

Hematite Decommissioning Project	Procedure: HDP-PR-FSS-701, Final Status Survey Plan Development		
		Revision: 10	Appendix P-4, Page 1 of 1

APPENDIX P-4

FSS SAMPLE & MEASUREMENT LOCATIONS & COORDINATES

Survey Area:	BSA 05	Description:	Class 1 Structure inside LSA 05-02
Survey Unit:	02	Description:	Former Tile Barn Foundation
Survey Type:	FSS	Classification:	Class 1

Measurement or Sample ID	Surface or CSM	Type	Start * Elevation	End * Elevation	Location ID	Remarks / Notes
B05-01-01-S-O-S-00	O	S	NA	NA	Foundation location #1	Spring House Foundation
B05-01-02-S-O-S-00	O	S	NA	NA	Foundation location #2	Spring House Foundation
B05-01-03-S-O-S-00	O	S	NA	NA	Foundation location #3	Spring House Foundation
B05-01-04-S-O-S-00	O	S	NA	NA	Foundation location #4	Spring House Foundation
B05-01-05-S-O-S-00	O	S	NA	NA	Foundation location #5	Spring House Foundation
B05-01-06-S-O-S-00	O	S	NA	NA	Foundation location #6	Spring House Foundation
B05-01-07-S-O-S-00	O	S	NA	NA	Foundation location #7	Spring House Foundation
B05-01-08-S-O-S-00	O	S	NA	NA	Foundation location #8	Spring House Foundation
B05-01-09-S-O-S-00	O	S	NA	NA	Foundation location #9	Spring House Foundation
B05-01-10-S-O-S-00	O	S	NA	NA	Foundation location #10	Spring House Foundation
B05-01-11-S-O-S-00	O	S	NA	NA	Foundation location #11	Spring House Foundation
B05-01-12-S-O-S-00	O	S	NA	NA	Foundation location #12	Spring House Foundation
B05-01-13-S-O-S-00	O	S	NA	NA	Foundation location #13	Spring House Foundation
B05-01-14-S-O-S-00	O	S	NA	NA	Foundation location #14	Spring House Foundation
B05-01-15-S-O-S-00	O	S	NA	NA	Foundation location #15	Spring House Foundation
B05-01-16-S-O-S-00	O	S	NA	NA	Foundation location #16	Spring House Foundation
B05-01-17-S-O-S-00	O	S	NA	NA	Foundation location #17	Spring House Foundation
B05-01-18-S-O-S-00	O	S	NA	NA	Foundation location #18	Spring House Foundation
B05-01-19-S-O-S-00	O	S	NA	NA	Foundation location #19	Spring House Foundation
B05-01-20-S-O-S-00	O	S	NA	NA	Foundation location #20	Spring House Foundation
B05-01-21-S-O-S-00	O	S	NA	NA	Foundation location #21	Spring House Foundation
B05-01-22-S-O-S-00	O	S	NA	NA	Foundation location #22	Spring House Foundation
B05-01-23-S-O-S-00	O	S	NA	NA	Foundation location #23	Spring House Foundation
B05-01-24-S-O-S-00	O	S	NA	NA	Foundation location #24	Spring House Foundation
B05-01-25-S-O-S-00	O	S	NA	NA	Foundation location #25	Spring House Foundation
B05-01-26-S-O-S-00	O	S	NA	NA	Foundation location #26	Spring House Foundation
B05-01-27-S-O-S-00	O	S	NA	NA	Foundation location #27	Spring House Foundation
B05-01-28-S-O-S-00	O	S	NA	NA	Foundation location #28	Spring House Foundation
B05-01-29-S-O-S-00	O	S	NA	NA	Foundation location #29	Spring House Foundation
B05-01-30-S-O-S-00	O	S	NA	NA	Foundation location #30	Spring House Foundation
B05-01-31-S-O-S-00	O	S	NA	NA	Foundation location #31	Spring House Foundation
B05-01-32-S-O-S-00	O	S	NA	NA	Foundation location #32	Spring House Foundation
B05-01-33-S-O-S-00	O	S	NA	NA	Foundation location #33	Spring House Foundation
B05-01-34-S-O-S-00	O	S	NA	NA	Foundation location #34	Spring House Foundation
B05-01-35-S-O-S-00	O	S	NA	NA	Foundation location #35	Spring House Foundation
B05-01-36-S-O-S-00	O	S	NA	NA	Foundation location #36	Spring House Foundation
B05-01-37-S-O-S-00	O	S	NA	NA	Foundation location #37	Spring House Foundation
B05-01-38-S-O-S-00	O	S	NA	NA	Foundation location #38	Spring House Foundation
B05-01-39-S-O-S-00	O	S	NA	NA	Foundation location #39	Spring House Foundation
B05-01-40-S-O-S-00	O	S	NA	NA	Foundation location #40	Spring House Foundation
B05-01-41-S-O-S-00	O	S	NA	NA	Foundation location #41	Spring House Foundation
B05-01-42-S-O-S-00	O	S	NA	NA	Foundation location #42	Spring House Foundation
B05-01-43-S-O-S-00	O	S	NA	NA	Foundation location #43	Spring House Foundation
B05-01-44-S-O-S-00	O	S	NA	NA	Foundation location #44	Spring House Foundation
B05-01-45-S-O-S-00	O	S	NA	NA	Foundation location #45	Spring House Foundation
B05-01-46-S-O-S-00	O	S	NA	NA	Foundation location #46	Spring House Foundation
B05-01-47-S-O-S-00	O	S	NA	NA	Foundation location #47	Spring House Foundation
B05-01-48-S-O-S-00	O	S	NA	NA	Foundation location #48	Spring House Foundation
B05-01-49-S-O-S-00	O	S	NA	NA	Foundation location #49	Spring House Foundation
B05-01-50-S-O-S-00	O	S	NA	NA	Foundation location #50	Spring House Foundation
B05-01-51-S-O-S-00	O	S	NA	NA	Foundation location #51	Spring House Foundation
B05-01-52-S-O-S-00	O	S	NA	NA	Foundation location #52	Spring House Foundation
B05-01-53-S-O-S-00	O	S	NA	NA	Foundation location #53	Spring House Foundation
B05-01-54-S-O-S-00	O	S	NA	NA	Foundation location #54	Spring House Foundation
B05-01-55-S-O-S-00	O	S	NA	NA	Foundation location #55	Spring House Foundation
B05-01-56-S-O-S-00	O	S	NA	NA	Foundation location #56	Spring House Foundation
B05-01-57-S-O-B-00	O	S	NA	NA	Biased location measurements #1	Biased loc. Section 42
B05-01-58-S-O-B-00	O	S	NA	NA	Biased location post sample measurement	Biased loc. Section 42

*X and Y coordinates originate from lower left or southwest corner of structural surface. Each structural surface has its own origin (0,0) point.

Surface: Floor = F; Wall = W; Ceiling = C; Roof = R; O = Other

CSM: Three-Layer (Surface-Root-Deep) or Uniform

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

Quality Record

Ludlum 2360 248161	Ludlum 43-68 B	Active Probe Area 125 cm ²	α HDP Efficiency 29.1%	α Cal. Efficiency N/A	β HDP Efficiency 13.6%	β Cal. Efficiency N/A
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TOTAL WEIGHTED INSTRUMENT EFFICIENCY CALCULATION

Radionuclide	Radiation	Maximum Energy (MeV)	Instrument Efficiency (ϵ_i)	Surface Efficiency (ϵ_s)	Yield 100%	Activity Fraction	Weighted Efficiency
Am-241	Alpha	5.6	0.2910	0.25	1.00	2.682E-03	1.95E-04
Np-237	Alpha	5.0	0.2910	0.25	1.00	5.573E-05	4.05E-06
Pu-239	Alpha	5.2	0.2910	0.25	1.00	2.027E-06	1.47E-07
Tc-99	Beta	0.294	0.1360	0.25	1.00	2.829E-03	9.62E-05
Th-232	Alpha	4.1	0.2910	0.25	1.00	3.214E-03	2.34E-04
Ra-228	Beta	0.046	0.1360	0.00	1.00	3.214E-03	0.00E+00
Ac-228	Beta	2.13	0.1360	0.50	1.00	3.214E-03	2.19E-04
Th-228	Alpha	5.5	0.2910	0.25	1.00	3.214E-03	2.34E-04
Ra-224	Alpha	5.8	0.2910	0.25	1.00	3.214E-03	2.34E-04
U-234	Alpha	4.9	0.2910	0.25	1.00	8.270E-01	6.02E-02
U-235	Alpha	4.7	0.2910	0.25	1.00	3.720E-02	2.71E-03
Th-231	Beta	0.390	0.1360	0.25	1.00	3.720E-02	1.26E-03
U-238	Alpha	4.3	0.2910	0.25	1.00	1.270E-01	9.24E-03
Th-234	Beta	0.270	0.1360	0.25	1.00	1.270E-01	4.32E-03
Pa-234m	Beta	2.20	0.1360	0.50	1.00	1.270E-01	8.64E-03

Total Weighted Instrument Efficiency = Σ Weighted Instrument Efficiency for all Nuclides of Concern

$\Sigma =$ 8.75%

Weighted Instrument Efficiency = $\epsilon_i * \epsilon_s * \text{Yield} * \text{Activity Fraction}$

ϵ_i = 2 Pi Instrument Efficiency for Nuclide of Concern

ϵ_s = Surface Efficiency for Nuclide of Concern

<p>Meter 43-89</p>

HDP-PR-FSS-721 Final Status Survey Data Evaluation
Preliminary Data Review and Determination of Sum-of-Fractions (SOF)

MEASUREMENT ID	MEASUREMENT LOCATION	DATE MEAS	MEASUREMENT	Step 8.3.2			Corrected Net dpm/100cm ²	Fraction of DCGL
				GROSS cpm (α+β)	BKG cpm (a+b)	Net cpm (α + β)		
B05-01-01-S-O-S-00	Foundation location #1	08/29/2013	alpha + beta TSC	256	247	9	82	0%
B05-01-02-S-O-S-00	Foundation location #2	08/29/2013	alpha + beta TSC	226	247	-21	-192	0%
B05-01-03-S-O-S-00	Foundation location #3	08/29/2013	alpha + beta TSC	257	247	10	91	0%
B05-01-04-S-O-S-00	Foundation location #4	08/29/2013	alpha + beta TSC	269	247	22	201	1%
B05-01-05-S-O-S-00	Foundation location #5	08/29/2013	alpha + beta TSC	274	247	27	247	1%
B05-01-06-S-O-S-00	Foundation location #6	08/29/2013	alpha + beta TSC	301	247	54	494	3%
B05-01-07-S-O-S-00	Foundation location #7	08/29/2013	alpha + beta TSC	299	247	52	475	3%
B05-01-08-S-O-S-00	Foundation location #8	08/29/2013	alpha + beta TSC	259	247	12	110	1%
B05-01-09-S-O-S-00	Foundation location #9	08/29/2013	alpha + beta TSC	275	247	28	256	1%
B05-01-10-S-O-S-00	Foundation location #10	08/29/2013	alpha + beta TSC	313	247	66	603	3%
B05-01-11-S-O-S-00	Foundation location #11	08/29/2013	alpha + beta TSC	273	247	26	238	1%
B05-01-12-S-O-S-00	Foundation location #12	08/29/2013	alpha + beta TSC	240	247	-7	-64	0%
B05-01-13-S-O-S-00	Foundation location #13	08/29/2013	alpha + beta TSC	274	247	27	247	1%
B05-01-14-S-O-S-00	Foundation location #14	08/29/2013	alpha + beta TSC	291	247	44	402	2%
B05-01-15-S-O-S-00	Foundation location #15	08/29/2013	alpha + beta TSC	319	247	72	658	3%
B05-01-16-S-O-S-00	Foundation location #16	08/29/2013	alpha + beta TSC	301	247	54	494	3%
B05-01-17-S-O-S-00	Foundation location #17	08/29/2013	alpha + beta TSC	259	247	12	110	1%
B05-01-18-S-O-S-00	Foundation location #18	08/29/2013	alpha + beta TSC	276	247	29	265	1%
B05-01-19-S-O-S-00	Foundation location #19	08/29/2013	alpha + beta TSC	278	247	31	283	1%
B05-01-20-S-O-S-00	Foundation location #20	08/29/2013	alpha + beta TSC	312	247	65	594	3%
B05-01-21-S-O-S-00	Foundation location #21	08/29/2013	alpha + beta TSC	269	247	22	201	1%
B05-01-22-S-O-S-00	Foundation location #22	08/29/2013	alpha + beta TSC	279	247	32	293	2%
B05-01-23-S-O-S-00	Foundation location #23	08/29/2013	alpha + beta TSC	271	247	24	219	1%
B05-01-24-S-O-S-00	Foundation location #24	08/29/2013	alpha + beta TSC	344	247	97	887	5%
B05-01-25-S-O-S-00	Foundation location #25	08/29/2013	alpha + beta TSC	300	247	53	485	3%
B05-01-26-S-O-S-00	Foundation location #26	08/29/2013	alpha + beta TSC	266	247	19	174	1%
B05-01-27-S-O-S-00	Foundation location #27	08/29/2013	alpha + beta TSC	246	247	-1	-9	0%
B05-01-28-S-O-S-00	Foundation location #28	08/29/2013	alpha + beta TSC	246	247	-1	-9	0%
B05-01-29-S-O-S-00	Foundation location #29	08/29/2013	alpha + beta TSC	294	247	47	430	2%
B05-01-30-S-O-S-00	Foundation location #30	08/29/2013	alpha + beta TSC	234	247	-13	-119	0%
B05-01-31-S-O-S-00	Foundation location #31	08/29/2013	alpha + beta TSC	228	247	-19	-174	0%
B05-01-32-S-O-S-00	Foundation location #32	08/29/2013	alpha + beta TSC	252	247	5	46	0%
B05-01-33-S-O-S-00	Foundation location #33	08/29/2013	alpha + beta TSC	250	247	3	27	0%
B05-01-34-S-O-S-00	Foundation location #34	08/29/2013	alpha + beta TSC	236	247	-11	-101	0%
B05-01-35-S-O-S-00	Foundation location #35	08/29/2013	alpha + beta TSC	266	247	19	174	1%
B05-01-36-S-O-S-00	Foundation location #36	08/29/2013	alpha + beta TSC	258	247	11	101	1%
B05-01-37-S-O-S-00	Foundation location #37	08/29/2013	alpha + beta TSC	230	247	-17	-155	0%
B05-01-38-S-O-S-00	Foundation location #38	08/29/2013	alpha + beta TSC	253	247	6	55	0%
B05-01-39-S-O-S-00	Foundation location #39	08/29/2013	alpha + beta TSC	266	247	19	174	1%
B05-01-40-S-O-S-00	Foundation location #40	08/29/2013	alpha + beta TSC	243	247	-4	-37	0%
B05-01-41-S-O-S-00	Foundation location #41	08/29/2013	alpha + beta TSC	263	247	16	146	1%
B05-01-42-S-O-S-00	Foundation location #42	08/29/2013	alpha + beta TSC	383	247	136	1243	7%
B05-01-43-S-O-S-00	Foundation location #43	08/29/2013	alpha + beta TSC	290	247	43	393	2%
B05-01-44-S-O-S-00	Foundation location #44	08/29/2013	alpha + beta TSC	296	247	49	448	2%
B05-01-45-S-O-S-00	Foundation location #45	08/29/2013	alpha + beta TSC	283	247	36	329	2%
B05-01-46-S-O-S-00	Foundation location #46	08/29/2013	alpha + beta TSC	309	247	62	567	3%
B05-01-47-S-O-S-00	Foundation location #47	08/29/2013	alpha + beta TSC	271	247	24	219	1%
B05-01-48-S-O-S-00	Foundation location #48	08/29/2013	alpha + beta TSC	261	247	14	128	1%
B05-01-49-S-O-S-00	Foundation location #49	08/29/2013	alpha + beta TSC	267	247	20	183	1%
B05-01-50-S-O-S-00	Foundation location #50	08/29/2013	alpha + beta TSC	271	247	24	219	1%
B05-01-51-S-O-S-00	Foundation location #51	08/29/2013	alpha + beta TSC	266	247	19	174	1%
B05-01-52-S-O-S-00	Foundation location #52	08/29/2013	alpha + beta TSC	252	247	15	137	1%
B05-01-53-S-O-S-00	Foundation location #53	08/29/2013	alpha + beta TSC	300	247	53	485	3%
B05-01-54-S-O-S-00	Foundation location #54	08/29/2013	alpha + beta TSC	309	247	62	567	3%
B05-01-55-S-O-S-00	Foundation location #55	08/29/2013	alpha + beta TSC	294	247	47	430	2%
B05-01-56-S-O-S-00	Foundation location #56	08/29/2013	alpha + beta TSC	302	247	55	503	3%
B05-01-57-S-O-B-00	Biased location measurements #1	08/29/2013	alpha + beta TSC	495	247	248	2267	12%
B05-01-58-S-O-B-00	Biased location post sample measurement	08/29/2013	alpha + beta TSC	278	247	31	283	1%

*NOTE: Differences from documented survey results are due to rounding in Excel

Min	0
Max	2267
Mean	308
Median	219
Stdev	357.0

Average Fraction
Step 8.4.5.g
1%
DCGL₅₀
mrem SU Dose Contribution
Step 8.4.6
0.25
mrem

Instrument used for FSS Static Measurements:

08/29/2013	Survey # 3298 130829
Ludlum 2360/43-89 "B"	
Detector Area (A) = 125 cm ²	ave. ambient bkg = 247 cpm
	weighted eff (ε _w) = 0.08750
	(α + β)
TSC (dpm/100cm ²) = (gcpm-bkg) / (ε _w * (A _{net} /100 cm ²))	
DCGL (structures) = 18,925 dpm/100 cm ²	

HDP-PR-HP-314 *Unrestricted Release of Materials and Equipment*
Removable Data Evaluation

All removable alpha measurements less than MDA, max beta removable measurement 37.2 dpm/100 cm², see FSS Survey Documentation for results.

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

Sign Test					
SAMPLE ID	SAMPLE ID	Gross TSC Step 8.5.4.a	Gross TSC / Adj. Gross DCGL (W _s) Step 8.5.4.b	Difference (1-W _s) Step 8.5.4.d	Corrected Difference Step 8.5.4.e
B05-01-01-S-O-S-00	Foundation location #1	82	0.004	0.996	0.996
B05-01-02-S-O-S-00	Foundation location #2	0	0.000	1.000	1.000
B05-01-03-S-O-S-00	Foundation location #3	91	0.005	0.995	0.995
B05-01-04-S-O-S-00	Foundation location #4	201	0.011	0.989	0.989
B05-01-05-S-O-S-00	Foundation location #5	247	0.013	0.987	0.987
B05-01-06-S-O-S-00	Foundation location #6	494	0.026	0.974	0.974
B05-01-07-S-O-S-00	Foundation location #7	475	0.025	0.975	0.975
B05-01-08-S-O-S-00	Foundation location #8	110	0.006	0.994	0.994
B05-01-09-S-O-S-00	Foundation location #9	256	0.014	0.986	0.986
B05-01-10-S-O-S-00	Foundation location #10	603	0.032	0.968	0.968
B05-01-11-S-O-S-00	Foundation location #11	238	0.013	0.987	0.987
B05-01-12-S-O-S-00	Foundation location #12	0	0.000	1.000	1.000
B05-01-13-S-O-S-00	Foundation location #13	247	0.013	0.987	0.987
B05-01-14-S-O-S-00	Foundation location #14	402	0.021	0.979	0.979
B05-01-15-S-O-S-00	Foundation location #15	658	0.035	0.965	0.965
B05-01-16-S-O-S-00	Foundation location #16	494	0.026	0.974	0.974
B05-01-17-S-O-S-00	Foundation location #17	110	0.006	0.994	0.994
B05-01-18-S-O-S-00	Foundation location #18	265	0.014	0.986	0.986
B05-01-19-S-O-S-00	Foundation location #19	283	0.015	0.985	0.985
B05-01-20-S-O-S-00	Foundation location #20	594	0.031	0.969	0.969
B05-01-21-S-O-S-00	Foundation location #21	201	0.011	0.989	0.989
B05-01-22-S-O-S-00	Foundation location #22	293	0.015	0.985	0.985
B05-01-23-S-O-S-00	Foundation location #23	219	0.012	0.988	0.988
B05-01-24-S-O-S-00	Foundation location #24	887	0.047	0.953	0.953
B05-01-25-S-O-S-00	Foundation location #25	485	0.026	0.974	0.974
B05-01-26-S-O-S-00	Foundation location #26	174	0.009	0.991	0.991
B05-01-27-S-O-S-00	Foundation location #27	0	0.000	1.000	1.000
B05-01-28-S-O-S-00	Foundation location #28	0	0.000	1.000	1.000
B05-01-29-S-O-S-00	Foundation location #29	430	0.023	0.977	0.977
B05-01-30-S-O-S-00	Foundation location #30	0	0.000	1.000	1.000
B05-01-31-S-O-S-00	Foundation location #31	0	0.000	1.000	1.000
B05-01-32-S-O-S-00	Foundation location #32	46	0.002	0.998	0.998
B05-01-33-S-O-S-00	Foundation location #33	27	0.001	0.999	0.999
B05-01-34-S-O-S-00	Foundation location #34	0	0.000	1.000	1.000
B05-01-35-S-O-S-00	Foundation location #35	174	0.009	0.991	0.991
B05-01-36-S-O-S-00	Foundation location #36	101	0.005	0.995	0.995
B05-01-37-S-O-S-00	Foundation location #37	0	0.000	1.000	1.000
B05-01-38-S-O-S-00	Foundation location #38	55	0.003	0.997	0.997
B05-01-39-S-O-S-00	Foundation location #39	174	0.009	0.991	0.991
B05-01-40-S-O-S-00	Foundation location #40	0	0.000	1.000	1.000
B05-01-41-S-O-S-00	Foundation location #41	146	0.008	0.992	0.992
B05-01-42-S-O-S-00	Foundation location #42	1243	0.066	0.934	0.934
B05-01-43-S-O-S-00	Foundation location #43	393	0.021	0.979	0.979
B05-01-44-S-O-S-00	Foundation location #44	448	0.024	0.976	0.976
B05-01-45-S-O-S-00	Foundation location #45	329	0.017	0.983	0.983
B05-01-46-S-O-S-00	Foundation location #46	567	0.030	0.970	0.970
B05-01-47-S-O-S-00	Foundation location #47	219	0.012	0.988	0.988
B05-01-48-S-O-S-00	Foundation location #48	128	0.007	0.993	0.993
B05-01-49-S-O-S-00	Foundation location #49	183	0.010	0.990	0.990
B05-01-50-S-O-S-00	Foundation location #50	219	0.012	0.988	0.988
B05-01-51-S-O-S-00	Foundation location #51	174	0.009	0.991	0.991
B05-01-52-S-O-S-00	Foundation location #52	137	0.007	0.993	0.993
B05-01-53-S-O-S-00	Foundation location #53	485	0.026	0.974	0.974
B05-01-54-S-O-S-00	Foundation location #54	567	0.030	0.970	0.970
B05-01-55-S-O-S-00	Foundation location #55	430	0.023	0.977	0.977
B05-01-56-S-O-S-00	Foundation location #56	503	0.027	0.973	0.973
Number of Positive Differences (S+)					56
Sign Test Critical Value (MARSSIM Table I-3)					34

α = 0.05

MARSSIM Table I-3 Critical Values for the Sign Test Statistic S+	
N	Alpha = 0.05
4	4
5	4
6	5
7	6
8	6
9	7
10	8
11	8
12	9
13	9
14	10
15	11
16	11
17	12
18	12
19	13
20	14
21	14
22	15
23	15
24	16
25	17
26	17
27	18
28	18
29	19
30	19
31	20
32	21
33	21
34	22
35	22
36	23
37	23
38	24
39	25
40	25
41	26
42	26
43	27
44	27
45	28
46	29
47	29
48	30
49	30
50	31

For N greater than 50 use:

$$\frac{N}{2} + \frac{z}{2} \sqrt{N}$$

Where z = 1.645 (for α = 0.05)

TEST: **PASS**

If every measurement in the systematic sample population is ≤ the DCGL, a statistical test is not required.