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Direct tel:314-810-3353E-mail:pallagke@westinghouse.comOur ref:HEM-17-35Date:May 15, 2017

Subject: Westinghouse Hematite Decommissioning Project - Request for NRC Review of Final Status Survey Final Report Volume 3, Chapter 23, Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 (License No. SNM-00033, Docket No. 070-00036)

The purpose of this letter is to provide for the U.S. Nuclear Regulatory Commission review of the Final Status Survey document Final Status Survey Final Report Volume 3, Chapter 23, Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 (LSA 03-01 and LSA 03-02).

Attachment 1 contains Final Status Survey Final Report Volume 3, Chapter 23, with a CD containing Appendices.

Please contact me at 314-810-3353, should you have questions or need additional information.

Sincerely,

und Spely

Kenneth E. Pallagi Licensing Manager, Hematite Decommissioning Project

Attachment: 1) Final Status Survey Final Report Volume 3, Chapter 23, Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 (LSA 03-01 and LSA 03-02), with a CD containing Appendices (HDP-RPT-FSS-225) HEM-17-35 May 15, 2017 Page 2 of 2

cc: J. W. Smetanka, Westinghouse S. S. Koenick, NRC/DUWP/MDB J. A. Smith, NRC/DUWP/MDB

Attachment 1

Final Status Survey Final Report Volume 3, Chapter 23

Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 with CD containing Appendices

Westinghouse Electric Company LLC, Hematite Decommissioning Project

Docket No. 070-00036

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Final Status Survey Report

Hematite Decommissioning Project

Final Status Survey Final Report Volume 3, Chapter 23

TITLE:

Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 (LSA 03-01 and LSA 03-02)

REVISION:

0

EFFECTIVE DATE: MAY 1 5 2017

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HDP-RPT-FSS-225

FSSFR Volume 3, Chapter 23: Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 (LSA 03-01 and LSA 03-02)

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	LIST OF ACRONYMS AND SYM	BOLS
ALARA	As Low As Reasonably Achievable	
bgs	below ground surface	
CFR	Code of Federal Regulations	
cm	centimeter(s)	
cpm	count(s) per minute	
CSM	Conceptual Site Model	
DCGL	Derived Concentration Guideline Level	
DCGL _W	DCGL for average concentrations over a surve ("W" suffix denotes "Wilcoxon")	y unit, used with statistical tests.
DGPS	Digital Global Positioning System	
DP	Hematite Decommissioning Plan	
DQO	Data Quality Observation	
EMC	Elevated Measurement Comparison	
EPA	U.S. Environmental Protection Agency	
ft	foot (feet)	
FSS	Final Status Survey	
FSSFR	Final Status Survey Final Report	
gcpm	gross count(s) per minute	
GIS	Graphical Information Software	
GPS	Global Positioning System	
GWS	Gamma Walkover Survey	
HDP	Hematite Decommissioning Project	
HP	Health Physics	
HRCR	Hematite Radiological Characterization Report	t
HSA	Historical Site Assessment	
IAL	Investigation Action Level	
LSA	Land Survey Area	
m	meter(s)	
m ²	square meter(s)	
MARSSIM	Multi-Agency Radiation Survey and Site Inves	tigation Manual
MCL	Maximum Concentration Limit	
MDC	Minimum Detectable Concentration	
mrem	milliroentgen equivalent man	
NAD	North American Datum	
Nai	Sodium Iodiae	
ncpm	Neeleer Criticality Safety	
NCS NDC	Nuclear Criticality Safety	
NKU nCi/~	U.S. INUCLEAR REGULATORY COMMISSION	
pCI/g	Quality Control	
	Quality Collion Dadium	
ла Дат	Naululli Doquast for Additional Information	
KAI DASS	Request for Auditional Information	
NASS DSO	Rediction Safety Officer	
NЭО	Naulation Safety Officer	

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SOF SU	Sum of Fractions Survey Unit		
Tc	Technetium Tetal Effective Dece Equivalent		
Th	Thorium		
U WRS	Uranium Wilcoxon Rank Sum		

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EXECUTIVE SUMMARY

This Survey Area Release Record (SARR) presents the results of the final status radiological surveys of the Hematite Decommissioning Project (HDP) Land Survey Area (LSA) 03, Survey Unit (SU) 01 (LSA 03-01), and SU 02 (LSA 03-02). As provided in Final Status Survey Final Report (FSSFR), Volume 1, Chapter 1, Section 7.0 {ML15257A307}, the final report summary, FSSFR Volume 7, *Final Status Survey Final Report*, will be submitted at the conclusion of the post-remediation groundwater monitoring period. FSSFR Volume 7 will be submitted to demonstrate that the site has met the requirements for unrestricted release consistent with the requirements of the Title 10 Code of Federal Regulations (CFR) 20 Subpart E, "Criteria for License Termination."

The land area that comprises LSA 03-01 was initially designated as a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) Class 3 SU. Subsequently LSA 03-01 was divided into SU LSA 03-01, which remained a Class 3 SU, and LSA 03-02 which was designated a Class 2 SU.

For SU LSA 03-01 and LSA 03-02 evaluation of analytical results against the Derived Concentration Guideline Levels (DCGL) for the Uniform Stratum Conceptual Site Model (CSM) was the selected approach. The objective of the FSS for the SUs was to obtain and document measurement results, analytical data, and other supporting information in order to demonstrate that the residual radioactivity levels in LSA 03-01 and LSA 03-02 SUs are below the applicable Uniform Stratum DCGLs and therefore the land area of these SUs meet the criteria for unrestricted release.

The Uniform Stratum CSM assumes residual radioactivity is uniformly distributed over the entire depth profile of the SU from ground surface to 6.7 meter (m) below ground surface (bgs). As described in FSSFR Volume 3, Chapter 1, 6.2.1, *Systematic Soil Sampling*, systematic soil samples were obtained at depths dependent upon the systematic soil sample location.

This SARR was prepared as described in FSSFR Volume 3, Chapter 1, Section 7.0, *Survey Area Release Record Organization*, as implemented by FSS procedure HDP-PR-FSS-722.

1.0 REPORT BACKGROUND

As a result of the U. S. Nuclear Regulatory Commission (NRC) feedback regarding the submittal of the FSSFR, Westinghouse and the NRC agreed that Westinghouse would develop an outline presenting the format and content of FSS documents required for NRC review. Westinghouse provided the outline to the NRC for discussion during the August 19, 2015, publicly noticed teleconference and the format was agreed upon {ML15238B032}.

FSSFR Volume 3, Chapter 1, Revision 3, *Land Survey Areas (LSA) Overview* provides the information common to land survey areas. This report, FSSFR Volume 3, Chapter 23, builds upon the general information provided in FSSFR Volume 3, Chapter 1, Revision 3.

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2.0 HDP SITE, LSA AND SURVEY UNIT DESCRIPTIONS

2.1 HDP Site Description

A general description of the HDP site is given in FSSFR Volume 1, Chapter 1.

2.2 LSA 03 Configuration

The DP Chapter 14 and DP Figure 14-14 provided the conceptual approach for the configuration of LSAs and the SUs within a LSA. Figure 2-1 indicates the conceptual LSA configurations for the HDP site. Figure 2-2 provides the final LSA configuration for the HDP site.

LSA 03 encompasses the area west of the Site Pond. LSA 03 consists of SUs LSA 03-01 and LSA 03-02 (See Figure 2-3).

The DP stated that it was expected that the conceptual boundaries of the SUs would be altered based on the actual configuration and condition of the SU at the time of survey design. As expected, it was necessary to modify the boundary of SUs within LSA 03 to facilitate the FSS process. A portion of the land area that comprises LSA 03 was elevated in MARSSIM classification. No classification of any land area of LSA 03 was lowered, thus ensuring compliance with the DP.

2.2.1 LSA 03 Configuration Change

A small area of LSA 03 was transferred to LSA 02 and LSA 05 to ensure compliance with the DP in regards to FSS classification due to the progress of remediation work and radiological status in the Site Pond and Site Spring Area. Transferring the land areas to LSA 02 and LSA 05 resulted in those land areas being upgraded to MARSSIM Class 1. Therefore ensuring compliance with the DP for the specific land areas that were transferred. Figure 2-4 provides a depiction of the final configuration of land survey areas and survey units.

2.2.2 LSA 03 Survey Unit Configuration and Classification Change - Flooding

LSA 03 was originally designated as one SU, the Class 3 SU LSA 03-01 (see Figure 2-1).

On April 18, 2013, Jefferson County, Missouri, experienced a weather pattern that created heavy rainfall following prior rainfall that had largely saturated the soil. The heavy rainfall led to significant runoff within the watershed of Joachim Creek, creating a flash flood all along Joachim Creek. The extent of the flash flooding was sufficient to encroach upon the Hematite Decommissioning Project site, which is approximately 1000 feet from Joachim Creek. The flash flooding included two on-site tributaries to Joachim Creek, the Northeast Site Creek and the Site Creek/Pond.

To address the impacts to the site of the rain/flooding event site personnel developed and issued report HDP-RPT-EM-006, *Joachim Creek Flash Flood Event*.

The flooding caused a backup of the Site Pond. As the Site Creek is an effluent pathway for the site, radiological survey and sampling was conducted after the flood waters receded. The radiological sample results were below the DCGLs and were consistent with license conditions for site discharges. The radiological sample results for sediment, particularly samples 5079-SS-

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130424-00-02, 5079-SS-130424-00-03, and 5095-SS-130425-00-02, indicate that these areas required further evaluation as part of FSS. The LSA 03 land area to the west of the Site Pond/Creek that had standing water as a result of the April 18, 2013 flooding was established as LSA 03-02 and designated as Class 2 SU for FSS. The unaffected area of LSA 03 remained designated as LSA 03-01 a Class 3 SU.

The SU configuration and classification change was reviewed by NRC Region III as documented in Inspection Report 07000036/2014002 {ML14160B134}.

2.3 LSA 03-01 Survey Unit Description and Configuration

The LSA 03-01 SU is comprised of the land area that contains the western most portion of the site adjacent to the Site Pond, and borders State Road P within the Westinghouse site property boundary. The land area is an open field with a small number of trees. Due to its location west of the Site Pond it was not amenable to and was not utilized during site licensed operations. During site remediation activities the SU was used to store reuse soil collected from the construction of the Site Pond Diversion. As prepared for FSS the SU consists of native soils, grass and a small number of trees.

In its final configuration as prepared for FSS, LSA 03-01 presents 10,540 square meters (m²) in planar (2-dimensional) extent.

2.4 LSA 03-02 Survey Unit Description and Configuration

The LSA 03-02 SU is comprised of the land area southwest and adjacent to the Site Pond and Site Pond Dam. The land area is an open field with a small number of trees. As prepared for FSS the SU consists of native soils, grass and a small number of trees.

In its final configuration as prepared for FSS, LSA 03-02 presents 2,553 m^2 in planar (2-dimensional) extent.









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3.0 HISTORY OF OPERATIONS

A discussion of site historical operations prior to the decommissioning phase of the HDP is presented in the FSSFR Volume 1, Chapter 1, Section 3.0, *Site Historical Operations*.

The LSA 03 land area is west of and adjacent to the Site Creek and Site Pond. The Historical Site Assessment (HSA) determined that prior to purchase of the property by Mallinckrodt for licensed activities, the LSA 03 land area consisted of the homestead for the dairy farm that was located on the site property. Aerial photographs in the HSA indicate that by 1971 the homestead no longer existed. During site operations due to its location west of the Site Pond it was not amenable to and was not utilized during site operations.

To accomplish remediation of the Site Pond it was necessary to divert flow from the Site Spring to allow the Site Pond to be drained and then remediated. Due to its location away from land areas subject to site operation the land area that comprises LSA 03-01 was utilized to construct the Site Pond Diversion and to process and store the reuse soil that was generated within LSA 03-01.

3.1 Radioactive Materials in LSA 03-01 and LSA 03-02

The land area that comprises LSA 03-01 and LSA 03-02 was not used during the operational history of the site, and as such had no history of radioactive materials present within the boundaries of the SUs.

As described in Section 2.2.2 flooding that occurred on April 18, 2013, provided a potential for transfer of radioactive material suspended in the Site Pond water to be deposited on the land area that comprises LSA 03-02. The radioactive material in LSA 03-01 and LSA 03-02 is consistent with the Radionuclides of Concern as described in FSSFR Volume 1, Chapter1.

3.2 Reuse Soil Disposition and Characterization

During remediation operations, LSA 03-01 was used to process and store the reuse soil that was generated from the construction of the Site Pond Diversion. During the construction of the Site Pond Diversion the soil that was excavated to construct the diversion was placed within LSA 03-01 and LSA 03-02 with the intent to return the soil to the area upon restoration of the area. The soil was designated as Reuse Soil Stockpile 8b and processed in accordance with site procedures (See Figure 3-1). The radiological data for Reuse Soil Stockpile 8b is contained in FSSFR Volume 2, Chapter 6 {ML16285A368}.

The successful processing of Reuse Soil Stockpile 8b indicated that there was no impact to the land area of LSA 03-01 from site remediation activities. As such the Class 3 classification of LSA 03-01 remained appropriate.

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Figure 3-1 Construction of Site Pond Diversion and Reuse Soil Stockpile 8b



3.3 Remediation and Remedial Action Support Surveys (RASS) Phase of LSA 03-01 and LSA 03-02

Based upon the results of the Final RASS and FSS field activities performed in LSA 03 no remediation was required to be performed in LSA 03-01 and LSA 03-02.

3.3.1 Nuclear Criticality Safety (NCS) Borings

NCS Borings were not required within LSA 03 as the land area of the SUs was never subject to NCS controls.

3.3.2 Groundwater Monitoring Wells

A detailed discussion of history, purpose, use, issues, and results of the groundwater monitoring wells at HDP is presented in the FSSFR Volume 6, Chapter 1.

Two groundwater monitoring wells (both bedrock design) are located within the boundary of SU LSA 03-01. Bedrock groundwater monitoring well BR-01-JC is currently in service and is screened in the Jefferson City-Cotter bedrock formation. Bedrock monitoring well BR-01-RB is currently in service and is screened in the Roubidoux bedrock formation. Both of these wells will continue to be monitored as part of the post-remediation groundwater monitoring. See FSSFR Volume 6, Chapter 1 for a discussion on post-remediation groundwater monitoring.

No monitoring wells were/are installed within the boundary of LSA 03-02.

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3.3.3 Subterranean Piping

No buried piping existed or exists within the footprint of LSA 03-01, and LSA 03-02. As such, there is no dose contribution from this pathway.

3.3.4 Characterization History

Radiological characterization surveys for the HDP were conducted in several phases by multiple contractors over several years prior to the approval of the DP. During the various characterization campaigns a total of seven (7) core borings to depths as deep as 15 feet bgs were performed for within LSA 03. None of these characterization sample results produced elevated Uniform SOF results. For these samples the maximum result was 0.05 Uniform SOF. Therefore the MARSSIM Class 2 and Class 3 classification were determined to be appropriate for FSS as no remediation was required in LSA 03.

3.3.5 Remedial Action Support Survey for FSS Design

RASS was conducted within LSA 03-01 and LSA 03-02, 1) to determine when a SU had been adequately prepared for FSS, and 2) to provide updated estimates of the parameters to be used for planning the FSS. Upon the completion of remediation of the SU and prior to implementation of FSS activities, a Final RASS was performed to validate the status of the SU prior to implementing Isolation and Control postings.

The RASS included a GWS, systematic surface sample collection based on an eight (8) point triangular grid, and biased surface sampling. The Final RASS results were used to develop the FSS Plan for each SU. The Final RASS systematic sample results used to develop the FSS sampling grid are summarized in Table 3-1 below.

LSA	Ra-22	6 (net)	Тс	-99	Th-23	2 (net)	U-2	234	U-2	235	U-2	238
2011	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max
03-01	<bkg< th=""><th><bkg< th=""><th>0.06</th><th>0.10</th><th>0.08</th><th>0.25</th><th>2.39</th><th>4.61</th><th>0.13</th><th>0.25</th><th>1.29</th><th>1.78</th></bkg<></th></bkg<>	<bkg< th=""><th>0.06</th><th>0.10</th><th>0.08</th><th>0.25</th><th>2.39</th><th>4.61</th><th>0.13</th><th>0.25</th><th>1.29</th><th>1.78</th></bkg<>	0.06	0.10	0.08	0.25	2.39	4.61	0.13	0.25	1.29	1.78
03-02	0.02	0.07	0.04	0.09	0.11	0.23	1.81	2.50	0.10	0.14	1.02	1.27
DCGL ³	1	.9	25	5.1	2	.0	19	5.4	51	.6	16	8.8

Table 3-1	
Summary of Final RASS Results for LSA 03-01 and LSA 03-02	2

Notes:

1. All units are in picocuries per gram (pCi/g)

2. Results reflect net concentrations after subtraction of background (Ra-226 bkg = 0.9 pCi/g; Th-232 bkg = 1.0 pCi/g).

3. Uniform Stratum DCGLs (From Table 4-1)

All Final RASS systematic sample and biased sample results were less than the appropriate DCGL_W, therefore the Final RASS data set was considered sufficient to support FSS design.

3.3.6 Isolation and Control

As directed by HDP-PR-HP-602, *Data Package Development and Isolation and Control Measures to Support Final Status Survey*, in June of 2015, the SUs in LSA 03 were isolated and controlled in accordance with Work Package HDP-WP-ENG-803, *Isolation and Control Measures*, (See Figure 3-2). Only limited isolation and control measures were required for LSA 03-01 and LSA 03-02 as they were Class 2 and Class 3 SUs, and as the adjacent LSA 02 (Site Pond) area was already subjected to isolation and control protocols. To ensure the integrity of

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the FSS the only isolation controls necessary were the placement of straw waddles between the boundaries of LSA 03-01 and LSA 03-02, and surrounding the reuse soil stockpile remaining in LSA 03-01.

The administrative control of multiple postings labeled "Contact Health Physics Prior to Entry" were installed around the entire perimeter of the SUs prior to FSS field activities to prevent inadvertent entry by site personnel. The LSA 03 SUs are isolated from the remainder of the property by the Site Pond Diversion and are bounded by the public roadway State Road P.



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3.4 Surveillance Following FSS

Following the completion of a FSS, the DP requires continued surveillance to minimize the potential to re-contaminate a SU (e.g., surface water transport of potentially contaminated sediment or a soil pile that was not present during FSS).

During the timeframe since the completion of FSS field activities to the date of completion of all physical work at HDP and project demobilization, LSA 03-01 and LSA 03-02 did not evidence an event that would cause them to be suspect and thus require investigation.

3.5 Backfill of Survey Units

As there were no remediation excavation activities in LSA 03 there were no backfill activities required to fill excavations. During the restoration phase of the project Reuse Soil Stockpile 8b was used to establish the final grade contour in LSA 03 for proper drainage. As such, the dose associated with Reuse Soil Stockpile 8b will be added to the total dose for LSA 03-01 and LSA 03-02.

3.6 Groundwater Monitoring

In response to NRC RAI Chapter 3-4, during the review and approval process for the DP, Westinghouse documented in letter HEM-11-96 {ML111880290} the revised text of DP Section 14.5.1 to be as follows:

"Post-remediation monitoring wells will be sampled quarterly after the completion of remediation until license termination. The data collected will be used to confirm that the sum of the annual dose from groundwater for all the radionuclides does not exceed the EPA Maximum Contaminant Level (MCL) of 4 millirem/year. Separately, the sum of the dose from all residual sources remaining after remediation, including soil and groundwater pathways, will be confirmed to result in an annual dose that does not exceed 25 millirem/year."

As stated in the Executive Summary section, the exposure results of this report will be combined with the dose attributed to groundwater to demonstrate that the site has met the requirements for unrestricted release consistent with the requirements of the Title 10 CFR 20 Subpart E, "Criteria for License Termination." As such, for the purpose of this report, groundwater will be assigned a conservative SOF of 0.16 which equates to 4 mrem/yr until such time that the post-remediation groundwater sampling has been completed and reported as part of FSSFR Volume 6, Chapter 7, *Post-remediation Groundwater Monitoring Summary*. The final dose for LSA 03-01 and LSA 03-02 will be reported in FSSFR Volume 7, reflecting the updated results of the post-remediation groundwater monitoring.

4.0 LSA RELEASE CRITERIA

As the release criteria for all LSA SUs is common, FSSFR Volume 3, Chapter 1, Section 3.0, *Release Criteria*, provides a detailed discussion on the release criteria that is applicable to LSA 03-01 and LSA 03-02. Table 4-1 provides the applicable DCGLs.

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Table 4-1 Adjusted Soil DCGL_w's by CSM^a

	Three Layer A	Uniform		
Radionuclide	Surface Stratum	Root Stratum	Excavation Scenario	Stratum (nCi/g)
Radium-226+C ^d	5.0	2.1	5.4	<u>(p = 2 g)</u> 1.9
Technetium-99	151.0	30.1	74.0	25.1
Thorium-232+C ^d	4.7	2.0	5.2	2.0
Uranium-234	508.5	235.6	872.4	195.4
Uranium-235+D ^c	102.3	64.1	208.1	51.6
Uranium-238+D ^c	297.6	183.3	551.1	168.8

^a Table as presented in FSSFR Volume 3, Chapter 1. ^b The reported DCGLw's are the activities for the parent radionuclide and were calculated to account for the dose contribution from insignificant radionuclides. ^c+D indicates the DCGL_w includes short-lived (half-life ≤ 6 mo.) decay products. ^d+C indicates the DCGL_w includes all radionuclides in the associated decay chain.

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5.0 FINAL STATUS SURVEY DESIGN LSA 03-01

This section of the report describes the method for determining the number of samples required for the FSS of LSA 03-01 as well as summarizing the applicable requirements of the FSS Plan. These include the $DCGL_W$, scan survey coverage, and Investigation Action Levels (IAL). The radiological instrumentation used in the FSS of LSA 03-01 and the detection sensitivities are also discussed.

5.1 FSS Plan Design Requirements

FSS Plan requirements for LSA 03-01 were driven by the type (Open Land) and Class (Class 3) of the SU and developed in accordance with HDP procedure, HDP-PR-FSS-701, Revision 8, *Final Status Survey Plan Development*, August 2015.

5.1.1 Surrogate Evaluation Areas

A discussion of Surrogate Evaluation Areas is given in the FSSFR Volume 3, Chapter 1, Section 5.0, *Final Status Survey Design*.

5.1.2 **DCGL**_W

During the FSS design process a review was performed of the RASS data for LSA 03-01. The RASS data was used as confirmation that no known areas of residual radioactivity remained within the SU that exceeded the Uniform Stratum $DCGL_W$. Therefore the Uniform Stratum $DCGL_W$ was selected for use in demonstrating compliance with the release criteria.

5.1.3 GWS Coverage

As a Class 3 SU, LSA 03-01 was required to undergo a minimum of a 10% GWS.

5.1.4 Instrumentation

Radiological instrumentation selected for performance of GWS within LSA 03-01 was the Ludlum 44-10 2" x 2" sodium iodide (NaI) detectors, coupled to a Ludlum 2221 scaler-ratemeter.

5.1.5 Scan Minimum Detectable Concentration (MDC)

Scan MDCs for LSA 03-01 were calculated in accordance with HDP-PR-FSS-701, Revision 10, *Final Status Survey Plan Development* and HDP-TBD-FSS-002, Revision 3, *Evaluation and Documentation of the Scanning Minimum Detectable Concentrations (MDC) for Final Status Surveys (FSS)*. As background levels were approximately 9,000 counts per minute (cpm) within LSA 03-01, the Scan MDC calculation for total uranium given in HDP-PR-FSS-701, *Final Status Survey Plan Development*, Step 8.2.6.d, was applied:

Scan MDC (total uranium) =
$$\frac{1}{\left(\left(\frac{f_{U-234}}{3471 \, pCi/g}\right) + \left(\frac{f_{U-235}}{2.20pCi/g}\right) + \left(\frac{f_{U-238}}{29.0 \, pCi/g}\right)\right)}$$

Equation 5-1

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To determine isotopic Uranium fractions HDP-PR-FSS-701, Revision 10, *Final Status Survey Plan Development* assumes that the average LSA enrichment is 4% or less. Based on the systematically collected RASS samples in LSA 03-01, the average enrichment for the SU was 1.6%. All other Scan MDC parameters agreed upon between Westinghouse and the NRC were applied (e.g. use of a 2 in air gap, scan rate of 1 ft/sec, 0.75 surveyor efficiency), therefore no subsequent changes to the calculated Scan MDCs need to be made.

Prospectively calculated Scan MDCs for 2" x 2" NaI detectors that were used in LSA 03-01 are shown below:

Table 5-1Scan MDCs for 2" x 2" NaI detector, 9,000 cpm background: LSA 03-01

	Scan MDC (Total U)	DCGLw (Total U)	Scan MDC (Ra-226)	DCGLw* (Ra-226)	Scan MDC (Th-232)	DCGLw* (Th-232)
LSA 03-01	38.8	54.1	1.14	2.8	0.82	3.0

*DCGL_w includes background concentrations of 0.9 pCi/g for Ra-226 (no ingrowth) and 1.0 pCi/g for Th-232. DCGLw values are based on the Uniform Stratum release criteria.

The values in Table 5-1 reflect those presented in the FSS Plan prepared for SU LSA 03-01 prior to FSS.

5.1.6 Investigation Action Level

FSSFR Volume 3, Chapter 1, Section 6.1.3, *Investigation Action Level (IAL)*, provides a discussion in regards to the IAL. The basis of the IAL is detailed in HDP-TBD-FSS-003, *Modeling and Calculation of Investigative Action Levels for Final Status Soil Survey Units*. The IAL used during the GWS of LSA 03-01 was established at 1,624 ncpm, which is the equivalent of an activity concentration that is less than the Uniform Stratum DCGL_W.

5.1.7 LSA 03-01 FSS Design Summary

The FSS Plan for LSA 03-01 can be found in Appendix D. Table 5-2 presents an overall FSS design and implementation summary for LSA 03-01.

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FSS Design Summary for LSA 03-01

Scan Coverage		Mini	Minimum 10% of LSA 03-01 total area			
Scan MDC		38.8 1.14 back	pCi/g total Uranium; 0.82 pCi/g Th-232; pCi/g Ra-226 (based on a 9,000 cpm ground)*			
Investigation Action Level (IAL)		1,624	net cpm **			
Systematic Sampling Locations:						
Depth	Number of S	ample	Comments			
0 – 15 cm (Surface)	8		These samples will be taken on a			
15 cm – 1.5 m (Root)	8		systematic orid ***Excavation stratum			
> 1.5m (Excavation)	8***		samples will be collected and archived, but will be analyzed <i>only</i> in the event the overlying root stratum sample exceeds a SOF of 0.5			
Biased Survey/Sampling Locations	•					
Collect a minimum of one biased sample at the maximum GWS measurement within the SU. Biased samples may be collected during GWS at the discretion of the HP Technician, after statistical analysis of the survey data, or at the direction of the FSS Supervisor. Sidewall Sampling Locations: Supplemental Sidewall Sampling: Not applicable; SU is an unexcavated (remediation not required) Class						
Instrumentation:						
Ludlum 2221 with 44-10 (2x2 NaI) detector Used for GWS and to obtain static count rates at biased measurement locations						
Ludlum 2221 with 44-10 (2x2 NaI) d	etector	biased n	GWS and to obtain static count rates at neasurement locations.			

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6.0 FINAL STATUS SURVEY IMPLEMENTATION LSA 03-01

FSS was performed in accordance with procedure HDP-PR-FSS-711, *Final Status Surveys and Sampling of Soil and Sediment*.

6.1 Gamma Walkover Survey

6.1.1 Instrumentation

The selected instrumentation to perform the GWS in LSA 03-01 was a 2" x 2" NaI detector in combination with a Ludlum 2221 rate meter. Each NaI instrumentation set was interfaced with a Trimble DGPS (Digital Global Positioning System) and handheld data logger.

Prior to the first field use of the GWS instrumentation, initial set-ups were performed. Also, daily pre- and post-use source checks were performed for each day that GWS was performed within the SU. Initial set-ups, daily source checks, and control charting were performed according to the requirements of HDP-PR-HP-416, *Operation of the Ludlum 2221 for Final Status Survey*.

6.1.2 GWS Performance

All GWS measurements were collected with the NaI detector(s) were connected to a Trimble DGPS and with a hand-held data logger. The logging frequency in the SU was 1 GWS measurement per second. Each gross gamma measurement is correlated to a set of coordinates based on the Missouri East State Plane, NAD 1983.

The GWS requirements involved moving the NaI detector in a side-to-side fashion no faster than 1 foot per second while holding the probe as close as possible to the excavation surface (nominally 1", but not to exceed 3"). At the same time, the Health Physics (HP) Technician was required to slowly advance, causing the detector to trace out a serpentine path over the excavation surface.

HP Technicians performing GWS in LSA 03-01 used the 1,624 ncpm IAL as a field guide to know when to slow or pause the GWS for more deliberate investigation. If during the GWS, audible count rates noticeably increase above the general area average (i.e., > minimum detectable count rate), HP Technicians were required to pause momentarily and observe count rates. If sustained count rates approached the IAL, further focused investigation was conducted within the locally elevated area.

To use the IAL effectively, HP Technicians first determined the local background count rate before starting the GWS. Although the ambient gamma level may vary across the SU due to the geometry and relative distance from contaminated materials in nearby remedial excavations, the average background rate (measured at waist level) within the LSA ranged between 9,000 and 10,000 gross counts per minute (gcpm). Therefore, at locations where the 2" x 2" NaI detector measurements exceeded 10,624 to 11,624 gcpm, HP Technicians slowed or paused the GWS for more careful investigation of the small areas of elevated activity before deciding if "flagging" a point for potential biased sampling was warranted.

After the GWS survey was complete, the GPS/GWS data was reviewed by Radiological Engineering and the HP Technician performing the survey to determine if possible areas of

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elevated residual activity remained within the SU that required biased sample investigation. Areas that were flagged by the HP Technician were considered, as well as a statistical evaluation of the GWS data set. The statistical evaluation determined the mean count rate and standard deviation associated with the GWS and then could be used to identify any areas that exceeded 3 standard deviations above the mean. The number of biased samples to be collected and the locations are based on flagged locations exceeding the IAL, the statistical evaluation of the GWS data set, and the professional judgment of Radiological Engineering.

6.2 Soil Sampling

6.2.1 Systematic Soil Sampling Summary

Table 6-1 provides a summary of systematic sampling by stratum for LSA 03-01.

	systematic sum		sj stratam is		
	SUArea		Systematic		
LSA	planar (m ²)	Surface	Root	Deep (Excavation)	QC
03-01	10,540	8	8	0	2

Table 6-1Systematic Sampling Summary by Stratum for LSA 03-01

6.2.2 Systematic Sampling LSA 03-01

Within LSA 03-01, there were 8 systematic locations in which the surface stratum [0 - 15] centimeters (cm)] was sampled in the SU. The underlying root stratum was also sampled at all 8 locations. Excavation stratum samples were collected at all 8 locations, although they were not required to be analyzed since no root stratum sample exceeded a 0.5 Uniform SOF.

While there were eight (8) systematic locations on the LSA 03-01 sampling grid, a total of eighteen (18) samples were collected and analyzed at these locations, including:

- Eight (8) samples collected and analyzed within the surface stratum
- Eight (8) samples collected and analyzed within the root stratum
- Zero (0) samples analyzed within the excavation, or "deep" stratum
- Two (2) Quality Control (QC) field replicate

Figure 6-1 presents the map of the eight systematic sample locations, and three sediment sample locations, which were sampled within LSA 03-01. The inset table notes the location coordinates (Missouri East, North American Datum (NAD) 1983) and collection intervals for each systematic location.

Page 20 of 65 -SA 03-01 Systematic Sample Locations LSA 03-01 10,540 m² Planar Area FSSFR Volume 3, Chapter 23: Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 (LSA 03-01 and LSA 03-02) /320 Feet L03-01-16-P-S-S-00
L03-01-17-P-R-S-00 L03-01-19-P-S-S-00 L03-01-20-P-R-S-00 L03-01-10-P-S-S-00
L03-01-11-P-R-S-00 L03-01-04-P.S.S-00 03-01-05-P.R.S-00 L03-01-05-P.R.Q-00 L03-01-13-P-S-S-00 L03-01-14-P-R-S-00 Figure 6-1 LSA 03-01 Systematic Soil Sample Locations L03-01-22-P-S-S-00
L03-01-23-P-R-S-00 Π \$ L03-01-07-P-S-5-0 L03-01-08-P-R-S-00 Northing Easting (feet) ecommissioning Project (feet) (inches) Depth End (inches) Depth Start 9 0 9 0 0-0-0--S-00 -S-00 0-0--S-00 -S-00 L03-01-22-P-5-500 L03-01-23-P-R-S-00 Revision: 0



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Table 6-2 below presents a tabular listing of all FSS samples collected within LSA 03-01 with associated IDs, sample types, collection intervals, coordinates, and notes.

Table 6-2 FSS Sample Locations and Coordinates for LSA 03-01

APPI AEASUREME Elevation* 430.3 429.8 430.1 429.6 438.0 437.5	ENDIX P-4 NT LOCATIO Description: Classification End Elevation* 429.8 425.3 429.6 425.2 437.5 433.1	NS & COORD : Northing** (Y Axis) 863957 863957 863957 864105 864105 864187	INATES Plant Op West of Site C Easting** (X Axis) 826599 826617 826617 826617 826457	Revision: 10 en Land Area Pond in "Area 5" Class 3 Remarks / No Surface 6-inch Root 5-foot con Surface 6-inch Root 5-foot con	Appendix P-4 Page 1 of 1	
APPI MEASUREME Start Elevation* 430.3 429.8 430.1 429.6 438.0 437.5	ENDIX P-4 NT LOCATIO Description: Classification End Elevation* 429.8 425.3 429.6 425.2 437.5 433.1	NS & COORD : Northing** (Y Axis) 863957 863957 863957 864105 864105 864187	Easting** (X Axis) 826599 826617 826617 826457	een Land Area Pond in "Area 5" Class 3 Remarks / No Surface 6-inch Root 5-foot con Surface 6-inch Root 5-foot con	otes grab posite grab posite	
Start Elevation* 430.3 429.8 430.1 429.6 438.0 437.5	Description: Description: Classification End Elevation* 429.8 425.3 429.6 425.2 437.5 433.1	: Northing** (Y Axis) 863957 863957 863957 864105 864105 864105 864187	Plant Op West of Site C Easting** (X Axis) 826599 826599 826617 826617 826457	Pen Land Area Pond in "Area 5" Class 3 Remarks / No Surface 6-inch Root 5-foot con Surface 6-inch Root 5-foot con Surface 6-inch	otes grab posite grab posite	
Start Elevation* 430.3 429.8 430.1 429.6 438.0 437.5	Description: Classification End Elevation* 429.8 425.3 429.6 425.2 437.5 433.1	Northing** (Y Axis) 863957 863957 864105 864105 864105 864187	West of Site C Easting** (X Axis) 826599 826617 826617 826617 826457	Pond in "Area 5" Class 3 Remarks / No Surface 6-inch Root 5-foot con Surface 6-inch Root 5-foot con	grab grab grab grab grab	
Start Elevation* 430.3 429.8 430.1 429.6 438.0 437.5	End Elevation* 429.8 425.3 429.6 425.2 437.5 433.1	Northing** (Y Axis) 863957 863957 864105 864105 864187	Easting** (X Axis) 826599 826617 826617 826617 826457	Remarks / No Surface 6-inch Root 5-foot con Surface 6-inch Root 5-foot con	grab posite grab grab	
Start Elevation* 430.3 429.8 430.1 429.6 438.0 437.5	End Elevation* 429.8 425.3 429.6 425.2 437.5 433.1	Northing** (Y Axis) 863957 863957 864105 864105 864187	Easting** (X Axis) 826599 826699 826617 826617 826457	Remarks / No Surface 6-inch Root 5-foot con Surface 6-inch Root 5-foot con	grab grab grab grab posite	
430.3 429.8 430.1 429.6 438.0 437.5	429.8 425.3 429.6 425.2 437.5 433.1	863957 863957 864105 864105 864187	826599 826599 826617 826617 826457	Surface 6-inch Root 5-foot con Surface 6-inch Root 5-foot con	grab posite grab posite	
429.8 430.1 429.6 438.0 437.5	425.3 429.6 425.2 437.5 433.1	863957 864105 864105 864187	826599 826617 826617 826457	Root 5-foot con Surface 6-inch Root 5-foot con	posite grab	
430.1 429.6 438.0 437.5	429.6 425.2 437.5 433.1	864105 864105 864187	826617 826617 826457	Surface 6-inch Root 5-foot con	grab	
429.6 438.0 437.5	425.2 437.5 433.1	864105 864187	826617 826457	Root 5-foot con	nposite	
438.0 437.5	437.5 433.1	864187	826457	Surface 6 inch		
437.5	433.1			Surface 0-men	grab	
		864187	826457	Root 5-foot con	posite	
437.4	436.9	864219	826534	Surface 6-inch grab		
436.9	432.5	864219	826534	Root 5-foot con	nposite	
435.2	434.7	864261	826593	Surface 6-inch	grab	
434.7	430.2	864261	826593	Root 5-foot con	nposite	
431.9	431.4	864281	826670	Surface 6-inch	grab	
431.4	426.9	864281	826670	Root 5-foot con	nposite	
433.4	432.9	864337	826639	Surface 6-inch	grab	
432.9	428.5	864337	826639	Root 5-foot con	nposite	
437.5	437.1	864366	826559	Surface 6-inch	grab	
437.1	432.6	864366	826559	Root 5-foot con	nposite	
430.3	429.8	863957	826599	Root 5-foot con	posite	
429.6	425.2	864105	826617	Surface 6-inch	grab	
436.7	436.2	864274	826568	Surface 6-inch	grab	
	432.9 437.5 437.1 430.3 429.6 436.7	432.9 428.5 437.5 437.1 437.1 432.6 430.3 429.8 429.6 425.2 436.7 436.2	432.9 428.5 864337 437.5 437.1 864366 437.1 432.6 864366 430.3 429.8 863957 429.6 425.2 864105 436.7 436.2 864274	432.9 428.5 864337 826639 437.5 437.1 864366 826559 437.1 432.6 864366 826559 430.3 429.8 863957 826599 429.6 425.2 864105 826617 436.7 436.2 864274 826568	432.9 428.5 864337 826639 Root 5-foot con 437.5 437.1 864366 826559 Surface 6-inch 437.1 432.6 864366 826559 Root 5-foot con 430.3 429.8 863957 826599 Root 5-foot con 429.6 425.2 864105 826617 Surface 6-inch 436.7 436.2 864274 826568 Surface 6-inch	

ample location, for use in WRS test.

*Elevations are in feet above mean sea level.

** Missouri - East State Plane Coordinates [North American Datum (NAD) 1983] (Open Land Area) OR

Distance in feet from lower left corner of the surface (Structures); each surface has its own (X,Y) = (0,0); OR

For piping the distance from the beginning of the survey unit.

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

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

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

Quality Record

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6.3 Biased Soil Sampling

As discussed in FSSFR Volume 3, Chapter 1, Section 6.1.3, there are three key methods for identifying areas for biased soil sampling, the IAL, the Z-score of the FSS GWS, and the professional judgment of the HP Staff. For LSA 03-01 one (1) biased sample location was selected within the SU based on the evaluation of the GWS survey data and HP Technician professional judgment. The biased location represented the maximum GWS measurement encountered within the SU. Biased samples are collected at the prescribed location to a depth of 6 inches below the exposed ground surface.

6.4 Judgmental/Sidewall Sampling for Tc-99

As an unexcavated Class 3 SU, no Tc-99 sidewall sampling was required for LSA 03-01.

6.5 Quality Control Soil Sampling

Two QC field duplicate sample point were randomly selected and collected at systematic locations L03-01-01 and L03-01-05 for LSA 03-01.

7.0 FINAL STATUS SURVEY RESULTS LSA 03-01

7.1 Gamma Walkover Survey

Post-processed GPS coordinate data is accurate to within ± 0.1 m for the handheld GPS models used during the GWS. The GWS maps are plotted and presented in a 2-D format. When multiple data points are collected at the same GPS location during the walkover, the most elevated radiological measurements are plotted.

GWS measurements were collected in LSA 03-01 from September 30, 2015 to October 6, 2015.

7.1.1 GWS Results for LSA 03-01

For LSA 03-01, GWS count rates ranged between 7,106 gcpm and 13,925 gcpm, with a mean count rate of 10,438 gcpm. The median count rate was 10,461 gcpm and the standard deviation was 589 cpm. Figure 7-1 below presents a map of the complete GWS data set.

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Figure 7-1 Colorimetric GWS Plot for LSA 03-01



An evaluation of the entire GWS data set was performed to evaluate those small areas of elevated activity which exceeded three (3) standard deviations above the GWS mean measurement, (i.e., "+3 Z-score"). One location, L03-01-25 was selected for biased sample collection. The biased location represented the maximum GWS measurement encountered within the SU.

Figure 7-2 below presents a map of the +3 Z-score GWS measurements within LSA 03-01, including the selected biased sampling location.

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All GWS data collected in LSA 03-01 was datalogged and post-processed in Graphical Information Software (GIS).

7.1.2 GWS Coverage Results LSA 03-01

As a Class 3 SU LSA 03-01 was required to undergo a minimum of a 10% GWS as specified by the FSS Plans. The GWS coverage for FSS was 25.3% of the SU surface.

7.2 Soil Sample Results LSA 03-01

Appendix A presents the analytical results and associated statistics for all FSS surface samples collected within LSA 03-01.

7.2.1 Surface Soil Sample Results LSA 03-01

There were eight systematic samples collected within the surface stratum (0 - 15 cm) of LSA 03-01. Additionally one QC sample and one biased sample were collected in the topmost layer of soil. The maximum Uniform SOF result for the surface samples was 0.18.

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7.2.2 Subsurface Soil Sample Results LSA 03-01

There were eight systematic locations within LSA 03-01 where root stratum composite sampling was necessary. Additionally there was one QC sample collected from the root stratum. The root stratum zone is between 0.15 and 1.50 m below the surface. At all of the eight root stratum composite sampling locations, the top six inches (1.50 - 1.65 m below final grade surface) of the underlying excavation stratum was also collected, however these excavation samples were not required to be analyzed as no overlying root stratum sample exceeded a 0.5 SOF. The maximum SOF result of the subsurface samples collected in LSA 03-01 was 0.19.

7.2.3 WRS Test Evaluation

Per Step 7.8.3 of HDP-PR-FSS-721 *Final Status Survey Data Evaluation*, the Wilcoxon Rank Sum (WRS) statistical test was not required for LSA 03-01 since the difference between the maximum SU data set gross SOF and the minimum background area SOF was less than one using the Uniform Stratum criteria. However, for illustrative purposes, the WRS Test evaluation was still performed for LSA 03-01. All systematically collected samples regardless of depth are used to perform the WRS Test, however biased and QC sample results are not utilized in the WRS Test. The 22 systematically collected samples in LSA 03-01 were ranked against the adjusted activity concentrations of the 32 samples collected within the Background Reference Area. The SU passed the WRS Test since the ranked sum of the reference area ranks, or test statistic W_R , (1040) was greater than the critical value (860) for the test. As such, the null hypothesis that the SU average concentration is greater than the DCGL_W was rejected. The WRS Test Evaluation is also included in Appendix A.

7.2.4 Graphical Data Review LSA 03-01

Table 7-1 below presents summary results for the all systematically collected samples (includes surface, and root, but not biased or QC samples) collected within LSA 03-01, and the associated SOF when compared to the Uniform Stratum DCGL_{WS}. The arithmetic average concentration resulted in a SOF of 0.09.

Statistic	Ra-226 DCGL = 1.9 BKG = 1.07 (pCi/g)	Tc-99 DCGL = 25.1 (pCi/g)	Th-232 DCGL = 2.0 BKG = 1.0 (pCi/g)	U-234 DCGL=195.4 (pCi/g)	U-235 DCGL=51.6 (pCi/g)	U-238 DCGL=168.8 (pCi/g)	Sample SOF (Uniform DCGL)
Average	0.053	0.222	0.065	1.879	0.099	1.091	0.09
Minimum	0.00 (<bkg)< td=""><td>0.00 (NEG)</td><td>0.00 (<bkg)< td=""><td>0.746</td><td>0.033</td><td>0.634</td><td>0.02</td></bkg)<></td></bkg)<>	0.00 (NEG)	0.00 (<bkg)< td=""><td>0.746</td><td>0.033</td><td>0.634</td><td>0.02</td></bkg)<>	0.746	0.033	0.634	0.02
Maximum	0.160	1.070	0.180	3.615	0.199	1.780	0.19

 Table 7-1

 LSA 03-01 FSS Sample Data Summary and Calculated SOF Values (Systematic)

Notes:

1. Ra-226 and Th-232 background activities subtracted prior to calculating SOF value. Ra-226 background without ingrowth = 0.9 pCi/g; Ra-226 background with ingrowth = 1.07 pCi/g. Negative SOF components are set to zero in SOF calculation.

2. Average SOF for data set calculated using average radionuclide concentrations.

3. U-234 values are inferred from the U-235/U-238 ratio.
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Survey Units 01 and 02 (LSA 03-01 and LSA 03-02) | and Survey Area 03, |
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Section 8.2.2.2 of MARSSIM recommends a graphical review of FSS analytical data, to include at a minimum, a posting plot and a histogram. A frequency plot, or histogram, is a useful tool for examining the general shape of a data distribution. This plot is a bar chart of the number of data points within a certain range of values. The frequency plot will reveal any obvious departures from symmetry, such as skewness or bimodality (two peaks), in the data distribution for the SU. The presence of two peaks in the SU frequency plot may indicate the existence of isolated areas of residual radioactivity.

Figure 7-3 presents the overall statistical metrics for the SOF parameter for the 16 systematically collected samples from LSA 03-01. The top graph is a histogram and line plot of the SOF for the systematic data population for LSA 03-01. The middle graph presents the mean SOF (0.01 as indicated by the blue vertical line) of the sample population and the 95% confidence interval of the mean SOF represented by the blue diamond which is 0.05 to 0.12. The 97.87% confidence interval based on the median (0.07) of the sample results is 0.02 to 0.16. The bottom two charts present the various statistical metrics of the LSA 03-01 SOF data set, including the mean, median, standard deviation, minimum, maximum, confidence intervals, etc.

Figure 7-3 exhibits no unusual symmetry or bimodality concerns for the LSA 03-01 data associated with the systematically collected measurement locations.



N 16

	Mean	95%	6 CI	Mean SE	SD	Variance	Skewness	Kurtosis
LSA 03-01 Sys SOF	0.09	0.05	to 0.12	0.017	0.07	0.00	0.4	-1.56
		1st				3rd		
	Minimum	quartile	Median	97.8	7% CI	quartile	Maximum	IQR
LSA 03-01 Sys SOF	0.02	0.02	0.07	0.02	to 0.16	0.15	0.2	0.13

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A posting plot is simply a map of the SU with the data values (in this case the SOF values for each systematically collected sample) entered at the measurement locations. This potentially reveals heterogeneities in the data – especially possible patches of elevated residual radioactivity. The posting plot for LSA 03-01 is presented below in Figure 7-4. Figure 7-4 shows no unusual patterns in the data.

Figure 7-4 Posting Plot for LSA 03-01 Systematic Measurement Locations



Appendix A to this report presents the complete analytical data set (in Microsoft Excel format) used to derive the summary statistics presented in Table 7-1, Figure 7-3, and Figure 7-4 above. A summary of the analytical data is presented in Table 7-2 below. Appendix G to this report presents the TestAmerica Analytical Laboratory soil sample reports.

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01-25-FR-00 4.3 5 1000 0.13 0.03 0.04 0.03 0.03 0.03 0.03 0.04	01-20-FR.500 4.3 5 1.06 0.14 0.03	01-20-P-R-S-00 4.43 S 106 015 N -0010 0023 023 023 023 033 013 N	-01-19-P-S-S-00 0.49 S	1.040 0.147 0	0.063 N/	A -0.03C	0.000	0.511	0.511	1.150 C	.380 N,	A 0.957	0.148	0.104	NA -0.	043 0.0	100 2.2	50 NA	AN	AN	0.118	0.121	0.232		340 0.6	0.782	A	1.4	0.04			
01-22-PS-SO 04 0 013 014 023 013 0	0.12-P-S-S-00 0.40 0.14 0.13 0.051 0.40 0.135 0.136 0.13 0.136 0.13 0.136 <	01-22-PS-S-00 0.46 0.74 0.13 0.05 0.13 0.32 0.34 0 080 0.13 010 161 N	-01-20-P-R-S-00 4.43 S	1.060 0.151 0).063 N/	A -0.01C	0000	0.253	0.253	0.528 C	.392 L	1.060	0.174	0.136	NA 0.(0.0 0.0	J60 0.7₄	46 NA	AN	AN	0.033	0.099	0.232	U	0.40	35 0.714	AN	0.5	0.05			
01-23-TA-SO 4.1 5 1.10 0.165 0.073 Na 0.036 0.036 0.036 0.036 0.036 0.037 Na Na Na	01-25-FR-300 4.4 0 100 0.16 0.00	01-23-PR-30 4.43 5 1.10 0.165 0.073 Na 0.085 0.065 0.085 0.065 0.085 Na 0.180 0.145 0.147 Na 0.070 Na Na Na 0.145 0.147 0.061 Na 0.012 0.012 0.012 0.002 0.012 <t< td=""><td>01-22-P-S-S-00 0.49 S</td><td>0.747 0.113 0</td><td>).051 N/</td><td>A -0.323</td><td>0.000</td><td>0.135</td><td>0.135</td><td>0.372 0</td><td>.342 L</td><td>0.802</td><td>0.128</td><td>0.113</td><td>NA -0.</td><td>198 0.0</td><td>1.6</td><td>10 NA</td><td>NA</td><td>AA</td><td>0.085</td><td>0.115</td><td>0.194</td><td>о Л</td><td>915 0.4</td><td>32 0.725</td><td>AN</td><td>1.5</td><td>0.02</td></t<>	01-22-P-S-S-00 0.49 S	0.747 0.113 0).051 N/	A -0.323	0.000	0.135	0.135	0.372 0	.342 L	0.802	0.128	0.113	NA -0.	198 0.0	1.6	10 NA	NA	AA	0.085	0.115	0.194	о Л	915 0.4	32 0.725	AN	1.5	0.02			
01-10-5-300 04 0.0 0.10 0.00 0.00 0.10 0.10 0.00 0.00 0.10 0.00 0.10 0.00 0.10	01-U1-S-Q0 04 0 04 0 05 04 05 06 055 0 054 0 054 0 054 0 054 0 054 0 054 0 </td <td>01-1-F-S-00 0.49 0.100 0.145 0.00 0.145 0.385 0.4 0.385 0 0.385 0 0.380 0.176 0.176 0.100 0.140 0.17 NA NA</td> <td>-01-23-P-R-S-00 4.43 S</td> <td>1.100 0.165 0</td> <td>).073 N/</td> <td>۵.030</td> <td>0.030</td> <td>0.056</td> <td>0.056</td> <td>0.089 0</td> <td>.343 L</td> <td>1.180</td> <td>0.203</td> <td>0.085</td> <td>NA 0.1</td> <td>180 0.1</td> <td>80 2.8</td> <td>12 NA</td> <td>NA</td> <td>NA</td> <td>0.154</td> <td>0.143</td> <td>0.182</td> <td>U O</td> <td>369 0.3</td> <td>16 0.871</td> <td></td> <td>2.7</td> <td>0.13</td>	01-1-F-S-00 0.49 0.100 0.145 0.00 0.145 0.385 0.4 0.385 0 0.385 0 0.380 0.176 0.176 0.100 0.140 0.17 NA	-01-23-P-R-S-00 4.43 S	1.100 0.165 0).073 N/	۵.030	0.030	0.056	0.056	0.089 0	.343 L	1.180	0.203	0.085	NA 0.1	180 0.1	80 2.8	12 NA	NA	NA	0.154	0.143	0.182	U O	369 0.3	16 0.871		2.7	0.13			
01-05-FR-00-0 4.43 0 1/50 0.46 0.41 N 0.40 0.12 0.40 0.14 0.25 V 1 V 0.40 0.44 0.25 V 1 V 0.40 0.41 0.40 0.41 0.40 0.41 0.40 0.41 0.40 0.41 0.41 0.40 0.41	01-05-PAC-00 4.3 0 110 0.16 0.10	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	-01-01-P-S-Q-00 0.49 Q	1.000 0.145 0).068 N/	a -0.07C	0.000	-0.005	0.000	0.154 0	.385 L	0:930	0.168	0.127	-0- NA	070 0.0	100 4.40	AN OC	NA	NA	0.243	0.150	0.183	NA 0.	388 0.30	J9 0.85₄	NA	4.1	0.03			
O1-25-P3-B-0 0.49 B 0.926 0.11 0.000 0.200 0.301 0.030 0.501 0.781 N 33 0.031 0.781 N 33 0.031 0.051 N 33 0.033 Systematic Minium 0.160 N -1.070 0.000 0.200 0.200 0.200 0.361 0.12 0.163 N 1.03 0.501 N 33 0.03 Systematic Minium 0.160 1.070 0.12 0.160 1.070 0.166 1.879 0.193 1.780 16 0.19 Systematic Maximu 0.053 0.165 1.879 0.195 1.879 0.199 1.780 16 0.19 Systematic Maximu 0.053 0.055 1.879 0.195 1.879 0.199 1.780 1.9 0.19 Systematic Maximu 0.053 1.879 0.195 1.879 0.195 1.780 1.9 0.19 Systematic Maximu 0.053 0.0	01-25-5-3-00 0.40 0.14 0.000 0.200 0.224 0.12 0.13 NA NA NA NA NA 0.12 NA 1.030 0.501 0.782 NA 3.3 0.03 Systematic Minimu 0.11 0.000 0.200 0.206 0.12 0.000 0.001 0.000 0.002 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.012 0.001	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$.01-05-P-R-Q-00 4.43 Q	1.190 0.168 0	0.071 N/	٩ 0.120	0.120	-0.026	0.000	0.074 0	.341 L	1.040	0.176	0.110	NA 0.(040 0.0 [.]	1.3	10 NA	NA	AN	0.064	0.140	0.225	U L	270 0.5	40 0.825	AA	0.8	0.10			
Systematic Minimu 0.000 0.000 0.000 0.003 0.634 16 0.02 Systematic Maximu 0.160 1.770 0.169 1.780 0.63 0.19 0.16 0.19 0.16	Systematic Minimu 0.000 0.000 0.000 0.014 16 0.02 1780 16 0.02 Systematic Maximu 0.160 0.100 0.190 0.190 1.780 0.190 1.780 0.190	Systematic Miniture 0.000 0.000 0.000 0.746 0.033 Systematic Maximum 0.160 1.070 0.180 3.615 0.190 Systematic Maximum 0.053 0.022 0.180 3.615 0.190 Systematic Maximum 0.053 0.222 0.222 0.665 1.879 0.093 Systematic Mean 0.020 0.222 0.065 1.645 0.093 Systematic Mean 0.020 0.16 0.055 1.645 0.063 Systematic Mean 0.062 0.222 0.070 0.743 0.043 Systematic Standard Deviation 0.062 0.222 0.224 0.743 0.043 Min Introvuki use Ra26 big = 1.07 Min Introvuki use Ra26 big = 1.07 1.822 big = 1.0 1.822 big = 1.0 1.822 big = 1.0 1.822 big = 1.0	-01-25-P-S-B-00 0.49 B	0.926 0.131 0	7.060 N/	٩ -0.144	0.000	-0.012	0.000	0.200 0	.386 L	0.829	0.148	0.131	NA -0.	171 0.0	100 4.0	12 NA	NA	ΥN	0.221	0.122	0.163	NA 1	0.50	01 0.782	NA	3.3	0.03			
Systematic Maximu 0.160 1.070 0.180 0.199 1.780 0.199 0.199 0.190 0.190 0.190 0.190 0.190 0.190 0.190 0.190 0.190 0.190 0.190 0.09 0.009	Systematic Maximu 0.160 1.780 0.180 0.199 1.780 0.99 1.780 0.99 1.780 0.99 1.780 0.99 1.780 0.99 1.780 0.99 1.780 0.99 1.780 0.99 1.780 0.99 1.780 0.99 1.780 0.99 1.91 0.9 Systematic Median 0.023 0.024 0.025 0.099 0.91 0.99 0.	Systematic Maximum 0.160 1.070 0.180 3.615 0.190 Systematic Maximum 0.053 0.053 0.055 1.879 0.099 Systematic Median 0.020 0.116 0.065 1.879 0.085 Systematic Median 0.020 0.116 0.055 1.645 0.085 Systematic Median 0.062 0.116 0.070 0.073 0.043 Systematic Median 0.062 0.116 0.070 0.0743 0.043 Systematic Standard Deviation 0.062 0.292 0.070 0.743 0.043 Mith ingrowth, use Ra26 bkg= 1.07 722 bkg= 1.0 1.043 1.043	Systematic Minimum		0.000				0	000				0.000	0			0	.746			0.03	3			0.634		1.6	0.02			
Systematic Mean 0.053 0.065 1.879 0.099 1.091 0.09 Systematic Median 0.020 0.116 0.055 1.879 0.099 1.091 0.09 Systematic Median 0.020 0.116 0.055 1.645 0.085 0.038 0.038 0.03 Systematic Median 0.022 0.016 0.055 0.043 0.0343 0.03 Systematic Standard Deviation 0.022 0.070 0.743 0.043 0.343 0.07 Mith ingrowth, use Ra26 big= 1.07 722 big= 1.0 1.223 big= 1.0 0.043 0.343 0.07	Systematic Mean 0.053 0.022 0.065 1.879 0.099 1.091 6.0 Systematic Median 0.020 0.016 1.645 0.095 1.091 6.0 0.005 Systematic Median 0.020 0.0165 1.645 0.095 1.091 6.0 0.005 Systematic Median 0.020 0.016 0.055 0.043 0.038 0.038 0.01 Systematic Median 0.062 0.070 0.073 0.043 0.033 0.01	Systematic Mean 0.053 0.222 0.065 1.879 0.099 Systematic Median 0.020 0.116 0.055 1.645 0.085 Systematic Median 0.062 0.165 0.733 0.043 0.043 Systematic Median 0.062 0.196 0.070 0.743 0.043 Systematic Standard Deviation 0.062 0.292 0.070 0.743 0.043 Mith ingrowth, use Ra26 bkg = 1.07 Mith ingrowth use Ra26 bkg = 1.07 Th22 bkg = 1.0 Th22 bkg = 1.0 Th22 bkg = 1.0 Th22 bkg = 1.0	Systematic Maximum		0.160				-	020				0.180	6			ε	.615	Ī		0.19	6			1.780		(%	0.19			
Systematic Median 0.020 0.116 0.055 1.645 0.085 0.998 60 Systematic Median 0.020 0.116 0.055 0.055 0.998 63 Systematic Median 0.062 0.292 0.070 0.073 0.043 0.343 63 Systematic Standard Deviation 0.062 0.292 0.0743 0.043 0.343 60 Nith ingrowth, use Ra26 big = 1.0 Th232 big = 1.0 Th	Systematic Median 0.020 0.116 0.055 1.645 0.085 0.998 0.998 0.07 Systematic Median 0.062 0.116 0.055 0.055 0.055 0.998 0.998 0.07 Systematic Standard Deviation 0.062 0.292 0.070 0.0743 0.043 0.343 0.07 Mithin Standard Deviation 0.043 0.043 0.043 0.343 0.07 Mithin Standard Deviation 0.043 0.043 0.043 0.343 0.07	Systematic Median 0.020 0.116 0.055 1.645 0.085 Systematic Median 0.020 0.116 0.055 0.055 0.043 Systematic Standard Deviation 0.062 0.292 0.070 0.743 0.043 Mith ingrowth, use Ra226 bkg = 1.0 1.07 Th232 bkg = 1.0 Th232 bkg = 1.0 1.07 1.043	Systematic Mean		0.053				Ö	222				0.065	10			~	.879			0.09	0			1.091		ae ge	0.09			
ystematic Standard Deviation 0.062 0.292 0.070 0.073 0.043 0.343 0.043 0.343 0.07 Vith ingrowth, use Ra26 bkg = 1.07 Th232 bkg = 1.0 1.02<	ystematic Standard Deviation 0.062 0.292 0.070 0.043 0.033 A5 0.07 ystematic Standard Deviation 0.062 0.292 0.292 0.070 0.043 0.033 A5 0.07 With ingrowth, use Ra26 bkg = 1.07 Th232 bkg = 1.0 Th232 bkg = Th232 bkg = Th232 bkg =	Systematic Standard Deviation 0.062 0.292 0.070 0.743 0.043 Note the standard Deviation 0.062 0.292 0.070 0.743 0.043	Systematic Median		0.020				Ő	116				0.055	10				.645			0.08	5			0.998		hmé vera	0.07			
With ingrowth, use Ra226 bkg = 1.07 Th232 bkg = 1.0	With ingrowth, use Ra226 bkg = 1.07 Th232 bkg = 1.0 Th232 bkg = 1.0 NOTES: NOTES: <td>With ingrowth, use Ra226 bkg = 1.07 Th232 bkg = 1.0</td> <td>Systematic Standard Deviation</td> <td></td> <td>0.062</td> <td></td> <td></td> <td></td> <td>0</td> <td>292</td> <td></td> <td></td> <td></td> <td>0.070</td> <td></td> <td></td> <td></td> <td>0</td> <td>.743</td> <td></td> <td></td> <td>0.04</td> <td>3</td> <td></td> <td></td> <td>0.343</td> <td></td> <td>A Enric</td> <td>0.07</td>	With ingrowth, use Ra226 bkg = 1.07 Th232 bkg = 1.0	Systematic Standard Deviation		0.062				0	292				0.070				0	.743			0.04	3			0.343		A Enric	0.07			
With ingrowth, use Ra226 bkg = 1.07 Th232 bkg = 1.0	With ingrowth, use Ra226 bkg = 1.0 Th232 bkg = 1.0 NOTES: NOTES:	With ingrowth, use Ra226 bkg = 1.07 Th232 bkg = 1.0																										3				
	NOTES:			With ingrowth, use	Ra226 bk	= b	1.07					Th232	? bkg =	1.0																		

**Background, 1.0 pCi/g subtracted from gross result. U Qualifier: Result is less than the sample detection limit. All uncertainty values are reported at the 2-sigma confidence level.

* Background with ingrowth, 1.07 pCi/g subtracted from gross result.

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7.2.5 Biased Soil Sample Result LSA 03-01

One (1) biased sample was collected from LSA 03-01. The sample collected at location L03-01-25 represented the maximum GWS measurement (13,925 gcpm) within the SU, and had a result of 0.03 Uniform SOF.

7.2.6 Quality Control Soil Sample Result LSA 03-01

Two QC field duplicate sample points were randomly selected for LSA 03-01 which were collected at systematic locations L03-01-01 and L03-01-05.

For the 17 samples (i.e., 16 systematic + 1 biased) collected within LSA 03-01, two field duplicate samples were collected. This frequency equates to 11.8%, (i.e. 2/17). Form HDP-PR-FSS-703-1 documents that the duplicate sample result comparison with the partner's sample results that all comparison criteria were less than the calculated warning limits (see Figure 7-5 below).

Hematite	FSSFI (LSA	R Volume 03-01 and	3, Chapter LSA 03-02	23: Sur 2)	vey Area R	elease Ru	ecord for La	und Surve	y Area 03	, Survey	Units (01 and 02	
Project	Revisi	ion: 0									Р	age 31 of 6	10
	Form H	HDP-PR-F	SS-703-1	Field Du	Figure 7-	5 umple As	sessment L	SA 03-01	l (1 of 2)				
		Procedure: F	HDP-PR-FSS-	703, Final	Status Surve	y Quality C	ontrol						
Hematite Decon	nmissioning Project									Revisio	n: 2	Page 1 of 1	
			Ĩ	F ELD DUI	ORM HDP-I PLICATE S/	PR-FSS-70 AMPLE A	3-1 SSESSMENT						
Survey Unit No.:	LSA 03-01				Survey Unit I	Description:	Class 3 Survey	Unit West of	Site Pond in	"Area 5"			
	Eiold Dumlicote		Sample (nCi/ø)	Field Duplica	ate Sample	Average	Nuclide		Warning	Control	Statistic Freeds	
Sample ID	Sample ID	Radionuclide	Activity (x _i)	MDC	Activity (x _i)	MDC	(pCi/g)	(pCi/g)	Statistic ²	Limit	Limit	Limit? (Y/N)	
L03-01-01-P-S-S-00	L03-01-01-P-S-Q-00	Ra-226	1.180	0.0725	1.000	0.068	1.09	1.9	0.18	0.269	0.403	N	
L03-01-01-P-S-S-00	L03-01-01-P-S-Q-00	Tc-99	1.07	0.335	-0.00462	0.385	0.53269	25.1	NA	3.552	5.321	NA	
L03-01-01-P-S-S-00	L03-01-01-P-S-Q-00	Th-232	1.07	0.115	0.930	0.127	1.000	2.0	0.140	0.283	0.424	Z	
L03-01-01-P-S-S-00	L03-01-01-P-S-Q-00	U-234 ¹	1.655	NA	4.400	NA	3.027	195.4	2.745	27.649	41.425	Z	
L03-01-01-P-S-S-00	L03-01-01-P-S-Q-00	U-235	0.0805	0.262	0.243	0.183	0.162	51.6	NA	7.301	10.939	NA	
L03-01-01-P-S-S-00	L03-01-01-P-S-Q-00	U-238	1.71	0.751	0.888	0.854	1.299	168.8	0.822	23.885	35.786	Z	
Comments: 1. U-234 is inferred, 1 2. Duplicate assessme	no MDC available. ent is not necessary if the	result of either	sample is < M	DC.									
Performed by: Thoma	as Yardy	la l					Reviewed by: C	lark Evers					
	with the o	1					17	11	0		-		
Date:	5-3-17						Date: N.	and a	S	S	8/13		
Quality Record													

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Hematite	FSSF (LSA	R Volume 03-01 and	3, Chapter LSA 03-0.	- 23: Surr 2)	vey Area R	elease Re	ecord for La	nd Survey	v Area 03,	Survey	Units ()1 and 02	
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	Form F	HDP-PR-F	SS-703-1	Field Du	Figure 7-	5 ample As	sessment L	SA 03-01	(2 of 2)				
		Procedure: H	DP-PR-FSS-	703, Final	Status Surve	y Quality C	ontrol						
Hematite Decom	missioning Project									Revisio	n: 2	Page 1 of 1	
			Ţ.	F ELD DUI	ORM HDP-I	PR-FSS-70 AMPLE A	3-1 SSESSMENT				1		
Survey Unit No.:	LSA 03-01				Survey Unit I	Description:	Class 3 Survey l	Unit West of	Site Pond in	Area 5"			
2	Field Dunlicate		Sample (pCi/g)	Field Duplics (pCi	ate Sample /g)	Average Activity (\vec{X})	Nuclide DCGL		Warning	Control	Statistic Exceeds	
Sample ID	Sample ID	Radionuclide	Activity (x _i)	MDC	Activity (x _i)	MDC	(pCi/g)	(pCi/g)	Statistic ²	Limit	Limit	Limit? (Y/N)	
L03-01-05-P-R-S-00	L03-01-05-P-R-Q-00	Ra-226	1.06	0.0686	1.19	0.071	1.125	1.9	0.13	0.269	0.403	Z	
L03-01-05-P-R-S-00	L03-01-05-P-R-Q-00	Tc-99	0.0962	0.367	-0.0256	0.341	0.0353	25.1	NA	3.552	5.321	NA	
L03-01-05-P-R-S-00	L03-01-05-P-R-Q-00	Th-232	1.13	0.0676	1.04	0.11	1.085	2.0	060.0	0.283	0.424	Z	
L03-01-05-P-R-S-00	L03-01-05-P-R-Q-00	U-234 ¹	1.210	NA	1.310	NA	1.260	195.4	0.100	27.649	41.425	Z	
L03-01-05-P-R-S-00	L03-01-05-P-R-Q-00	U-235	0.0624	0.223	0.0637	0.225	0.063	51.6	NA	7.301	10.939	NA	
L03-01-05-P-R-S-00	L03-01-05-P-R-Q-00	U-238	0.852	0.809	1.27	0.825	1.061	168.8	0.418	23.885	35.786	Z	
Comments: 1. U-234 is inferred, n 2. Duplicate assessmet	o MDC available. nt is not necessary if the	result of either	sample is < N	DC.									
Performed by: Thomas	s Yardy	- Kul	A.				Reviewed by: C	lark Evers					
Date:	5-3-17						Date: W.	Clar	S	S	11/8		
Quality Record						0							

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7.3 Tc-99 Hot Spot Assessment LSA 03-01

As a Class 3 SU, there is no history of any sample from the SU exceeding the Tc-99 DCGL_W, or a SOF of 1.0. The highest Tc-99 sample result collected from both Final RASS and FSS was 1.07 pCi/g. There is no indication of a potential Tc-99 hot spot exceeding the DCGL_W of 25.1 pCi/g, and therefore a Tc-99 hot spot assessment is not required.

8.0 ALARA EVALUATION LSA 3-01

All samples collected within LSA 03-01 were evaluated against the Uniform Stratum DCGL_W. For LSA 03-01 no FSS sample result exceeded a SOF of 1.0. The average SOF result, based on all systematically collected samples, was 0.09 for LSA 03-01. The average SOF equates to residual activity contributions from the SU area of 2.25 mrem/year for LSA 03-01. Groundwater monitoring well data provided in FSSFR Volume 6, Chapters 2 and 3 {ML16287A528}, and Chapter 4 {ML16342B552}, and Chapter 5 {ML17018A105} indicate that the groundwater dose contribution will be a fraction of the MCLs. Nevertheless, a maximum groundwater contribution assumption of 4.0 mrem/yr based upon the U.S. Environmental Protection Agency (EPA) MCLs will be added to the total estimated dose for LSA 03-01. Additionally, 4.25 mrem/year will be added to LSA 03-01 to account for the dose contribution from the presence of Reuse Soil Stockpile 8b soil. Adding these dose contributions together, the total estimated dose for LSA 03-01 is 10.5 mrem/year.

Since the estimated Total Effective Dose Equivalent (TEDE) is below the regulatory release criterion of 25 mrem/yr, the conclusion of the ALARA evaluation is that the FSS of LSA 03-01 was successful and that there would be no discernable benefit to the health and safety of the public in attempting to further reduce the results of FSS by performing remediation of LSA 03-01.

9.0 FSS PLAN DEVIATIONS LSA 03-01

9.1 Remedial Actions during FSS

There was no remedial action after FSS in LSA 03-01.

9.2 Adjustments to Scan MDC Calculations

Scan MDCs for LSA 03-01 were calculated in accordance with HDP-PR-FSS-701, Revision 10, *Final Status Survey Plan Development* and HDP-TBD- FSS-002, Revision 3, *Evaluation and Documentation of the Scanning Minimum Detectable Concentrations (MDC) for Final Status Surveys (FSS)*. The assumed LSA background count rate of 9,000 cpm was applied to determine the prospective Scan MDCs, and the actual mean count rate from the FSS survey was 10,438 cpm. Therefore the calculated Scan MDCs will be updated to the following:

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Table 9-1

Revised Scan MDCs for 2" x 2" NaI detector background of 11,000 cpm

	Scan MDC (Total U)	DCGLw (Total U)	Scan MDC (Ra-226)	DCGLw (Ra-226)	Scan MDC (Th-232)	DCGLw (Th-232)
LSA 03-01	42.9	54.1	1.26	1.9	0.91	2.0

The revised Scan MDCs presented in Table 9-1 above better reflect the actual field conditions encountered in LSA 03-01 during the performance of FSS GWS. However, the change has little effect of the results of the FSS performed as the calculated Scan MDCs remain under the respective DCGLs for each nuclide of concern.

10.0 DATA QUALITY ASSESSMENT

The DQO process is thoroughly integrated within the DP and Hematite FSS procedures. The steps of the DQO process are presented in Volume 3, Chapter 1, Section 4.0 of the FSSFR and correspond to the DQO steps described in Chapter 14, Section 4.2.1 of the DP. The HDP DQO process reflects the recommendations given in MARSSIM, Chapter 2, Figure 2-2.

10.1 Data Quality Assessment for LSA 03-01

The Data Quality Assessment of the survey methodology, sampling and sample analysis results, and the Quality Control sampling and analysis results to ascertain the validity of the conclusion for LSA 03-01 (see Figure 10-1) provides the following:

- The field and laboratory instruments utilized were capable of detecting activity at a MDC less than the appropriate investigation level, and were verified to be operable prior to and after use in accordance with HDP-PR-HP-416 (*Operation of the Ludlum 2221 for Final Status Survey*).
- The calibration of all instruments that were used to measure or analyze data was current at the time of use and the calibrations of the instruments were performed using a NIST traceable source. The instruments used were successfully source checked prior to and after use.
- The systematic samples that were collected (on a random grid) and the gamma scan surveys that were conducted were performed in accordance with procedure HDP-PR-FSS-711, *Final Status Surveys and Sampling of Soil and Sediment*.
- All samples sent for analysis at the approved offsite laboratory (TestAmerica) were tracked on a chain of custody form in accordance with HDP-PR-QA-006, *Chain of Custody*.
- Quality Control sample results were verified to meet the acceptance criteria as specified in HDP-PR-FSS-703, *Final Status Survey Quality Control.*
- LSA 03-01 survey and sample results were independently reviewed and validated in accordance with HDP-PR-FSS-721 *Final Status Survey Data Validation*.

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•	The WRS Test is not necessary when the difference between the m unit data set measurement SOF and the minimum background ar SOF is less than or equal to one. For LSA 03-01, no individual g in the FSS data set exceeded the SOF of the minimum background measurement by more than one using the Uniform Stratum crite the WRS Test was not required for LSA 03-01. However, the WI performed for illustrative purposes. Since the test statistic, WR the critical value (860), the FSS data set passed the WRS Test hypothesis was rejected. The WRS Test worksheet is presented in	naximum survey ea measurement gross SOF result id reference area eria. Therefore, RS Test was still (1040) exceeded est and the null Appendix A.
•	One biased soil sample was collected from the location of the count rate within the SU, with a maximum result of 0.03 Uniform The maximum SOF result for all surface samples within LSA The maximum SOF result for all subsurface samples within LSA	highest gamma SOF. 03-01 was 0.18. 03-01 was 0.19.
•	The average SOF result for all systematically collected samples w was 0.09, with an upper 95% confidence level (UCL _{mean} 0.95) of 0 No FSS sample result in LSA 03-01 exceeded a SOF of 1.0 as Uniform Stratum criteria, therefore an elevated measurement cor	ithin LSA 03-01).12. compared to the nparison (EMC)
•	or supplemental investigations was not required. For the second comparisons to the alternate "Three-Layer" multi-CSM (i.e. Su Excavation) DCGLs were necessary. A retrospective sampling frequency evaluation was performed	ame reason, no rface, Root and to determine if
	sufficient statistical power exists to reject the null hypothesis bar number (8) of systematic sample locations actually collected with The successful result of the retrospective power evaluation pre 10-1 for LSA 03-01 indicates that the minimum number of sa- required (8) for the WRS Test were equal to the number of san actually collected within LSA 03-01. The methodology used for sampling frequency evaluation is similar to the prospective determination performed during FSS Plan Development except sample results and statistics are used in the sample size verification the mean and standard deviation of the eight LSA surface sample Test sample data set) are used to derive the relative shift for each HDP Type I and Type II errors of 0.05 and 0.10, respectively relative shift is then correlated to a minimum sample size number Table 5-1 of MARSSIM.	used on the total thin LSA 03-01. esented in Table ample locations mpling locations the retrospective ve sample size that actual FSS on. Specifically, es (i.e., the WRS LSA. Given the v, the calculated er as provided in
•	HDP staff ensured that a visual inspection of the SU configuration periodically, and confirmed that there were no instances of contamination from weather events until the FSS of all remaining were completed.	n was performed potential cross ng areas at HDP

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Table 10-1

Retrospective Sample Size Verification for LSA 03-01

N/2 Value Verification Isotope(s) SOF (Ra/Tc/Th/Iso U) St. Dev. 0.07 St. Dev. 0.07 DCGL _{SOF} 1 DCGL _{SOF} 0.09 Shift 0.091 Relative Shift (Δ/σ) 13.69 MARSSIM Table 5.1 (Pr) 1.000000 N 12 N+20% 14.4 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	Uniform DCG	L Criteria Evaluation
Isotope(s) SOF (Ra/Tc/Th/Iso U) St. Dev. 0.07 St. Dev. 0.07 DCGL _{SOF} 1 DCGL _{SOF} 0.091 LBGR (Mean) 0.091 Shift 0.091 Relative Shift (Δ/σ) 13.69 MARSIM Table 5.1 (Pr) 1.00000 N 12 N+20% 14.4 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	N/2 Valu	e Verification
St. Dev. 0.07 DCGL _{SOF} 1 DCGL _{SOF} 1 LBGR (Mean) 0.09 Shift 0.091 Shift 0.01 Relative Shift (Δ/σ) 13.69 MARSSIM Table 5.1 (Pr) 1.000000 N 12 N+20% 14.4 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	Isotope(s)	SOF (Ra/Tc/Th/Iso U)
DCGL _{SOF} 1 LBGR (Mean) 0.09 Shift 0.091 Shift 0.01 Relative Shift (Δ/σ) 13.69 MARSIM Table 5.1 (P ₁) 1.000000 N 12 N + 20% 14.4 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	St. Dev.	0.07
LBGR (Mean) 0.09 Shift 0.91 Shift 0.91 Relative Shift (Δ/σ) 13.69 MARSIM Table 5.1 (Pr) 1.000000 N 12 N 12 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	DCGL _{SOF}	1
Shift 0.91 Relative Shift (Δ/σ) 13.69 MARSSIM Table 5.1 (Pr) 13.69 N 12 N + 20% 14.4 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	LBGR (Mean)	0.09
Relative Shift (Δ/σ) 13.69 MARSSIM Table 5.1 (P ₁) 1.000000 N 12 N + 20% 14.4 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	Shift	0.91
MARSSIM Table 5.1 (Pr) 1.000000 N N 12 N + 20% 14.4 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	Relative Shift (Δ/σ)	13.69
N 12 N + 20% 14.4 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	MARSSIM Table 5.1 (Pr)	1.00000
N + 20% 14.4 N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	z	12
N/2 8 FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	N + 20%	14.4
FSS N/2 8 Verification Check SUFFICIENT MEASUREMENTS	N/2	8
Verification Check SUFFICIENT MEASUREMENTS	FSS N/2	8
	Verification Check	SUFFICIENT MEASUREMENTS

SIM Table 5.1	P	0.528182	0.556223	0.583985	0.611335	0.638143	0.664290	0.689665	0.714167	0.737710	0.760217	0.781627	0.801892	0.820978	0.838864	0.855541	0.871014	0.885299	0.898420	0.910413	0.921319	0.944167	0.961428	0.974067	0.983039	0.993329	0.997658	1.000000
MARS	Δ/σ	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.25	2.5	2.75	3.0	3.5	4.0	4.01

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

= 0.10						α	β				
[able 5.2, α = 0.05, β	Z _{1-α} (or Z _{1-β})	2.576	2.326	2.241	1.960	1.645	1.282	1.036	0.842	0.674	0.524
MARSSIM 1	α (or β)	0.005	0.01	0.015	0.025	0.05	0.10	0.15	0.2	0.25	0.30

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Hematite Decommissioning Project		Procedure: HDP-PR-F	Procedure: HDP-PR-FSS-721, Final Status Survey Data Evaluation								
					Revision	10	Appendix G-1, Page 1 of 2				
	FINAL	STATUS SURVEY D	APPENDIX (ATA QUALITY O	G-1 BJECTIVES REV	VIEW CHI	ECK	LIST				
Sui	rvey Area:	LSA 03	Description:	Plant Open Land	Area						
Sui	rvey Unit:	y Unit: 01 Description: West of Site Por				"					
1.	Have all m to data and accordance	neasurements and/or an alysis for FSS been ind with Section 8.1 of thi	nalysis results that v lividually reviewed s procedure?	vill be subjected and validated in	Yes 🔀	No					
2.	Have all a acquired a Instruction	systematic measureme t the locations specifie s?	stematic measurements and/or samples been taken or the locations specified in the FSSP and the FSS Sample Yes \square No \square ?								
3.	Have all s required in	cans surveys been performed of the areas specified as $Yes \boxtimes No \square$ the FSSP and the FSS Sample Instructions?									
4.	Have all be at the locat	iased measurements and ions specified in the FS	d/or samples been ta SSP & the FSS Samp	aken or acquired ble Instructions?	Yes 🖂	No	NA 🗌				
5.	Have dupl acquired at	icate and/or split samp each location designat	ed as a QC sample?	s been taken or	Yes 🖂	No	NA 🗌				
6.	Were the capable of the appropriate the the the appropriate the the appropriate the the appropriate the the the the the the the the the t	instruments used to m detecting the ROCs or riate investigation level	neasure or analyze r gross activity at a ?	the survey data MDC less than	Yes 🖂	No					
7.	Was the ca analyze da performed	alibration of all instrur ta, current at the time using a NIST traceable	nents that were use of use and were the source?	d to measure or lose calibrations	Yes 🖂	No					
8.	Were the i where requ	nstruments successfull ired, after use on the da	y response-checked ay the data was meas	before use and, sured?	Yes 🖂	No					
9.	Do the sam	ples match those ident	ified on the chain of	custody?	Yes 🖂	No	NA 🗌				
10.	Do the QC HDP-PR-F	Sample Results meet to SS-703, Final Status S	he acceptance criter urvey Quality Contr	a as specified in ol?	Yes 🖂	No	NA 🗌				
11.	Are all Lat	poratory QC parameters	s within acceptable 1	imits?	Yes 🖂	No	NA 🗌				

Comments: N/A

Quality Record

Hematite	FSSFR Volume 3, Chapter 23: Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 (LSA 03-01 and LSA 03-02)						
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Figure 10-1
Data Evaluation Checklists prepared for LSA 03-01 (page 2 of 2)

Hematite	Procedure: HDP-	-PR-FSS-721, Fina	l Status Su	rvey Data Ev	aluation	
ecommissioning Project					Revision:	Appendix G-1, Page 2 of 2
FINAL	L STATUS SURVI	APPEN EY DATA QUALI	DIX G-1 TY OBJE	CTIVES RE	VIEW CHE	CKLIST
Survey Area:	No. LSA 03	Descri	ption: Pl	ant Open Lan	d Area	
Survey Unit:	No. 01	Descri	ption: W	est of Site Po	nd In "Area 5	
Discrepancy:	None					
Corrective Acti	ons Taken: Non	e				
11 Have the c	corrective actions	resolved the discret	pancy with	the data?	Ves 🗌	
11. Have the c	corrective actions	resolved the discrepts form to the RSO.	pancy with	the data?	Yes	No 🗌 NA 🔀
11. Have the oral a. If "No"12. The follow	corrective actions f ', then forward this ving questions wil	resolved the discrep s form to the RSO. ! be answered by th	pancy with ne RSO.	the data?	Yes	No 🗌 NA 🛛
 11. Have the oral a. If "No" 12. The follow a. If the a still val 	corrective actions i , then forward this ving questions wil nswer to question lid?	resolved the discrep s form to the RSO. l be answered by th 11 was "No", then	pancy with ne RSO. is the affect	the data?	Yes 🗌	No \square NA \boxtimes No \square NA \checkmark
 Have the oral a. If "No" The follow a. If the a still val b. If "No" sufficie 	corrective actions i , then forward this ving questions wil nswer to question lid? , then are the exist ent to demonstrate	resolved the discreps form to the RSO. l be answered by the 11 was "No", then ting valid measurer compliance for the	pancy with the RSO. is the affect ments or sa survey un	the data? cted data imples it?	Yes Yes Yes	No \square NA \bowtie No \square NA \bigstar No \square NA \bigstar
 11. Have the of a. If "No" 12. The follow a. If the a still val b. If "No" sufficie c. If "No" demonstitution 	corrective actions i , then forward this wing questions wil nswer to question lid? , then are the exist ent to demonstrate , then direct the action strate compliance	resolved the discrep s form to the RSO. l be answered by th 11 was "No", then ting valid measurer compliance for the equisition of addition for the survey unit.	pancy with the RSO. is the affect nents or sa survey un ponal measu	the data? cted data imples it? irements or sa	Yes Yes Yes Yes umples as nece	No 🗌 NA 🔀 No 🗌 NA 🗶 No 🗌 NA 🗶 ssary to
 11. Have the of a. If "No" 12. The follow a. If the a still val b. If "No" sufficie c. If "No" demons Prepared by 	corrective actions of , then forward this wing questions will nswer to question lid? , then are the exist- ent to demonstrate , then direct the ac- strate compliance (HP Staff):	resolved the discrep s form to the RSO. l be answered by th 11 was "No", then ting valid measurer compliance for the cquisition of addition for the survey unit. 	pancy with the RSO. is the affect nents or sa survey un ponal measu	the data? cted data imples it? irements or sa	Yes Yes Yes tumples as nece	No \square NA \boxtimes No \square NA \boxtimes No \square NA \boxtimes ssary to $5 - 3 - 1 \overline{7}$ (Date)
 11. Have the c a. If "No" 12. The follow a. If the a still val b. If "No" sufficie c. If "No" demons Prepared by 	corrective actions r , then forward this ving questions wil nswer to question lid? , then are the exist ent to demonstrate , then direct the ac strate compliance (HP Staff): y (RSO):	resolved the discrep s form to the RSO. l be answered by th 11 was "No", then ting valid measurer compliance for the cquisition of additio for the survey unit. <u>Thomas Yardy</u> (Print Name <u>Clark Evers</u> (Print Name	bancy with the RSO. is the affect nents or sa survey un onal measu	the data? cted data imples it? urements or sa <i>M</i> Signa (Signa	Yes Yes Yes umples as nece	No \square NA \boxtimes No \square NA \boxtimes No \square NA \boxtimes ssary to 5 - 3 - 7 - 7 $\int \frac{(Date)}{7} / 7$ (Date)
 11. Have the c a. If "No" 12. The follow a. If the a still val b. If "No" sufficie c. If "No" demons Prepared by Approved b 	corrective actions i , then forward this ving questions wil nswer to question lid? , then are the exist ent to demonstrate , then direct the action for the staff): y (RSO):	resolved the discrep s form to the RSO. ! be answered by th 11 was "No", then ting valid measurer compliance for the cquisition of addition for the survey unit. <u>Thomas Yardy</u> (Print Name <u>Clark Evers</u> (Print Name	pancy with the RSO. is the affect nents or sa survey un onal measu	the data? cted data umples it? urements or sa <i>Mu</i> (Signa	Yes Yes Yes umples as nece	No \square NA \boxtimes No \square NA \boxtimes No \square NA \boxtimes ssary to 5 - 3 - 7 (Date) (Date)
 11. Have the c a. If "No" 12. The follow a. If the a still val b. If "No" sufficie c. If "No" demons Prepared by Approved b 	corrective actions r r, then forward this ving questions wil nswer to question lid? r, then are the exist ent to demonstrate r, then direct the action strate compliance r (HP Staff): y (RSO):	resolved the discrep s form to the RSO. l be answered by th 11 was "No", then ting valid measurer compliance for the equisition of addition for the survey unit. <u>Thomas Yardy</u> (Print Name <u>(Print Name</u> (Print Name	pancy with the RSO. is the affect nents or sa survey un ponal measu	the data? cted data imples it? irements or sa <i>M</i> (Signa	Yes Yes Yes ture)	No \square NA \boxtimes No \square NA \boxtimes No \square NA \boxtimes ssary to $5 - 3 - 1 \frac{7}{3}$ $\int \sqrt{3} \frac{117}{117}$ (Date)

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11.0 SURVEILLANCE FOLLOWING FSS

FSS activities in LSA 03-01 were completed in October 2015. There were no events after the completion of FSS that would have the potential to cause contamination above the DCGLs in the SU.

12.0 CONCLUSION LSA 03-01

An adequate quantity and quality of radiological surveys and samples, as well as the corresponding laboratory analysis has been performed, evaluated and documented to demonstrate that the dose associated with all sources within SU LSA 03-01 of 10.5 mrem/year does not exceed the dose criterion for unrestricted release in accordance with 10 CFR 20.1402 of 25 mrem/year.

	AVE. SU SOIL RADIOACTIVITY	ELEVATED AREA CONTRIBUTION	GROUND WATER	BURIED PIPING	REUSE SOIL	TOTAL
SOF	0.09	N/A	0.16	N/A	0.17	0.42
DOSE	2.25 mrem/year	N/A	4.0 mrem/year	N/A	4.25 mrem/year	10.5 mrem/year

Table 12-1LSA 03-01 SOF and Dose Summation

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13.0 FINAL STATUS SURVEY DESIGN LSA 03-02

This section of the report describes the method for determining the number of samples required for the FSS of LSA 03-02 as well as summarizing the applicable requirements of the FSS Plan. These include the $DCGL_W$, scan survey coverage, and IAL. The radiological instrumentation used in the FSS of LSA 03-02 and their detection sensitivities are also discussed.

13.1 FSS Plan Design Requirements

FSS Plan requirements for LSA 03-02 were driven by the type (Open Land) and Class (Class 2) of the SU and developed in accordance with HDP procedure, HDP-PR-FSS-701, Revision 8, *Final Status Survey Plan Development*, August 2015.

13.1.1 Surrogate Evaluation Areas

A discussion of Surrogate Evaluation Areas is given in the FSSFR Volume 3, Chapter 1, Section 5.0, *Final Status Survey Design*.

13.1.2 DCGL_W

During the FSS design process a review was performed of the RASS data for LSA 03-02. The RASS data was used as confirmation that no known areas of residual radioactivity remained within the SU that exceeded the Uniform Stratum $DCGL_W$. Therefore the Uniform Stratum $DCGL_W$ was selected for use in demonstrating compliance with the release criteria.

13.1.3 GWS Coverage

As a Class 2 SU, LSA 03-02 was required to undergo a minimum of a 50% GWS.

13.1.4 Instrumentation

Radiological instrumentation selected for performance of GWS within LSA 03-02 was the Ludlum 44-10 2" x 2" NaI detectors, coupled to a Ludlum 2221 scaler-ratemeter.

13.1.5 Scan Minimum Detectable Concentration

Scan MDCs for LSA 03-02 were calculated in accordance with HDP-PR-FSS-701, Revision 10, *Final Status Survey Plan Development* and HDP-TBD- FSS-002, Revision 3, *Evaluation and Documentation of the Scanning Minimum Detectable Concentrations (MDC) for Final Status Surveys (FSS)*. As background levels were approximately 10,000 cpm within LSA 03-02, the Scan MDC calculation for total uranium given in HDP-PR-FSS-701, *Final Status Survey Plan Development*, Step 8.2.6.d, was applied:

Scan MDC (total uranium) =
$$\frac{1}{\left(\left(\frac{f_{U-234}}{3659 \ pCi/g}\right) + \left(\frac{f_{U-235}}{2.32 \ pCi/g}\right) + \left(\frac{f_{U-238}}{30.6 \ pCi/g}\right)\right)}$$

Equation 13-1

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To determine isotopic Uranium fractions HDP-PR-FSS-701, Revision 10, *Final Status Survey Plan Development* assumes that the average LSA enrichment is 4% or less. Based on the systematically collected RASS samples in LSA 03-02, the average enrichment for the SU was 1.5%. All other Scan MDC parameters agreed upon between Westinghouse and the NRC were applied (e.g. use of a 2 in air gap, scan rate of 1 ft/sec, 0.75 surveyor efficiency), therefore no subsequent changes to the calculated Scan MDCs need to be made.

Prospectively calculated Scan MDCs for 2" x 2" NaI detectors that were used in LSA 03-02 are shown below:

Table 13-1Scan MDCs for 2" x 2" NaI detector, 10,000 cpm background: LSA 03-02

	Scan MDC (Total U)	DCGLw (Total U)	Scan MDC (Ra-226)	DCGLw* (Ra-226)	Scan MDC (Th-232)	DCGLw* (Th-232)
LSA 03-02	40.9	55.2	1.21	2.8	0.87	3.0

*DCGL_w includes background concentrations of 0.9 pCi/g for Ra-226 (no ingrowth) and 1.0 pCi/g for Th-232. DCGLw values are based on the Uniform Stratum release criteria.

The values in Table 13-1 reflect those presented in the FSS Plan prepared for the SU prior to FSS.

13.1.6 Investigation Action Level

FSSFR Volume 3, Chapter 1, Section 6.1.3, *Investigation Action Level (IAL)*, provides a discussion in regards to the IAL. The basis of the IAL is detailed in HDP-TBD-FSS-003, *Modeling and Calculation of Investigative Action Levels for Final Status Soil Survey Units*. The IAL used during the GWS of LSA 03-02 was established at 1,624 ncpm, which is the equivalent of an activity concentration that is less than the Uniform Stratum DCGL_W.

13.1.7 LSA 03-02 FSS Design Summary

The FSS Plan for LSA 03-02 can be found in Appendix E. Table 13-2 presents an overall FSS design and implementation summary for LSA 03-02.

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Table 13-2					
FSS	Design Summa	ry for L	LSA 03-02		
Gamma Walkover Survey (GWS):					
Scan Coverage		Mini	mum 50% of LSA 03-02 total area		
		40.9	pCi/g total Uranium; 0.87 pCi/g Th-232;		
Scan MDC		1.21	pCi/g Ra-226 (based on a 10,000 cpm		
		back	background)*		
Investigation Action Level (IAL)		1,624	1 net cpm **		
Systematic Sampling Locations:					
Depth	Number of Sa	ample	Comments		
0 - 15 cm (Surface)	8		These samples will be taken on a		
15 cm – 1.5 m (Root)	8		systematic grid. ***Excavation stratum		
> 1.5m (Excavation)	8***		samples will be collected and archived, but will be analyzed <i>only</i> in the event the overlying root stratum sample exceeds a SOF of 0.5		
Biased Survey/Sampling Locations	•				
Collect a minimum of one biased sa samples may be collected during GW the survey data, or at the direction of	ample at the max /S at the discretion the FSS Supervise	cimum G on of the sor.	WS measurement within the SU. Biased HP Technician, after statistical analysis of		
Sidewall Sampling Locations:					
Supplemental Sidewall Sampling: No	t applicable; SU	is an unre	emediated Class 2 area.		
Instrumentation:					
Ludlum 2221 with 44-10 (2x2 NaI) detectorU bi			Jsed for GWS and to obtain static count rates at iased measurement locations.		
*Values based on information provide	ded in HDP-TBI	D-FSS-00	2, "Evaluation and Documentation of the		
Scanning Minimum Detectable Concentrations (MDC) for Final Status Surveys (FSS). The Scan MDC					
for total Uranium reflects a conservative assumption of 4% enrichment. The actual RASS enrichment					
(1.5%) would result in Scan MDC va	lues slightly less	than thos	e calculated for FSS planning purposes.		
**IAL is the net count per minute (ncpm) equivalent of an activity concentration less than the Uniform Stratum DCGL _W derived from the technical bases presented in HEM-MEMO-15-021 and HDP-TBD-FSS-003 " <i>Modeling and Calculation of Investigative Action Levels for Final Status Soil Survey Units</i> ",					

Westinghouse, March 2015.

14.0 FINAL STATUS SURVEY IMPLEMENTATION LSA 03-02

FSS was performed in accordance with procedure HDP-PR-FSS-711, *Final Status Surveys and Sampling of Soil and Sediment*.

14.1 Gamma Walkover Survey

14.1.1 Instrumentation

The selected instrumentation to perform the GWS in LSA 03-02 was a 2" x 2" NaI detector in combination with a Ludlum 2221 rate meter. Each NaI instrumentation set was interfaced with a Trimble DGPS and handheld data logger.

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Prior to the first field use of the GWS instrumentation, initial set-ups were performed. Also, daily pre- and post-use source checks were performed for each day that GWS was performed within the SU. Initial set-ups, daily source checks, and control charting were performed according to the requirements of HDP-PR-HP-416, *Operation of the Ludlum 2221 for Final Status Survey*.

14.1.2 GWS Performance

All GWS measurements were collected with the NaI detector(s) were connected to a Trimble DGPS and with a hand-held data logger. The logging frequency in the SU was one (1) GWS measurement per second. Each gross gamma measurement is correlated to a set of coordinates based on the Missouri East State Plane, NAD 1983.

The GWS requirements involved moving the NaI detector in a side-to-side fashion no faster than 1 foot per second while holding the probe as close as possible to the excavation surface (nominally 1", but not to exceed 3"). At the same time, the HP Technician was required to slowly advance, causing the detector to trace out a serpentine path over the excavation surface.

HP Technicians performing GWS in LSA 03-02 used the 1,624 ncpm IAL as a field guide to know when to slow or pause the GWS for more deliberate investigation. If during the GWS, audible count rates noticeably increase above the general area average (i.e., > minimum detectable count rate), HP Technicians were required to pause momentarily and observe count rates. If sustained count rates approached the IAL, further focused investigation was conducted within the locally elevated area.

To use the IAL effectively, HP Technicians first determined the local background count rate before starting the GWS. Although the ambient gamma level may vary across the SU due to excavation geometry and relative distance from contaminated materials in nearby remedial excavations, the average background rate (measured at waist level) within the LSA ranged between 10,000 and 11,000 gcpm. Therefore, at locations where the 2" x 2" NaI detector measurements exceeded 11,624 to 12,624 gcpm, HP Technicians slowed or paused the GWS for more careful investigation of the small areas of elevated activity before deciding if "flagging" a point for potential biased sampling was warranted.

After the GWS survey was complete, the GPS/GWS data was reviewed by Radiological Engineering and the HP Technician performing the survey to determine if possible areas of elevated residual activity remained within the SU that required biased sample investigation. Areas that were flagged by the HP Technician were considered, as well as a statistical evaluation of the GWS data set. The statistical evaluation determined the mean count rate and standard deviation associated with the GWS and then could be used to identify any areas that exceeded 3 standard deviations above the mean. The number of biased samples to be collected and the locations are based on flagged locations exceeding the IAL, the statistical evaluation of the GWS data set, and the professional judgment of Radiological Engineering.

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14.2 Soil Sampling

14.2.1 Systematic Soil Sampling Summary

Table 14-1 provides a summary of systematic sampling by stratum for LSA 03-02.

Systematic Sampling Summary by Stratum for LSR 05-02							
LSA	SU Area						
	planar (m ²)	Surface	Root	Deep (Excavation)	QC		
03-02	2,553	8	8	0	2		

Table 14-1Systematic Sampling Summary by Stratum for LSA 03-02

14.2.2 Systematic Sampling LSA 03-02

Within LSA 03-02, there were 8 systematic locations in which the surface stratum (0 - 15 cm) was sampled in the SU. The underlying root stratum was also sampled at all 8 locations. Excavation stratum samples were collected and archived, but were not required to be analyzed since no root stratum sample exceeded a 0.5 Uniform SOF.

Given a planar area of 2,553 m^2 for LSA 03-02 and an eight - point systematic triangular grid, the point-to-point distance within each row was 24 m within the SU.

While there were eight (8) systematic locations on the LSA 03-02 sampling grid, a total of eighteen (18) samples were collected and analyzed at these locations, including:

- Eight (8) samples collected and analyzed within the surface stratum
- Eight (8) samples collected and analyzed within the root stratum
- Zero (0) samples analyzed within the excavation, or "deep" stratum
- Two (2) QC field replicate

Figure 14-1 presents the map of the eight systematic sample locations which were sampled within LSA 03-02. The inset table notes the location coordinates (Missouri East, NAD 1983) and collection intervals for each systematic location.



Table 14-2 be	hin LSA 03	-02 with						
associated IDs	s, sample typ	pes, co	llection inte	rvals, coordi	nates, and	notes.		
	FSS S	amnla	[Locations	Fable 14-2 and Coordiv	natos for I	SA 03 03	,	
	Presedures UD		E 701 Einel Statu			JSA 0 5- 02		
Hematite	Plocedule. HD	Р-РК-ГБ	5-701, Fillar Statu	s Survey Plan Deve	lopment			
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			AF	PPENDIX P-4				
	FSS	SAMPLI	E & MEASUREN	MENT LOCATIO	NS & COORD	INATES		
Survey Area:	LSA 03			Description:		Plant Op	en Land Area	
Survey Unit: Survey Type	02 FSS			Description: Classification		West of Site	Pond in "Area 5" Tlass 2	
Survey Type:	100			Clussification			1455 2	
Measurement or Sample ID	Surface or CSM	Туре	Start Elevation*	End Elevation*	Northing** (Y Axis)	Easting** (X Axis)	Remarks / M	Notes
L03-02-01-P-S-S-00	Uniform	S	427.4	426.9	864144	826693	Surface 6-inc	h grab
L03-02-02-P-R-S-00	Uniform	S	426.9	422.5	864144	826693	Root 5-foot co	mposite
L03-02-04-P-S-S-00	Uniform	S	427.6	427.1	864089	826662	Surface 6-inc	h grab
L03-02-05-P-R-S-00	Uniform	S	427.1	422.7	864089	826662	Root 5-foot co	mposite
L03-02-07-P-S-S-00	Uniform	S	428.0	427.5	864035	826693	Surface 6-inc	h grab
L03-02-08-P-R-S-00	Uniform	5	427.5	423.1	864035	826693	Root 5-foot co	mposite
L03-02-10-P-S-S-00	Uniform	<u> </u>	430.1	429.0	863980	826662	Root 5-foot co	mosite
L03-02-13-P-S-S-00	Uniform	S	429.4	428.9	863980	826724	Surface 6-inc	h grab
L03-02-14-P-R-S-00	Uniform	S	428.9	424.5	863980	826724	Root 5-foot co	mposite
L03-02-16-P-S-S-00	Uniform	S	430.6	430.2	863926	826693	Surface 6-inc	h grab
L03-02-17-P-R-S-00	Uniform	S	430.2	425.7	863926	826693	Root 5-foot co	mposite
L03-02-19-P-S-S-00	Uniform	S	429.4	428.9	863926	826756	Surface 6-inc	h grab
L03-02-20-P-R-S-00	Uniform	S	428.9	424.5	863926	826756	Root 5-foot co	mposite
L03-02-22-P-S-S-00	Uniform	S	431.4	430.9	863871	826724	Surface 6-inc	h grab
L03-02-23-P-R-S-00	Uniform	S	430.9	426.5	863871	826724	Root 5-foot co	mposite
L03-02-11-P-R-Q-00	Uniform	Q	429.6	425.2	863980	826662	Root 5-foot co	mposite
L03-02-19-P-S-Q-00	Uniform	Q n	429.4	428.9	863926	826756	Surface 6-inc	n grab
L03-02-23-F-8-B-00	Uniform	R	427.4 429.4	420.9	863924	826763	Surface 6-inc	h grab
Elevations are in feet a *Elevations are in feet a *Missouri - East State Distance in feet from lo	Uniform Uniform bove mean sea le Plane Coordinate wer left corner of	B B vel. es [North the surfac	427.4 429.4 American Datum ce (Structures); ea	(NAD) 1983] (Ope ch surface has its o	863924 863924 n Land Area) C wn (X,Y) = (0,	826679 826763 Gre sar	Surface 6-inc Surface 6-inc een shaded sam the samples at e mple location, fo WRS test.	h grab h grab ples are each r use in

Quality Record

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14.3 Biased Soil Sampling

As discussed in FSSFR Volume 3, Chapter 1, Section 6.1.3, there are three key methods for identifying areas for biased soil sampling, the IAL, the Z-score of the FSS GWS, and the professional judgment of the HP Staff. For LSA 03-02 two (2) biased sample location were selected within the SU based on the evaluation of the GWS survey data and HP Technician professional judgment. Biased samples are collected at the prescribed location to a depth of 6 inches below the exposed ground surface.

14.4 Judgmental/Sidewall Sampling for Tc-99

As a Class 2 SU no remediation was expected to be or was conducted in LSA 03-02. As such, sidewall samples were not required to be collected in LSA 03-02. Therefore, no sidewall samples were collected within the SU.

14.5 Quality Control Soil Sampling

Two QC field duplicate sample point were randomly selected and collected at systematic location L03-02-11 and L03-02-19 for LSA 03-02.

15.0 FINAL STATUS SURVEY RESULTS LSA 03-02

15.1 Gamma Walkover Survey

Post-processed GPS coordinate data is accurate to within ± 0.1 m for the handheld GPS models used during the GWS. The GWS maps are plotted and presented in a 2-D format. When multiple data points are collected at the same GPS location during the walkover, the most elevated radiological measurements are plotted.

GWS measurements were collected in LSA 03-02 between October 13, 2015, and October 14, 2015.

15.1.1 GWS Results for LSA 03-02

For LSA 03-02, GWS count rates ranged between 7,598 gcpm and 12,567 gcpm, with a mean count rate of 10,673 gcpm. The median count rate was 10,681 gcpm with a standard deviation of 471 cpm. Figure 15-1 below presents a map of the complete GWS data set.

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Figure 15-1 Colorimetric GWS Plot for LSA 03-02



An evaluation of the entire GWS data set was performed to evaluate those small areas of elevated activity which exceeded both the IAL (> 4000 ncpm) and three (3) standard deviations above the GWS mean measurement, (i.e., "+3 Z-score"). Two locations (L03-02-25 and L03-02-26) were selected for biased sample collection. The sample collected at location L03-02-25 represented the maximum GWS measurement (12,567 gcpm) within the SU.

Figure 15-2 presents a map of the +3 Z-score GWS measurements within LSA 03-02, including the selected biased sampling location.

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Figure 15-2 Colorimetric GWS Plot for LSA 03-02 (Measurements > Z-score of 3)



All GWS data collected in LSA 03-02 was datalogged and post-processed in GIS software.

15.1.2 GWS Coverage Results LSA 03-02

FSSFR Volume 3, Chapter 1, Section 6.1.4, *Exposed Surfaces versus Accessible Surfaces*, provides a discussion and the criteria for evaluating the GWS coverage of a SU during FSS.

As a Class 2 SU LSA 03-02 was required to undergo a minimum of a 50% GWS. The actual GWS coverage was 52.5% of the SU surface.

15.2 Soil Sample Results LSA 03-02

Appendix B presents the analytical results and associated statistics for all FSS samples collected within LSA 03-02.

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15.2.1 Surface Soil Sample Results LSA 03-02

There were eight systematic samples collected within the surface stratum (0 - 15 cm) of LSA 03-02. Additionally there were two biased and one QC sample collected in the topmost layer of soil. The maximum Uniform SOF result for the surface samples was 0.28.

15.2.2 Subsurface Soil Sample Results LSA 03-02

There were eight systematic locations within LSA 03-02 where root stratum composite sampling was necessary. Additionally there was one QC sample collected in the root stratum. The root stratum zone is between 0.15 and 1.50 m below final grade surface. At each of the eight root stratum composite sampling locations, the top six inches (1.50 - 1.65 m below final grade surface) of the underlying excavation stratum was also collected and archived, however these excavation samples were not required to be analyzed as no overlying root stratum sample exceeded a 0.5 SOF. The maximum SOF result of the subsurface samples collected in LSA 03-02 was 0.47.

15.2.3 WRS Evaluation LSA 03-02

Per Step 7.8.3 of HDP-PR-FSS-721 *Final Status Survey Data Evaluation*, the WRS statistical test was required for LSA 03-02 since the difference between the maximum SU data set gross SOF and the minimum background area SOF was greater than one using the Uniform Stratum criteria. All systematically collected samples regardless of depth are used to perform the WRS Test, however biased and QC sample results are not utilized in the WRS Test. The 16 systematically collected samples in LSA 03-02 were ranked against the adjusted activity concentrations of the 32 samples collected within the Background Reference Area. The SU passed the WRS Test since the ranked sum of the reference area ranks, or test statistic W_{R} , (1039) was greater than the critical value (860) for the test. As such, the null hypothesis that the SU average concentration is greater than the DCGL_W was rejected. The WRS evaluation is also included in Appendix B.

15.2.4 Graphical Data Review LSA 03-02

Table 15-1 below presents summary results for the all systematically collected samples (includes surface, and root, but not biased or QC samples) collected within LSA 03-02, and the associated SOF when compared to the Uniform Stratum DCGL_{WS}. The arithmetic average concentration resulted in a SOF of 0.20.

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LSA 03-02 FSS Sample Data Summary and Calculated SOF Values (Systematic)								
Statistic	Ra-226 DCGL = 1.9 BKG = 1.07 (pCi/g)	Tc-99 DCGL = 25.1 (pCi/g)	Th-232 DCGL = 2.0 BKG = 1.0 (pCi/g)	U-234 DCGL=195.4 (pCi/g)	U-235 DCGL=51.6 (pCi/g)	U-238 DCGL=168.8 (pCi/g)	Sample SOF (Uniform DCGL)	
Average	0.166	0.072	0.183	2.107	0.111	1.202	0.20	
Minimum	0.00 (<bkg)< td=""><td>0.00 (NEG)</td><td>0.00 (<bkg)< td=""><td>0.071</td><td>0.002</td><td>0.751</td><td>0.04</td></bkg)<></td></bkg)<>	0.00 (NEG)	0.00 (<bkg)< td=""><td>0.071</td><td>0.002</td><td>0.751</td><td>0.04</td></bkg)<>	0.071	0.002	0.751	0.04	
Maximum	0.490	0.213	0.420	5.236	0.289	1.960	0.47	

Table 15-1 A 03-02 FSS Sample Data Summary and Calculated SOF Values (Systemat

Notes:

1. Ra-226 and Th-232 background activities subtracted prior to calculating SOF value. Ra-226 background without ingrowth = 0.9 pCi/g; Ra-226 background with ingrowth = 1.07 pCi/g. Negative SOF components are set to zero in SOF calculation.

2. Average SOF for data set calculated using average radionuclide concentrations.

3. U-234 values are inferred from the U-235/U-238 ratio.

Section 8.2.2.2 of MARSSIM recommends a graphical review of FSS analytical data, to include at a minimum, a posting plot and a histogram. A frequency plot, or histogram, is a useful tool for examining the general shape of a data distribution. This plot is a bar chart of the number of data points within a certain range of values. The frequency plot will reveal any obvious departures from symmetry, such as skewness or bimodality (two peaks), in the data distribution for the SU. The presence of two peaks in the SU frequency plot may indicate the existence of isolated areas of residual radioactivity.

Figure 15-3 presents the overall statistical metrics for the SOF parameter for the 16 systematically collected samples from LSA 03-02. The top graph is a histogram and line plot of the SOF for the systematic data population for LSA 03-02. The middle graph presents the mean SOF (0.20) as indicated by the blue vertical line of the sample population and the 95% confidence interval of the mean SOF represented by the blue diamond which is 0.14 to 0.26. The 97.87% confidence interval based on the median (0.20) of the sample results is 0.12 to 0.28. The bottom two charts present the various statistical metrics of the LSA 03-02 SOF data set, including the mean, median, standard deviation, minimum, maximum, confidence intervals, etc.

Figure 15-3 exhibits no unusual symmetry or bimodality concerns for the LSA 03-02 data associated with the systematically collected measurement locations.



N 16

	Mean	95%	6 CI	Mean SE	SD	Variance	Skewness	Kurtosis
LSA 03-02 Sys SOF	0.20	0.14	to 0.26	0.029	0.11	0.01	0.6	0.79
		1st				3rd		
	Minimum	quartile	Median	97.8	7% CI	quartile	Maximum	IQR
LSA 03-02 Sys SOF	0.04	0.12	0.20	0.12	to 0.28	0.26	0.5	0.14

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A posting plot is simply a map of the SU with the data values (in this case the SOF values for each systematically collected sample) entered at the measurement locations. This potentially reveals heterogeneities in the data – especially possible patches of elevated residual radioactivity. The posting plot for LSA 03-02 is presented below in Figure 15-4. Figure 15-4 shows no unusual patterns in the data.

Figure 15-4 Posting Plot for LSA 03-02 Systematic Measurement Locations



Appendix B to this report presents the complete analytical data set (in Microsoft Excel format) used to derive the summary statistics presented in Table 15-1, Figure 15-3, and Figure 15-4 above. A summary of the analytical data is presented in Table 15-2 below. Appendix H to this report presents the Test America Analytical Laboratory soil sample reports.

			nr. SOF _N	SOF _⊲	.1 0.20	.3 0.04	.4 0.12	.5 0.47	.6 0.12	.9 0.34	-4 0.23 5 0.23	5 0.28	.4 0.17	.0 0.17	.9 0.23	.3 0.04	.5 0.30	.5 0.07	.2 0.20	.1 0.25	.8 0.07	.7 0.03	.9 0.03	.6 0.04	ر» ان 10.47	0.20	0.20	Enric			
			ū	Qualifier	0 r	IA 1	1 1	IA 0	IA 2	IA 2			IA 0	J 5	IA 1	1 1	IA 0	IA 1	IA 1	IA 2	IA 0	L L	L L	-		əbi	Vers	4			
			ŀ	WDC	1 668	315 N	318 N	366 N	74 N	960 N	360 L	92 N	384 N	978 L	301 N	795 N	387 N	389 N	919 N	338 N	350 N	905 N	735 N								
			U-238	Uncertainty	33 0.8	93 0.8	43 0.8	73 0.8	10 0.7	86 1.0	94 0.8	80 0.9	87 0.8	39 0.6	96 0.8	50 0.7	38 0.8	32 0.8	01 0.9	53 0.8	87 0.8	02 0.9	80 0.7	0.751	1.960	1.202	1.135	0.341			
65				มกรอม	5 0.3	5 0.29	0 0.5	0 0.5	5 0.3	0 0.3	0.2	0.0	0.5	32 0.3	6 0.29	0.6	0 0.3	0.3	0.0	0 0.5	0.58	0.00	0.48								
54 of					0.87	0.91	1.32	1.51	0.97	1.07	0.75	1.67	1.52	0.86	0.85	1.96	1.11	1.16	1.35	1.45	1.83	1.49	1.12						-		
Page				Qualifier	N 69	D O	N 8	б U	.3 ∪	-7 U				98 NA	13 N	¥ ⊃	z ⊃	О 6;	⊃ q	'3 N∕	∩ 6;		0								
			-235	()	2 0.25	1 0.24	1 0.24	3 0.27	3 0.17	3 0.24	0.23	2 0.28	3 0.22	2 0.19	2 0.24	4 0.16	9 0.28	7 0.24	5 0.24	9 0.17	0.24	0.25	2 0.16	.002	.289	.111	.107	.073			
			D	Uncertainty	0.152	0.13	0.15′	0.093	0.123	0.198	0.135	0.162	0.143	0.162	0.142	0.11	0.169	0.147	0.14{	0.119	0.15(0.16(0.102	0	0	0	0	0			
				fluseЯ	0.002	0.073	0.112	0.041	0.167	0.199	0.068	0.160	0.031	0.289	0.102	0.163	0.033	0.111	660.0	0.191	060.0	0.158	0.133								
			_	Qualifier	ΝA	NA	ΝA	ΝA	ΝA	ΝA	AN AN	AN AN	NA	NA	NA	NA	ΝA	ΝA	ΑN	NA	ΝA	AA	AN								
			d U-234	WDC	ΝA	NA	AN	AN	AN	AN	AN N	A A	AA	NA	AN	ΝA	NA	AN	AN	NA	AA	A	AN	071	236	107	014	302			
	5		Inferre	Uncertainty	ΝA	NA	AN	ΝA	ΝA	AN	AN N	A N	AA	NA	ΝA	ΝA	NA	ΝA	NA	ΝA	NA	AN	A	0.0	5.2	5	2.(4			
	∆ 03-0			fluseЯ	0.071	1.405	2.136	0.941	3.054	3.625	1.293 2.568	3.031	0.750	5.236	1.897	3.133	0.741	2.103	1.926	3.529	1.859	2.962	2.473								
	ı: LS⁄	lts		Corrected Result	0.070	0.030	0.000	0.400	060.0	0.310	0.280	0.420	0.100	0.190	0.240	0.000	0.310	0.060	0.220	0.230	0.070	0.000	0.000								
	l Data	al Resu		**Jlus9A	0.070	0.030	-0.005	0.400	0.090	0.310	0.280	0.420	0.100	0.190	0.240	-0.003	0.310	0.060	0.220	0.230	0.070	-0.022	-0.065								
	15-2 lytica	Analytic	32	Qualifier	NA	NA	AN	AA	AN	AN	AN N	A N	AN	NA	AN	AN	AN	AN	ΑN	NA	NA	A	ΝA	0	50	33	95	88			
	Table y Ana	nerica /	Th-2	МDС	0.121	0.085	0.123	0.114	0.110	0.141	0.100	0.142	0.124	0.128	0.134	0.088	0.119	0.084	0.167	0.093	0.131	0.114	0.082	0.00	0.42	0.18	0.19	0.13	1.0		
	Surve	TestAr		Uncertainty	0.162	0.148	0.166	0.217	0.192	0.223	0.216 0.178	0.278	0.171	0.195	0.194	0.156	0.203	0.160	0.185	0.181	0.165	0.203	0.139						= 6		
	atus 9		•	tlusəЯ	020.	.030	.995	.400	060.	.310	.280	.420	.100	.190 (.240	.997	.310	.060	.220	.230	.070	.978	.935 (h232 bk		
	nal St			Qualifier	U 1	U 1	0 N		U L			 > -		U 1	U 1	0	U L	U L	U L	U 1	NA 1	o ⊃	NA 0						-		
	E			MDC	0.211	0.221	0.218	0.264	0.206	0.262	0.213	0.225	0.219	0.234	0.234	0.240	0.233	0.212	0.221	0.233	0.234	0.222	0.257								
			66-	Uncertainty	0.031	0.033	0.032	.044	.054	0.014	0.028	0.075	0.051	0.73	0.062	.163	.022	0.044	0.31	0.025	.146	.117	0.106	000	213	172	090	151			
			Ţ	Corrected Result	096	069 C	105 C	054 C	059 C	054 C	084 0	048	000	060 C	061 C	213 C	041 0	141 C	009 0	000 C	346 0	022 0	265 C	0.0	0.2	0.0	0.0	0.0			
				flusəЯ	96 0.	69 0.	05 0.	54 0.	59 0.	54 0.	84 34 0	48 148 10 10	01 0.	90 06	61 0.	13 0.	41 0.	41 0.	0 60	01 0.	46 0.	22 0.	.65 0.								
				רסוופכופמ אפצמוו	0.0 0.0	0.0 0.0	0 0.1	0.0	0.0 0.0	0.0		0.0	0.0-	0.0 0.0	0.0 0.0	0 0.2	0.0 0.0	0 0.1	0.0 0.0	0.0-	0 0.3	0.0	0 0.2						~		
					0.29	0.02	0.18	0.49	0.10	0.29	0.15	0.07	0.20	0.06	0.18	0.00	0.26	0.02	0.14	0.19	0.00	0.0	0.00						1.07		
on: 0				*fluseЯ teN	0.290	0.020	0.180	0.490	0.100	0.290	0.150	0.070	0.200	0.060	0.180	-0.030	0.260	0.020	0.140	0.190	-0.040	-0.060	-0.162								
tevisio			1-226	Qualifier	NA	NA (AN (A	AN	AN	A N	X N	AN NA	AN (N	AN	NA	AN 0	AN	AN (NA	¥	A	000	490	166	.165	127	26 bkg		
В	-		Ra	WDC	0.067	0.066	0.070	0.082	0.067	0.075	0.067	0.088	0.066	0.079	0.062	0.068	0.085	0.065	0.070	0.065	0.070	0.075	0.061	0	0.	Ö	0.	Ō	use Ra2		
				Uncertainty	0.187	0.151	0.176	0.204	0.161	0.198	0.167	0.177	0.172	0.170	0.164	0.148	0.193	0.155	0.174	0.166	0.149	0.159	0.131						growth,		
				Result	1.360	1.090	1.250	1.560	1.170	1.360	1.220	1.140	1.270	1.130	1.250	1.040	1.330	1.090	1.210	1.260	1.030	1.010	0.908						With in	NOTES	
t t		()	O 'SE	Type (Systematic, Bia	S	S	S	S	S	S	s S	ით	S	S	S	S	S	S	S	Ø	Ø	в	В					ion			
roject			(1J) H	Sample Dept	0.00	0.50	0.00	0.50	00.0	0.50	0.00	00.0	0.50	0.00	0.50	00.0	0.50	00.0	0.50	0.50	0.00	0.00	0.00	imum	kimum	ean	dian	d Deviati			
F			a	ll əlqms2	-01-P-S-S-00	-02-P-R-S-00	-04-P-S-S-00	?-05-P-R-S-00	?-07-P-S-S-00	?-08-P-R-S-00	2-10-P-S-S-00	-13-P-S-S-00	-14-P-R-S-00	-16-P-S-S-00	?-17-P-R-S-00	?-19-P-S-S-00	-20-P-R-S-00	-22-P-S-S-00	-23-P-R-S-00	-11-P-S-Q-00	-19-P-R-Q-00	?-25-P-S-B-00	?-26-P-S-B-00	Systematic Min	Systematic Max	Systematic M	Systematic Me	stematic Standarc			

**Background, 1.0 pCi/g subtracted from gross result. U Qualifier: Result is less than the sample detection limit. All uncertainty values are reported at the 2-sigma confidence level.

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15.2.5 Biased Soil Sample Result LSA 03-02

Two (2) biased sample was collected from LSA 03-02. The sample collected at location L03-02-25 represented the maximum GWS measurement (12,567 gcpm) within the SU, and had a result of 0.03 Uniform SOF.

15.2.6 Quality Control Soil Sample Result LSA 03-02

Two QC field duplicate sample points were randomly selected for LSA 03-02 which were collected at systematic locations L03-02-11 and L03-02-19.

For the 18 samples (i.e., 16 systematic + 2 biased) collected within LSA 03-02, two field duplicate samples were collected. This frequency equates to 11.1%, (i.e. 2/18). Form HDP-PR-FSS-703-1 documents that the duplicate sample result comparison with the partner's sample results that all comparison criteria were less than the calculated warning limits (see Figure 15-5 below).

Project F.	Revisio	n: 0										
For Hematite Decommissioning Pr	orm HI											Page 56 of
Hematite Decommissioning Pr		OP-PR-FS	S-703-1 F	ïeld Du	Figure 15 uplicate Sa	-5 ample A	ssessment	LSA 03-	02 (1 of 2	()		
Hematite Decommissioning Pr	- 1	Procedure: H	DP-PR-FSS-	703, Fina	I Status Surv	ey Quality	Control					
	roject									Revision	n: 2	Page 1 of 1
			FIE	FID DUF	ORM HDP-I	PR-FSS-70 AMPLE A	13-1 SSESSMENT					
Survey Unit No.: LSA 03-02					Survey Unit D	escription:	Class 2 Survey	Unit West of	Site Pond in	"Area 5"		
Field Dum	nlicate		Sample (p	Ci/g)	Field Duplica (pCi/s	te Sample	Average Activity (\vec{Y})	Nuclide		Warning	Control	Statistic Statistic
Sample ID Sample	e ID	Radionuclide	Activity (x _i)	MDC	Activity (x _i)	MDC	(pCi/g)	(pCi/g)	Statistic ²	Limit	Limit	(V/N)
L03-02-11-P-R-S-00 L03-02-11-P-	-S-Q-00	Ra-226	1.270	0.0519	1.260	0.069	1.265	1.9	0.01	0.269	0.403	Z
L03-02-11-P-R-S-00 L03-02-11-P-	-S-Q-00	Tc-99	0.0344	0.236	-0.0014	0.233	0.0165	25.1	NA	3.552	5.321	NA
L03-02-11-P-R-S-00 L03-02-11-P-	-S-Q-00	Th-232	1.2	0.114	1.230	0.093	1.215	2.0	0.030	0.283	0.424	z
L03-02-11-P-R-S-00 L03-02-11-P-	-S-Q-00	U-234 ¹	2.368	NA	3.529	NA	2.949	195.4	1.161	27.649	41.425	Z
L03-02-11-P-R-S-00 L03-02-11-P-	-S-Q-00	U-235	0.125	0.236	0.191	0.173	0.158	51.6	NA	7.301	10.939	NA
L03-02-11-P-R-S-00 L03-02-11-P-	-S-Q-00	U-238	1.32	0.845	1.45	0.838	1.385	168.8	0.13	23.885	35.786	z
Comments: 1. U-234 is inferred, no MDC availab 2. Duplicate assessment is not necess.	ble. sary if the n	esult of either	sample is < M	DC.								
Performed by: Thomas Yardy	Im	M				,	Reviewed by: C	lark Evers				
Date:	5-8	-17				0.53	Date: W	UN S	e X	51811	4	
Quality Record											2	

Project Revision: 0 Figure 15-5 Form HDP-PR-FSS-703-1 Field Duplicate Sample Assessment LSA 03-02 (2 of 2) Hematic Decommissioning Project Hematic Decommissioning Project FreLD DUPLCATE SAMPLE ASSESSMENT FreLD DUPLCATE SAMPLE ASSESSMENT Revision FreDation Sample (DCUS) Sample (DCUS) Fredation Fredation <	ct Evision: 0 Figu Form HDP-PR-FSS-703-1 Field Duplic Procedure: HDP-PR-FSS-703, Final Stat Decommissioning Project FORM FORM	ure 15-5 icate Sample A tus Survey Quality A HDP-PR-FSS-70	ssessment Control					
Figure 15-5Figure 15-5Figure 15-5Form HDP-PR-FSS-703-1 Field Duplicate Sample Assessment LSA 03-02 (2 of 2)Hematite Decommissioning ProjectProcedure: HDP-PR-FSS-703. Final Status Survey Quality ControlHematite Decommissioning ProjectProcedure: HDP-PR-FSS-703. Final Status Survey Quality ControlHematite Decommissioning ProjectProcedure: HDP-PR-FSS-703. Final Status Survey Quality ControlProcedure: HDP-PR-FSS-703. Final Status Survey Unit Decommissioning ProjectHematite Decommissioning ProjectField DuplicateSample (CCIG)Sample (CCIG)Sample (CCIG)Sample (CCIG)Sample (CCIG)Sample (D)Sample (D)Sample (D)Sample (D)Sample (D)Sample (CCIG)Sample (D)Sample (D) <th>Figure Form HDP-PR-FSS-703-1 Field Duplic Procedure: HDP-PR-FSS-703, Final Stat Decommissioning Project From From FIELD DUPLIC.</th> <th>ure 15-5 icate Sample A atus Survey Quality M HDP-PR-FSS-70</th> <th>ssessment]</th> <th></th> <th></th> <th></th> <th>Page 57 o</th>	Figure Form HDP-PR-FSS-703-1 Field Duplic Procedure: HDP-PR-FSS-703, Final Stat Decommissioning Project From From FIELD DUPLIC.	ure 15-5 icate Sample A atus Survey Quality M HDP-PR-FSS-70	ssessment]				Page 57 o	
Hematite Decommissioning Project Procedure: HDP-PR-FSS-703, Final Status Survey Quality Control Revisio Hematite Decommissioning Project FIELD DUFLICATE SAMPLE ASSESSMENT Revisio Survey Unit No.: ISA 03-02 Survey Unit Neerothic Class 2 Survey Unit West of Site Pond In "Area 5" Survey Unit No.: ISA 03-02 Survey Unit Neerothic Class 2 Survey Unit West of Site Pond In "Area 5" Survey Unit No.: ISA 03-02 Survey Unit Neerothic Class 2 Survey Unit West of Site Pond In "Area 5" Survey Unit No.: ISA 03-02 Survey Unit Neerothic Class 2 Survey Unit West of Site Pond In "Area 5" Survey Unit No.: ISA 03-02 ISA 03-02 ISA 03-02 Sumple ID Radiomiclide Activity (x) MDC Activity (x) DCCI (g) Sunsist IO3-02-19-Fx5-00 IO3-02-19-Fx4-0-00 U-224 IS3 IS4 IS3	Decommissioning Project FIELD DUPLIC	ttus Survey Quality M HDP-PR-FSS-70	Control	LSA 03-0	2 (2 of 2			
Hematite Decommissioning Project FORM HDP-PR-FSS-703-1 Revision Interference FORM HDP-PR-FSS-703-1 FIELD DUPLICATE SAMPLE ASSESSMENT Survey Unit No:: LSA 03-02 Colspan="2">Survey Unit No:: Readionuclide Survey Unit Description Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2" ISA 0103-02-19-PS-600 <td colspan<="" td=""><td>Decommissioning Project FORM</td><td>A HDP-PR-FSS-70 A TE SAMPLE A</td><td></td><td></td><td></td><td></td><td>-</td></td>	<td>Decommissioning Project FORM</td> <td>A HDP-PR-FSS-70 A TE SAMPLE A</td> <td></td> <td></td> <td></td> <td></td> <td>-</td>	Decommissioning Project FORM	A HDP-PR-FSS-70 A TE SAMPLE A					-
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Survey Unit No.: LSA 03-02 Survey Unit Description: Class 2 Survey Unit West of Site Pond in "Area 3" Survey Unit No.: LSA 03-02 Survey Unit Description: Class 2 Survey Unit West of Site Pond in "Area 3" Sample ID Sample ID Sample (D Sample (Cig) Ration (Site Pond in "Area 3" Sample ID Sample (D Sample (Cig) Molicide Activity (X) MOIC Activity (X) DCGL Statistic 3 Limit 03-02-19-PR-Q-00 Ra-226 1.04 0.0832 1.033 0.193 0.01 0.269 103-02-19-PR-Q-00 Th-233 0.214 0.214 0.134 1.034 2.0 0.013 0.283 0.01 0.269 103-02-19-PR-Q-00 U-235 0.163 0.164 0.084 0.219 NA 2.496 195.4 1.274 27.649 103-02-19-PR-Q-00 U-235 0.163 0.164 0.249 0.137 2.13 2.361 103-02-19-PR-Q-00 U-235 1.96 0.795 1.839 0.137 2.164 1.274 27.649			13-1 SSESSMENT				-	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	io.: LSA 03-02 Surve	ey Unit Description:	Class 2 Survey 1	Jnit West of S	ite Pond in	'Area 5"		
Example ID Fried Dupticate Sample ID Sample ID Sample ID Sample ID Sample ID Rationuclide Activity (x), MDC Activity (x), DCU Statistic Main 103-02-19-P.S.S-00 103-02-19-P.R.Q-00 Ra-236 1.03 0.0695 1.035 1.9 0.01 0.269 103-02-19-P.R.Q-00 Te-99 0.213 0.24 0.346 0.234 0.2795 25.1 NA 3.552 103-02-19-P.R.Q-00 Th-232 0.997 0.088 1.07 0.131 1.034 2.0 0.073 0.283 103-02-19-P.S.S-00 103-02-19-P.R.Q-00 T-2332 0.997 0.088 1.07 0.131 1.034 1.274 2.1649 103-02-19-P.S.S-00 103-02-19-P.R.Q-00 U-2334 0.163 0.164 0.0904 0.249 0.137 2.1649 103-02-19-P.S.S-00 103-02-19-P.R.Q-00 U-2334 1.96 0.795 1.839 0.133 2.3485 103-02-19-P.S.S-00 103-02-19-P.R.Q-00 U-2334 0.249 0.249	Field	d Duplicate Sample	Average	Nuclide			Statistic	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	ID Sample ID Radionuclide Activity (x,) MDC Activ	ivity (x _i) MDC	ACUVILY (X) (pCi/g)	(pCi/g)	Statistic ²	Limit Limit	t (Y/N)	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	S-S-00 L03-02-19-P-R-Q-00 Ra-226 1.04 0.0682 1	1.03 0.0695	1.035	1.9	0.01	0.269 0.40	N N	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	S-S-00 L03-02-19-P-R-Q-00 Tc-99 0.213 0.24 0.).346 0.234	0.2795	25.1	NA	3.552 5.32	I NA	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	S-S-00 L03-02-19-P-R-Q-00 Th-232 0.997 0.088 1	1.07 0.131	1.034	2.0	0.073	0.283 0.42	4 N	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	S-S-00 L03-02-19-P-R-Q-00 U-234 ¹ 3.133 NA 1.	I.859 NA	2.496	195.4	1.274	27.649 41.42	5 N	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	S-S-00 L03-02-19-P-R-Q-00 U-235 0.163 0.164 0.0	.0904 0.249	0.127	51.6	NA	7.301 10.93	AN 0	
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: Thomas Yardy	S-S-00 L03-02-19-P-R-Q-00 U-238 1.96 0.795 1	1.83 0.85	1.895	168.8	0.13	23.885 35.78	9 N	
Performed by: Thomas Yardy Clark Evers	ferred, no MDC available. ssessment is not necessary if the result of either sample is < MDC.							
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11 11 C. 10	Thomas Yardy		Reviewed by: C	lark Evers				
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15.3 Tc-99 Hot Spot Assessment LSA 03-02

As a Class 2 SU, there is no history of any sample from the SU exceeding the Tc-99 DCGL_W, or a SOF of 1.0. The highest Tc-99 sample result collected from both Final RASS and FSS was 0.2 pCi/g. There is no indication of a potential Tc-99 hot spot exceeding the DCGL_W of 25.1 pCi/g, and therefore a Tc-99 hot spot assessment is not required.

16.0 ALARA EVALUATION LSA 03-02

All samples collected within LSA 03-02 were evaluated against the Uniform Stratum DCGL_W. For LSA 03-02 no sample result exceeded a SOF of 1.0. The average SOF result, based on all systematically collected samples, was 0.20 for LSA 03-02. The average SOF equates to residual activity contributions from the SU area of 5.0 mrem/yr for LSA 03-02. Groundwater Monitoring Well data provided in FSSFR Volume 6, Chapters 2 and 3 {ML16287A528}, and Chapter 4 {ML16342B552}, and Chapter 5 {ML17018A105} indicate that the groundwater dose contribution will be a fraction of the MCLs. Nevertheless, a maximum groundwater contribution assumption of 4.0 mrem/yr based upon the EPA MCLs will be added to the total estimated dose for LSA 03-02. Additionally, 4.25 mrem/year will be added to LSA 03-02 to account for the dose contribution from the presence of Reuse Stockpile 8b soil. Adding these dose contributions together, the total estimated dose for LSA 03-02 is 13.25 mrem/year.

Since the estimated TEDE is below the regulatory release criterion of 25 mrem/yr, the conclusion of the ALARA evaluation is that the FSS of LSA 03-02 was successful and that there would be no discernable benefit to the health and safety of the public in attempting to further reduce the results of FSS by performing remediation of LSA 03-02.

17.0 FSS PLAN DEVIATIONS LSA 03-02

17.1 Remedial Actions during FSS

There were no remedial actions after FSS in LSA 03-02.

17.2 Adjustments to Scan MDC Calculations

Scan MDCs for LSA 03-02 were calculated in accordance with HDP-PR-FSS-701, Revision 10, *Final Status Survey Plan Development* and HDP-TBD- FSS-002, Revision 3, *Evaluation and Documentation of the Scanning Minimum Detectable Concentrations (MDC) for Final Status Surveys (FSS)*. The assumed LSA background count rate of 10,000 cpm was applied to determine the prospective Scan MDCs, and the actual mean count rate from the FSS survey was 10,673 cpm. Therefore the calculated Scan MDCs are appropriate, and no adjustments need to be made.

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18.0 DATA QUALITY ASSESSMENT

The DQO process is thoroughly integrated within the DP and Hematite FSS procedures. The steps of the DQO process are presented in Volume 3, Chapter 1, Section 4.0 of the FSSFR and correspond to the DQO steps described in Chapter 14, Section 4.2.1 of the DP. The HDP DQO process reflects the recommendations given in MARSSIM, Chapter 2, Figure 2-2.

18.1 Data Quality Assessment for LSA 03-02

The Data Quality Assessment of the survey methodology, sampling and sample analysis results, and the Quality Control sampling and analysis results to ascertain the validity of the conclusion for LSA 03-02 (see Figure 18-1) provides the following:

- The field and laboratory instruments utilized were capable of detecting activity at an MDC less than the appropriate investigation level, and were verified to be operable prior to and after use in accordance with HDP-PR-HP-416 (*Operation of the Ludlum 2221 for Final Status Survey*).
- The calibration of all instruments that were used to measure or analyze data was current at the time of use and the calibrations of the instruments were performed using a NIST traceable source. The instruments used were successfully source checked prior to and after use.
- The systematic samples that were collected (on a random-start triangular grid) and the gamma scan surveys that were conducted were performed in accordance with procedure HDP-PR-FSS-711, *Final Status Surveys and Sampling of Soil and Sediment*.
- All samples sent for analysis at the approved offsite laboratory (TestAmerica) were tracked on a chain of custody form in accordance with HDP-PR-QA-006, *Chain of Custody*.
- Quality Control sample results were verified to meet the acceptance criteria as specified in HDP-PR-FSS-703, *Final Status Survey Quality Control.*
- LSA 03-02 survey and sample results were independently reviewed and validated in accordance with HDP-PR-FSS-721 *Final Status Survey Data Validation*.
- The WRS Test is necessary when the difference between the maximum survey unit data set measurement SOF and the minimum background area measurement SOF is less than or equal to one. For LSA 03-02, one individual gross SOF result in the FSS data set exceeded the SOF of the minimum background reference area measurement by more than one using the Uniform Stratum criteria. Therefore, the WRS Test was required for LSA 03-02. Since the test statistic, WR (1039) exceeded the critical value (860), the FSS data set passed the WRS Test and the null hypothesis was rejected. The WRS Test worksheet is presented in Appendix B.
- A biased soil sample was collected from the location of the highest gamma count rate within the SU, with a maximum result of 0.03 Uniform SOF.

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•	T T W N U n m	he maximum SOF result for all surface samples within LSA (he maximum SOF result for all subsurface samples within LSA he average SOF result for all systematically collected samples we ras 0.03, with an upper 95% confidence level (UCL _{mean} 0.95) of C for FSS sample result in LSA 03-02 exceeded a SOF of 1.0 as a finiform Stratum criteria, therefore an EMC or supplemental involt required. For the same reason, no comparisons to the alternat multi-CSM (i.e. Surface, Root and Excavation) DCGLs were nece	03-02 was 0.23. 03-02 was 0.47. ithin LSA 03-02 0.20. compared to the estigations were e "Three-Layer" essary.
	A su L fc co sa do sa th T H re T	a retrospective sampling frequency evaluation was performed afficient statistical power exists to reject the null hypothesis ba- umber of systematic sample locations actually collected within I accessful result of the retrospective power evaluation presented i SA 03-02 indicates that the minimum number of sample locati- or the WRS Test was equal to the number of sampling lo- ollected (8) within LSA 03-02. The methodology used for t ampling frequency evaluation is similar to the prospective etermination performed during FSS Plan Development except ample results and statistics are used in the sample size verification the mean and standard deviation of the eight LSA surface sample est sample data set) are used to derive the relative shift for each IDP Type I and Type II errors of 0.05 and 0.10, respectively elative shift is then correlated to a minimum sample size number able 5-1 of MARSSIM.	to determine if sed on the total LSA 03-02. The n Table 18-1 for ons required (8) cations actually he retrospective re sample size that actual FSS on. Specifically, es (i.e., the WRS LSA. Given the r, the calculated er as provided in
•	H	DP staff ensured that a visual inspection of the SU configurate	ation and of the

• HDP staff ensured that a visual inspection of the SU configuration and of the Isolation & Control measures were performed periodically, and confirmed that there were no instances of potential cross contamination from weather events until the FSS of all remaining areas at HDP were completed.

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Retrospective Sample Size Verification for LSA 03-02 Table 18-1

Uniform DCG	L Criteria Evaluation
N/2 Valu	le Verification
Isotope(s)	SOF (Ra/Tc/Th/Iso U)
St. Dev.	0.11
DCGL _{SOF}	1
LBGR (Mean)	0.20
Shift	0.80
Relative Shift (Δ/σ)	6.96
MARSSIM Table 5.1 (Pr)	1.000000
Z	12
N + 20%	14.4
N/2	8
FSS N/2	8
Verification Check	SUFFICIENT MEASUREMENTS

SIM Table 5.1	P,	0.528182	0.556223	0.583985	0.611335	0.638143	0.664290	0.689665	0.714167	0.737710	0.760217	0.781627	0.801892	0.820978	0.838864	0.855541	0.871014	0.885299	0.898420	0.910413	0.921319	0.944167	0.961428	0.974067	0.983039	0.993329	0.997658	1.000000
MARS	Δ/σ	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.25	2.5	2.75	3.0	3.5	4.0	4.01

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

ς.	
0	
Ш	
β	
0.05,	1-B)
Ш	N
α	or
5.2,	Z _{1-a} (6
Fable	
SSIM -	or B)
MAF	α (

= 0.10						α	ъ				
MARSSIM Table 5.2, $\alpha = 0.05$, β	Z _{1-α} (or Z _{1-β})	2.576	2.326	2.241	1.960	1.645	1.282	1.036	0.842	0.674	0.524
	α (or β)	0.005	0.01	0.015	0.025	0.05	0.10	0.15	0.2	0.25	0:30
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Da	Figure 1 Figure 1 Figure 1	8-1 red for LSA 03-02	c (page 1 c	of 2)							
II	Procedure: HDP-PR-FSS-721, Final Sta	tus Survey Data Evalua	tion								
Decommission Project	ing	I	Revision: 10	Appendix G-1, Page 1 of 2							
FIN	APPENDIX AL STATUS SURVEY DATA QUALITY	↓ G-1 OBJECTIVES REVII	EW CHECK	LIST							
Survey Are	ea: LSA 03 Description	: Plant Open Land Ar	ea								
Survey Un	it: 02 Description	: West of Site Pond Ir	"Area 5"								
1. Have a to data accord	all measurements and/or analysis results that analysis for FSS been individually reviewe ance with Section 8.1 of this procedure?	t will be subjected d and validated in	Yes 🛛 No								
2. Have acquire Instruc	all systematic measurements and/or sampled at the locations specified in the FSSP and tions?	es been taken or d the FSS Sample	Yes 🛛 No								
3. Have require	all scans surveys been performed of the a	areas specified as ns?	Yes 🛛 No								
4. Have a at the l	Il biased measurements and/or samples been ocations specified in the FSSP & the FSS Sam	taken or acquired mple Instructions?	Yes 🛛 No								
5. Have acquire	duplicate and/or split samples or measuremented at each location designated as a QC sample	ents been taken or e?	Yes 🛛 No								
6. Were capabl the app	the instruments used to measure or analyz e of detecting the ROCs or gross activity at propriate investigation level?	e the survey data a MDC less than	Yes 🛛 No								
7. Was tl analyz perform	ne calibration of all instruments that were u e data, current at the time of use and were ned using a NIST traceable source?	sed to measure or those calibrations	Yes 🛛 No								
8. Were where	the instruments successfully response-checked required, after use on the day the data was me	ed before use and, easured?	Yes 🛛 No								
9. Do the	samples match those identified on the chain	of custody?	Yes ⊠* No	🗌 NA 🗌							
10. Do the HDP-F	QC Sample Results meet the acceptance crit PR-FSS-703, Final Status Survey Quality Cor	eria as specified in ntrol?	Yes 🛛 No								
11. Are all	Laboratory QC parameters within acceptable	e limits?	Yes 🛛 No	NA 🗌							
If "No" wa corrective a	is the response to any of the questions about ctions that were taken to resolve the discrepan	ve, then document the ncy.	discrepancy	as well as any							
Comments: L03-02-11- 19-P -S -Q-0 prepared us	*Item 9 Sample IDs for QC samples were lal P-S-Q-00 should be L03-02-11-P-R-Q-00 and 0. This mis-labeling does not affect any resul ing the correct IDs.	beled with the wrong C d L03-02-19-P- R -Q-00 ts or calculations. The H	SM, i.e. samp should be L0 FSS Plan was	le ID 3-02-							

ecommissioning	Survey Units (01 and 02 (LSA 03-01 and LSA	03-02)		
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Da	ita Evaluation	Figure 18-1 Checklists prepared for LSA	03-02 (page 2 o	f 2)	
Homotito	Procedure: HE	DP-PR-FSS-721, Final Status Survey Data	a Evaluation		
Decommission Project	ing		Revision: 10	Appendix G-1, Page 2 of 2	
FIN	AL STATUS SUR	APPENDIX G-1 VEY DATA OUALITY OBJECTIVES	REVIEW CHECK	LIST	
Survey Are Survey Un	ea: No. <u>LSA 03</u> it: No. 02	Description: Plant Open Description: West of Sit	Land Area e Pond In "Area 5"		
Discrepanc	v: None				
Corrective	Actions Taken: N	one			
11. Have	the corrective action	ns resolved the discrepancy with the data	? Yes 🗌 No	D 🗌 NA 🖂	
12 The fo	No , then forward t				
12. The R	mowing questions v	will be answered by the RSO.			
a. If t	he answer to question	will be answered by the RSO. on 11 was "No", then is the affected data	Yes 🗌 N		
a. If t stil b. If ' suf	he answer to questions v l valid? 'No'', then are the ex ficient to demonstra	will be answered by the RSO. on 11 was "No", then is the affected data xisting valid measurements or samples ate compliance for the survey unit?	Yes 🗌 No Yes 🗌 No		
a. If t stil b. If ' suf c. If ' der	he answer to questions v l valid? 'No", then are the ev ficient to demonstrat 'No", then direct the nonstrate compliance	will be answered by the RSO. on 11 was "No", then is the affected data xisting valid measurements or samples ate compliance for the survey unit? e acquisition of additional measurements ce for the survey unit.	Yes No Yes No or samples as necessa	n NA X	
a. If t stil b. If ' suf c. If ' der Prepare	he answer to questions of l valid? 'No", then are the ex ficient to demonstra 'No", then direct the nonstrate compliance d by (HP Staff):	will be answered by the RSO. on 11 was "No", then is the affected data xisting valid measurements or samples ate compliance for the survey unit? e acquisition of additional measurements ce for the survey unit.	Yes \square Notes	$ D \square NA X $ $ D \square NA X $ $ arry to $ $ (Date) $	
a. If t stil b. If ' suf c. If ' der Prepare Approv	he answer to questions of l valid? 'No", then are the ey ficient to demonstra 'No", then direct the nonstrate compliance d by (HP Staff): ed by (RSO):	will be answered by the RSO. on 11 was "No", then is the affected data xisting valid measurements or samples ate compliance for the survey unit? e acquisition of additional measurements ce for the survey unit. <u>Thomas Yardy</u> (Print Name) <u>Clark Evers</u> (Print Name) <u>(Print Name)</u>	Yes No Yes No or samples as necessa (Signature)	$\frac{5}{D} \square NA X$ ary to $\frac{-5}{(Date)} \frac{7}{Date}$	
a. If t stil b. If ' suf c. If ' der Prepare Approv	he answer to questions of l valid? 'No", then are the ex ficient to demonstra 'No", then direct the nonstrate compliance d by (HP Staff): ed by (RSO):	will be answered by the RSO. on 11 was "No", then is the affected data xisting valid measurements or samples ate compliance for the survey unit? e acquisition of additional measurements ce for the survey unit. Thomas Yardy (Print Name) Clark Evers (Print Name)	Yes No Yes No or samples as necessar	$\frac{5}{(Date)} = \frac{7}{7}$	

Hematite Decommissioning Project	FSSFR Volume 3, Chapter 23: Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 (LSA 03-01 and LSA 03-02)				
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19.0 SURVEILLANCE FOLLOWING FSS

FSS activities in LSA 03-02 were completed in October 2015. There were no events after the completion of FSS that would have the potential to cause contamination above the DCGLs in the SU.

20.0 CONCLUSION LSA 03-02

An adequate quantity and quality of radiological surveys and samples, as well as the corresponding laboratory analysis has been performed, evaluated and documented to demonstrate that the dose associated with all sources within SU LSA 03-02 of 13.25 mrem/year does not exceed the dose criterion for unrestricted release in accordance with 10 CFR 20.1402 of 25 mrem/year.

	AVE. SU SOIL RADIOACTIVITY	ELEVATED AREA CONTRIBUTION	GROUND WATER	BURIED PIPING	REUSE SOIL	TOTAL
SOF	0.20	N/A	0.16	N/A	0.17	0.53
DOSE	5.0 mrem/year	N/A	4.0 mrem/year	N/A	4.25 mrem/year	13.25 mrem/year

Table 20-1LSA 03-02 SOF and Dose Summation

Hematite Decommissioning Project	FSSFR Volume 3, Chapter 23: Survey Area Release Record for Land Survey Area 03, Survey Units 01 and 02 (LSA 03-01 and LSA 03-02)				
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21.0 **REFERENCES**

- 21.1 DO-08-004, Hematite Decommissioning Plan {ML092330123}.
- 21.2 DO-08-003, Radiological Characterization Report, July 2009 {ML092870496}
- 21.3 HDP-TBD-FSS-002, Evaluation and Documentation of the Scanning Minimum Detectable Concentrations (MDC) for Final Status Surveys (FSS)
- 21.4 Westinghouse letter HEM-10-80, Response to request for Additional Information Concerning Hematite Decommissioning Plan: Chapter 14, Characterization Report and Surrogates Report {ML102140158}
- 21.5 Westinghouse letter HEM-11-96, Final Supplemental Response to NRC Request for Additional Information on the Hematite Decommissioning Plan and Related Revision to a Pending License Amendment Request {ML111880290}

22.0 APPENDICES (To Be Provided On Separate Data Disc)

APPENDIX A: Analytical Data Evaluation Spreadsheets for LSA 03-01
APPENDIX B: Analytical Data Evaluation Spreadsheets for LSA 03-02
APPENDIX C: FSS Plan Development for LSA 03-01
APPENDIX D: FSS Plan Development for LSA 03-02
APPENDIX E: TestAmerica Laboratory Analytical Data Reports for LSA 03-01
APPENDIX F: TestAmerica Laboratory Analytical Data Reports for LSA 03-02
APPENDIX G: Completed Field Logs