	419.4	418.9	865119.0	827858.0	Excavation 6-inch grab
L11-01-02-B-R-Q-00	Uniform	Q	426.5	422.0	865441.0	827549.0	Root 4.4-ft composite
L11-01-16-B-R-Q-00	Uniform	Q	420.4	415.9	865227.0	828043.0	Root 4.4-ft composite
L11-01-22-B-S-B-00	Uniform	B	423.0	422.5	865291.0	827544.0	Surface 6-inch grab
L11-01-23-B-S-B-00	Uniform	B	424.0	423.5	865247.0	827842.0	Surface 6-inch grab

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
 Steps 8.3 Preliminary Data Review and 8.4 Calculation of the Sum-of-Fractions (SOF)

Use corrected net results for all DE calcs 721 Sec. 8.4.2

0.09
0.10
0.11
0.10
0.10
0.08
0.13
0.10
0.13
0.09
0.11
0.11
0.09
0.13
0.12

Step 8.4.1 DCLG_W Measure Tc-99, All SEAs

Uniform	
U-234	199.4
U-235	51.6
U-238	168.8
Tc-99	25.1
Th-232	2.0
Ra-226	1.9

Step 8.4.2a
 Weighted SOF_{MEAN} = 0.03

fractions			
SS	BS	ES	
0.3125	0.5	0.1875	

Step 8.4.5c SOF_{MEAN} Re-use Backfill Material = 0

Step 8.4.5e SOF_{MEAN} Groundwater = 0.15

Step 8.4.5g (c<*)

SOF _{MEAN,SU}	0.18	PASS
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Step 8.4.6 Calculate the dose contribution for the SU by multiplying SOF_{MEAN,SU} (including contribution from Re-use backfill and Groundwater) by 25 mrem.

4.8 mrem

Infer U234 Step 8.3.4			
U-238/U235	U-234/U235	U-234	%
11.9	19.2	0.4	1.3
10.0	18.8	1.7	1.6
3.9	18.1	2.4	3.9
6.3	18.3	1.1	2.6
14.9	19.6	0.6	1.1
18.3	20.2	0.7	0.9
5.7	18.3	2.5	2.7
6.0	18.3	1.6	2.6
7.6	18.5	1.6	2.1
34.7	22.7	0.7	0.6
9.0	18.7	3.2	1.7
41.3	23.2	0.3	0.4
7.3	18.5	1.5	2.1
6.5	18.7	1.6	1.7
36.5	22.7	0.5	0.5
8.6	18.7	1.4	1.8
9.8	18.8	1.5	1.6
7.9	18.5	1.8	2.0
3.3	18.1	14.9	4.5
11.0	18.1	2.8	1.4
Average Enrichment (%)			1.85

Infer U-234 MDC using U-235 MDC * ratio of U-234/U-235 @ that sample's enrichment

3.473141
3.315686
3.49549
3.095324
3.743619
2.339232
4.163145
3.419441
4.046539
4.138295
3.449277
4.161127
2.291248
4.011659
4.614264
2.518803
3.353344
2.697206
4.381335
4.176651

HDP-PR-FSS-701 Final Status Survey Plan Development

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.	0.04
DCGL _{SOF}	1
LBGR (Mean)	0.03
Shift	0.97
Relative Shift (Δ/σ)	25.77
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

Hematite Decommissioning Project	Procedure: HDP-PR-FSS-703, Final Status Survey Quality Control							Revision: 2	Page 1 of 1
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**FORM HDP-PR-FSS-703-1
FIELD DUPLICATE SAMPLE ASSESSMENT**

Survey Unit No.:		LSA 11-01				Survey Unit Description:		Plant Soils Open Land Area east of Burial Pits in "Area 9"					
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)	Statistic2	Warning Limit	Control Limit	Statistic Exceeds Limit? (Y/N)	
			Activity (xi)	MDC	Activity (xi)	MDC							
L11-01-02-B-R-S-00	L11-01-02-B-R-Q-00	Ra-226	0.937	0.0507	0.804	0.048	0.8705	1.9	0.133	0.269	0.403	N	
L11-01-02-B-R-S-00	L11-01-02-B-R-Q-00	Tc-99	0.0546	0.241	0.139	0.23	0.0968	25.1	NA	3.552	5.321	NA	
L11-01-02-B-R-S-00	L11-01-02-B-R-Q-00	Th-232	0.716	0.089	0.665	0.057	0.691	2.0	0.051	0.283	0.424	N	
L11-01-02-B-R-S-00	L11-01-02-B-R-Q-00	U-2341	1.701	NA	1.498	NA	1.599	195.4	0.203	27.649	41.425	N	
L11-01-02-B-R-S-00	L11-01-02-B-R-Q-00	U-235	0.0903	0.176	0.0795	0.178	0.085	51.6	NA	7.301	10.939	NA	
L11-01-02-B-R-S-00	L11-01-02-B-R-Q-00	U-238	0.904	0.57	0.783	0.581	0.8435	168.8	0.121	23.885	35.786	N	
L11-01-16-B-R-S-00	L11-01-16-B-R-Q-00	Ra-226	0.822	0.0545	0.847	0.0543	0.8345	1.9	0.025	0.269	0.403	N	
L11-01-16-B-R-S-00	L11-01-16-B-R-Q-00	Tc-99	-0.0235	0.228	-0.0146	0.231	-0.01905	25.1	NA	3.552	5.321	NA	
L11-01-16-B-R-S-00	L11-01-16-B-R-Q-00	Th-232	0.73	0.0866	0.792	0.0729	0.761	2.0	0.062	0.283	0.424	N	
L11-01-16-B-R-S-00	L11-01-16-B-R-Q-00	U-2341	0.520	NA	1.801	NA	1.161	195.4	1.281	27.649	41.425	N	
L11-01-16-B-R-S-00	L11-01-16-B-R-Q-00	U-235	0.0215	0.172	0.0972	0.145	0.059	51.6	NA	7.301	10.939	NA	
L11-01-16-B-R-S-00	L11-01-16-B-R-Q-00	U-238	0.889	0.548	0.769	0.644	0.829	168.8	0.12	23.885	35.786	N	

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

Performed by: _____

Reviewed by: _____

Date: _____

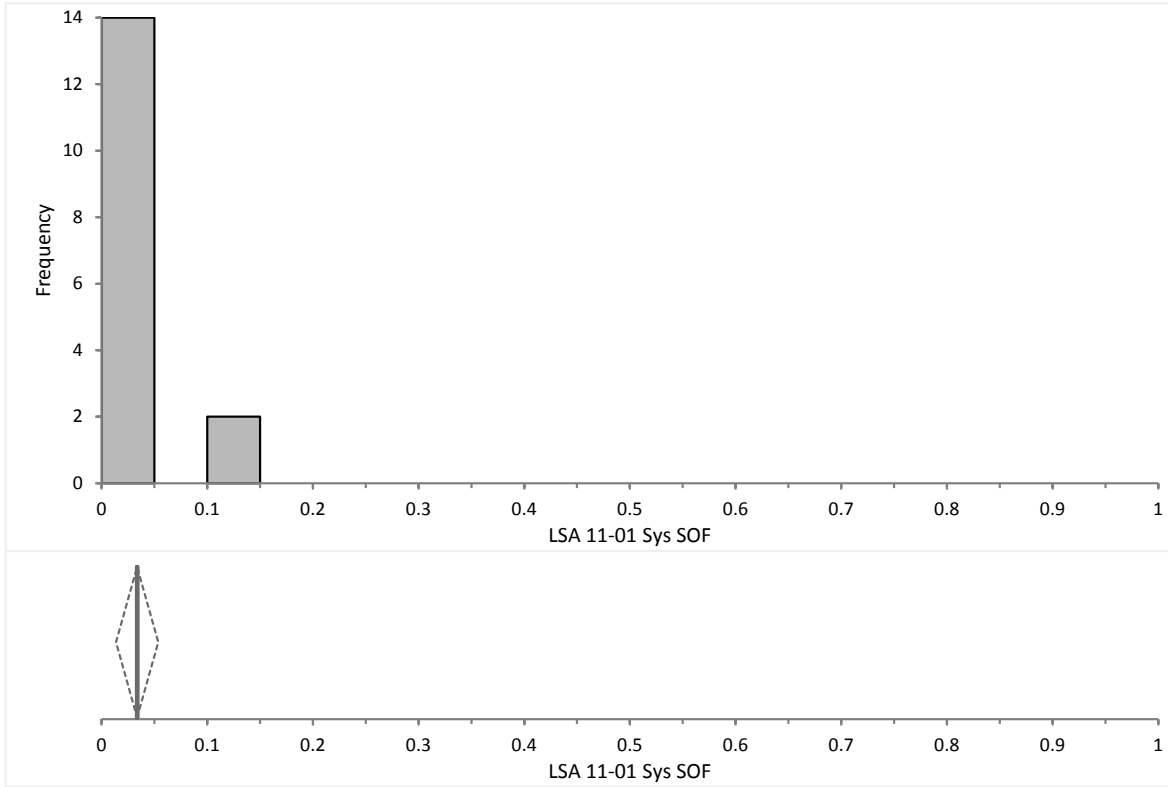
Date: _____

Quality Record

LSA 11-01 Sys SOF

0.0
0.0
0.0
0.0
0.0
0.0
0.1
0.0
0.0
0.0
0.1
0.0
0.0
0.0
0.0
0.0
0.0

Descriptives



N		16					
	Mean	95% CI	Mean SE	SD	Variance	Skewness	Kurtosis
LSA 11-01 Sys SOF	0.03	0.01 to 0.05	0.009	0.04	0.00	2.3	5.04
	Minimum	1st quartile	Median	97.87% CI	3rd quartile	Maximum	IQR
LSA 11-01 Sys SOF	0.0	0.01	0.02	0.01 to 0.04	0.03	0.1	0.02