

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

APPENDIX P-4

FSS SAMPLE & MEASUREMENT LOCATIONS & COORDINATES

Survey Area:	LSA 10	Description:	Burial Pits Open Land Area
Survey Unit:	03	Description:	West Central Survey Unit (North Burial Pit)
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
L10-03-01-B-E-S-00	Uniform	S	425.7	425.2	865253.0	827323.7	Excavation 6-inch grab
L10-03-02-B-E-S-00	Uniform	S	423.4	422.9	865253.0	827373.2	Excavation 6-inch grab
L10-03-03-B-E-S-00	Uniform	S	426.1	425.6	865210.0	827298.9	Excavation 6-inch grab
L10-03-04-B-E-S-00	Uniform	S	423.7	423.2	865210.0	827348.5	Excavation 6-inch grab
L10-03-05-B-E-S-00	Uniform	S	424.6	424.1	865210.0	827398.0	Excavation 6-inch grab
L10-03-06-B-E-S-00	Uniform	S	427.9	427.4	865167.0	827323.7	Excavation 6-inch grab
L10-03-07-B-E-S-00	Uniform	S	426.8	426.3	865167.0	827373.2	Excavation 6-inch grab
L10-03-08-B-R-S-00	Uniform	S	431.3	429.8	865124.0	827348.5	Root 1.5-foot composite
L10-03-09-B-E-S-00	Uniform	S	429.8	429.3	865124.0	827348.5	Excavation 6-inch grab
L10-03-07-B-E-Q-00	Uniform	Q	426.8	426.3	865167.0	827373.2	Excavation 6-inch grab
L10-03-10-B-E-B-00	Uniform	B	431.8	417.8	865249.6	827396.8	Excavation 6-inch grab
L10-03-11-B-E-B-00	Uniform	B	433.3	415.5	865221.3	827362.8	Excavation 6-inch grab
L10-03-12-B-E-B-00	Uniform	B	434.7	420.0	865210.7	827298.5	Excavation 6-inch grab
L10-03-13-B-E-B-00	Uniform	B	424.0	423.5	865253.3	827340.4	Excavation 6-inch grab
L10-03-14-B-E-I-01	Uniform	I	435.4	424.1	865194.0	827287.0	Excavation 6-inch grab
L10-03-15-B-E-B-00	Uniform	B	425.2	424.7	865216.7	827313.3	Excavation 6-inch grab
L10-03-16-B-E-B-00	Uniform	B	425.5	425.0	865175.9	827300.8	Excavation 6-inch grab

*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 Stratum DCGLs

Type: Systematic = S, Biased = B; QC = Q; Investigation = I

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

Quality Record

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)

DCLG_W, Measure Tc-99, All SEAs

	Uniform
U-234	185.4
U-235	51.6
U-238	168.8
Tc-99	25.1
Th-232	2.0
Ra-226	1.9

Infer U234			
U-238/U235	U-234/U235	U-234	%
5.6	19.3	4.3	2.7
4.7	18.2	2.6	3.2
13.3	19.4	2.2	1.2
9.1	18.3	2.7	2.5
7.3	18.5	2.4	2.1
8.0	18.5	3.2	2.0
3.6	18.1	6.3	4.2
2.9	18.1	6.3	5.4
6.2	18.3	2.3	2.5
17.8	20.2	1.3	0.9
6.1	18.3	11.2	2.5
4.7	18.2	11.1	3.2
10.5	18.9	2.0	1.5
6.1	18.3	8.1	2.6
4.6	18.1	3.7	3.4
9.8	18.8	2.5	1.6
3.7	18.1	6.0	4.1
Average Enrichment (%)			2.87

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

3.77869741
6.376821595
5.701218298
4.816982953
6.31940956
4.410723565
3.765717373
3.881277682
5.49465729
4.617966774
6.080754145
4.251081063
5.342896975
5.193162048
5.116648221
4.705722808
4.128132169

weighted SOF _{MEAN}	0.34		
SS	RS	ES	
fractions	0	0.1111111111	0.888889
SOF _{MEAN} Re-use Backfill Material			
0 Off-Site Backfill			
SOF _{MEAN} Groundwater			
0.16			
SOF <= 1			
SOF _{MEAN} BU	0.50	PASS	

Calculate the dose contribution for the SU by multiplying SOF_{MEAN} (including contribution from Re-use backfill and Groundwater) by 25 mrem.

12.4 mrem

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 ($X_{i,ref}$, $Y_{i,SU}$)	ADJUSTED SOF (Z_i)	RANKS	REFERENCE AREA RANKS
9574-SS-140910-01-01	Reference	1.31	2.310	39	39
9574-SS-140910-01-02	Reference	1.18	2.179	30	30
9574-SS-140910-01-03	Reference	1.06	2.064	25	25
9574-SS-140910-01-04	Reference	1.10	2.101	26	26
9574-SS-140910-01-05	Reference	1.29	2.293	38	38
9574-SS-140910-01-07	Reference	1.34	2.339	40	40
9574-SS-140910-01-08	Reference	1.15	2.154	29	29
9574-SS-140910-01-09	Reference	1.18	2.182	31	31
9574-SS-140910-01-10	Reference	1.23	2.227	36	36
9574-SS-140910-01-11	Reference	1.38	2.380	41	41
9574-SS-140910-01-12	Reference	1.05	2.055	24	24
9574-SS-140910-01-13	Reference	0.94	1.941	14	14
9574-SS-140910-01-14	Reference	1.12	2.119	27	27
9574-SS-140910-01-15	Reference	1.15	2.152	28	28
9574-SS-140910-01-16	Reference	1.03	2.028	21	21
9574-SS-140910-01-17	Reference	0.44	1.443	7	7
9574-SS-140910-01-18	Reference	1.19	2.188	33	33
9574-SS-140910-01-20	Reference	0.76	1.757	11	11
9574-SS-140910-01-21	Reference	1.02	2.023	20	20
9574-SS-140910-01-22	Reference	1.02	2.018	19	19
9574-SS-140910-01-23	Reference	1.00	2.002	16	16
9574-SS-140910-01-24	Reference	0.87	1.873	13	13
9574-SS-140910-01-25	Reference	1.04	2.040	23	23
9574-SS-140910-01-26	Reference	0.96	1.959	15	15
9574-SS-140910-01-27	Reference	1.20	2.204	34	34
9574-SS-140910-01-28	Reference	1.01	2.007	18	18
9574-SS-140910-01-29	Reference	1.22	2.223	35	35
9574-SS-140910-01-30	Reference	1.03	2.035	22	22
9574-SS-140910-01-31	Reference	1.00	2.005	17	17
9574-SS-140910-01-32	Reference	0.86	1.865	12	12
9574-SS-140910-01-33	Reference	1.24	2.238	37	37
9574-SS-140910-01-34	Reference	1.19	2.185	32	32
L10-03-01-B-E-S-00	Survey Unit	1.55	1.551	9	0
L10-03-02-B-E-S-00	Survey Unit	1.64	1.638	10	0
L10-03-03-B-E-S-00	Survey Unit	1.41	1.415	6	0
L10-03-04-B-E-S-00	Survey Unit	1.36	1.362	4	0
L10-03-05-B-E-S-00	Survey Unit	1.50	1.498	8	0
L10-03-06-B-E-S-00	Survey Unit	1.21	1.208	1	0
L10-03-07-B-E-S-00	Survey Unit	1.40	1.397	5	0
L10-03-08-B-R-S-00	Survey Unit	1.30	1.304	3	0
L10-03-09-B-E-S-00	Survey Unit	1.22	1.224	2	0
Rank Sums				861	813
# Reference Area Measurements				m	32
# Survey Unit Measurements				n	9
Total Number of Measurements				N	41
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	725

Min adjusted bkg SOF
1.44

Perform WRS test
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

W_r

$\alpha = 0.05$

TEST: **PASS** Step 8.5.3f

Calculate the Number of Samples (N/2)	
Uniform DCGL Criteria Evaluation	
N/2 Value Verification	
Isotope(s)	SOF (Ra/Tc/Th/Iso U)
St. Dev.	0.14
DCGL _{SOF}	1
LBGR (Mean)	0.34
Shift	0.66
Relative Shift (Δ/σ)	4.58
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
<p>"N/2" Corresponds to the number of survey unit measurement locations required for the WRS Test</p>	

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

Survey Unit No.:	LSA 10-03				Survey Unit Description:	West Central Survey Unit (North Burial Pits)						
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						
#REF!	#REF!	Ra-226	1.32	0.0858	1.35	0.085	1.335	1.9	0.03	0.269	0.403	N
L10-03-07-B-E-S-00	L10-03-07-B-E-Q-00	Tc-99	0.669	0.275	1.11	0.273	0.890	25.1	0.441	3.552	5.321	N
L10-03-07-B-E-S-00	L10-03-07-B-E-Q-00	Th-232	1.26	0.0909	1.18	0.0974	1.220	2.0	0.080	0.283	0.424	N
L10-03-07-B-E-S-00	L10-03-07-B-E-Q-00	U-234 ¹	6.264	NA	1.339	NA	3.802	195.4	4.925	27.649	41.425	N
L10-03-07-B-E-S-00	L10-03-07-B-E-Q-00	U-235	0.346	0.208	0.0664	0.229	0.206	51.6	NA	7.301	10.939	NA
L10-03-07-B-E-S-00	L10-03-07-B-E-Q-00	U-238	1.24	0.818	1.18	0.786	1.210	168.8	0.060	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: _____

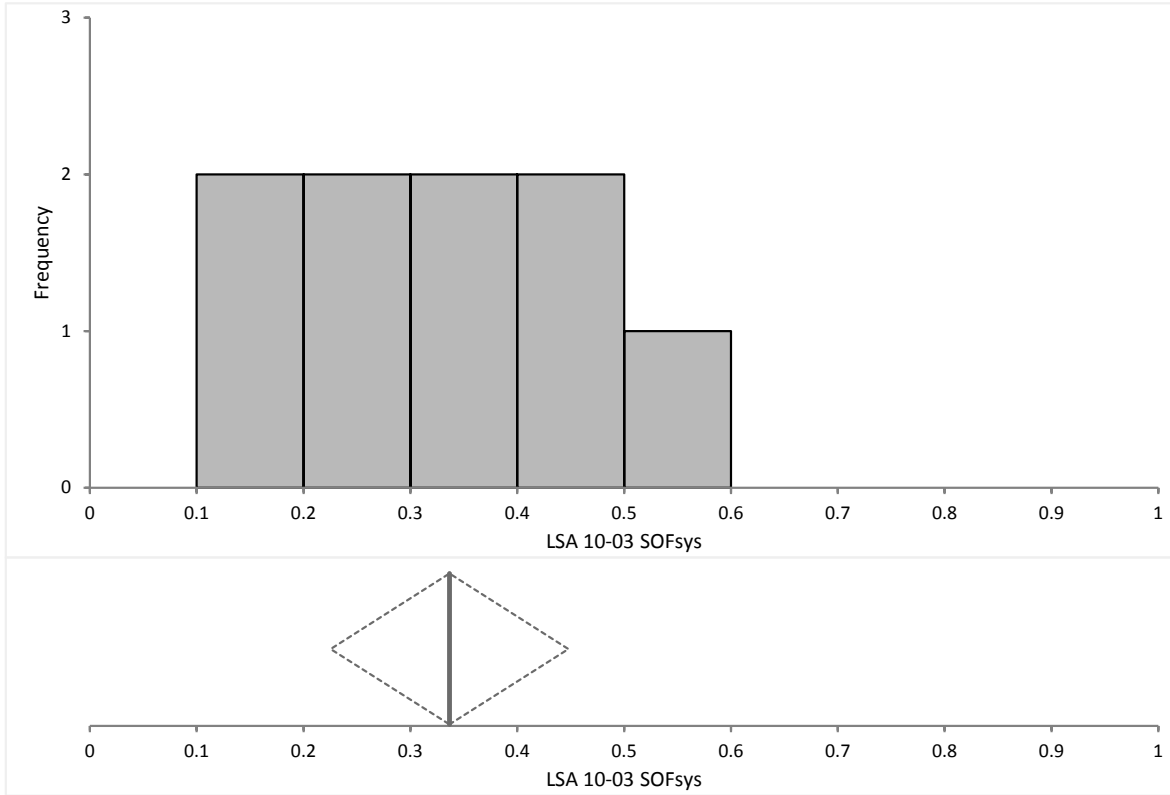
Date: _____

Date: _____

LSA 10-03 SOF_{sys}

0.5
0.6
0.4
0.3
0.4
0.1
0.3
0.2
0.2

Descriptives



N | 9

	Mean	95% CI	Mean SE	SD	Variance	Skewness	Kurtosis
LSA 10-03 SOFsys	0.34	0.23 to 0.45	0.048	0.14	0.02	0.2	-0.78
	Minimum	1st quartile	Median	96.09% CI	3rd quartile	Maximum	IQR
LSA 10-03 SOFsys	0.1	0.21	0.33	0.16 to 0.49	0.45	0.6	0.24