Hematite Decommissioning Project

SURVEY PLAN FOR THE PROPOSED RAIL SPUR WESTINGHOUSE ELECTRIC COMPANY HEMATITE, MISSOURI

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Preface

In order to facilitate the remediation of the Westinghouse Hematite Facility in Hematite Missouri, Westinghouse is proposing to install a rail spur to allow the direct loading of rail cars for the shipment of waste to a licensed disposal facility. It has been determined that the area to be affected by the installation of the rail spur should be surveyed prior to allowing its installation in order to either:

1. Provide the necessary data prior to its installation to release the impacted area for unrestricted use. Although the surface soil within this area may be impacted by future site activities such as the loading of rail cars, with proper controls there should not be a need to address subsurface contamination. At the completion of shipping, the impacted area can be released for unrestricted use based on surface or near surface surveys.

or

2. Provide timely notice that the impacted area may require remediation at depth following the completion of shipping.

Since neither the Decommissioning Plan nor the Final Status Survey Plan for the site has been approved by the NRC it is recognized that the survey of the area affected by the proposed rail spur is being performed at risk. However, the survey will be performed in a conservative manner with respect to the draft Final Status Survey Plan to ensure adequate survey coverage in anticipation that once the associated plans are approved, the information obtained from this survey can be used as final status survey data and can be evaluated against the site-specific DCGLs using area factors and surrogate relationships for hard-to-detect radionuclides as may be appropriate.

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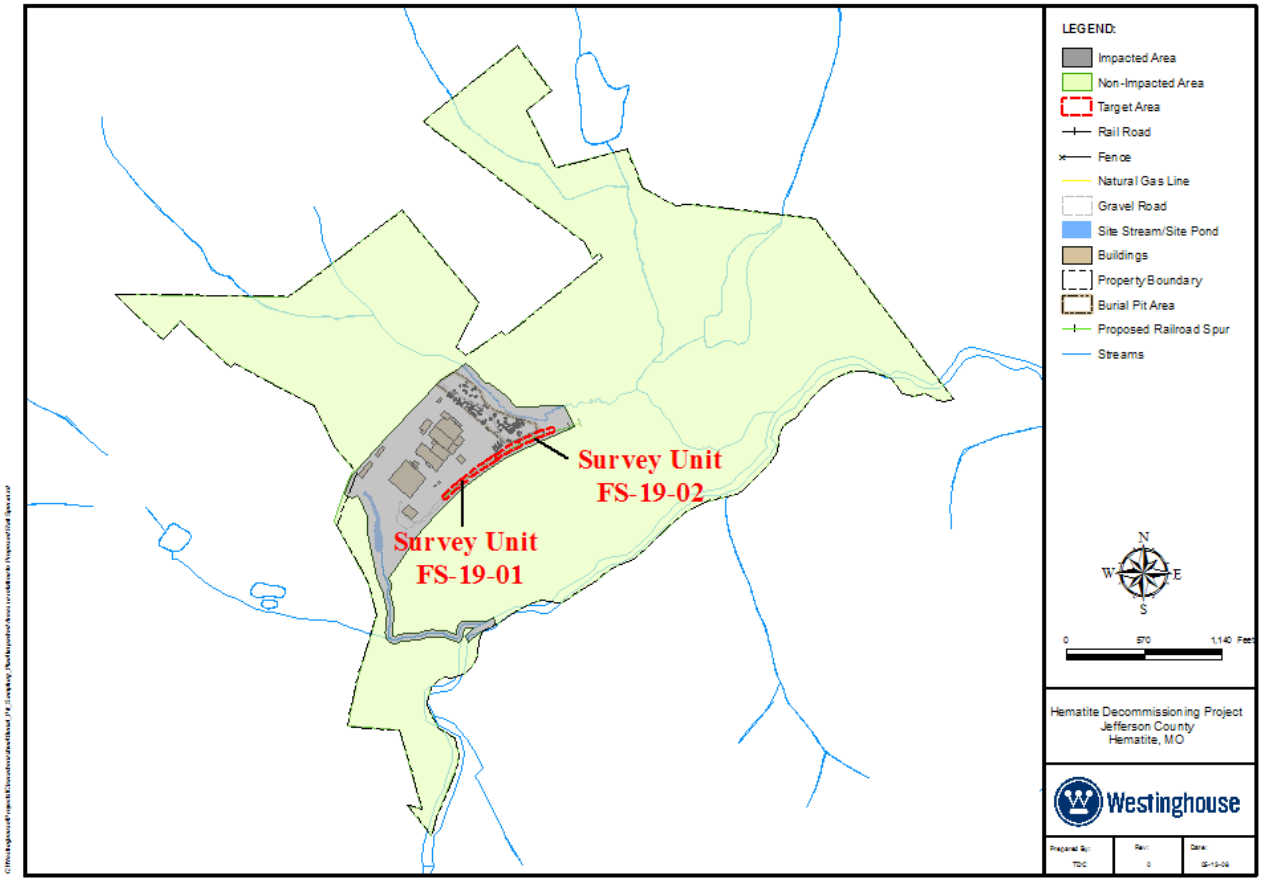
1.0 INTRODUCTION

The Westinghouse Electric Company LLC (Westinghouse, or WEC) former fuel cycle facility in Hematite, Missouri ceased production in June 2001 after nearly 47 years of operations under several owners and operators. The Facility's central tract area and the site creek down to Joachim Creek were impacted by the fuel fabrication operations. The central tract area is bounded by State Road P to the north, the northeast site creek to the east, the Union Pacific railroad tracks to the south, and the site creek/pond to the west. It is Westinghouse's objective to decommission the site and release it for unrestricted use. Figure 1-1 shows the layout of the impacted area.

The impacted areas of the site consists of approximately 19 acres and includes both buildings and open land areas surrounding the buildings. In order to facilitate the remediation of the Westinghouse Hematite Facility in Hematite Missouri, Westinghouse is proposing to install a rail spur adjacent to the existing Union Pacific railroad tracks in order to allow the direct loading of rail cars for the shipment of waste to a license disposal facility. Since the proposed rail spur will be located within the impacted area of the site it has been determined that the area to be affected by the installation of the rail spur should be surveyed prior to allowing its installation.

FIGURE 1-1
IMPACTED AREA



2.0 PURPOSE

Since the proposed rail spur area is within the impacted areas of the site, the purpose of this survey plan is to provide guidance for surveying the area to be affected by the installation of the rail spur in order to either:

1. Provide data necessary to support the future release of this impacted area for unrestricted use at the completion of shipping. Although the surface of this area may be impacted by future site activities such as the loading of rail cars, with proper controls there should not be a need to address subsurface contamination

or

2 Provide timely notice that the impacted area may require remediation at depth following the completion of rail shipping.

Since neither the Decommissioning Plan nor the Final Status Survey Plan for the site has been approved by the NRC, it is recognized that the survey of the area affected by the proposed rail spur is being performed at risk. However, the survey will be performed in a conservative manner with respect to the draft Final Status Survey Plan to ensure adequate survey coverage in anticipation that once the associated plans are approved, the use of the information obtained from this survey can be used as final status survey data and can be evaluated against the site-specific DCGLs using area factors and surrogate relationships for hard-to-detect radionuclides as may be appropriate.

3.0 ORGANIZATION AND RESPONSIBILITES

The rail spur sampling will be performed by the Hematite Decommissioning Project (HDP) with the support of contractor personnel. The roles and responsibilities of key survey project personnel are outlined below; an organization chart for this survey project indicating reporting and responsibility lines is provided at the end of this section, Figure 3-1.

3.1 Project Director

The Project Director for the HDP will provide oversight of the entire rail spur survey effort and will authorize restart of work after a stop work order has been given. The managers from Quality Assurance, Operations, Radiation Protection, Environmental Health & Safety (EH&S), and Environmental Engineering report directly to the Project Director.

3.2 Project Manager (Operations Manager)

The Operations Manager will act as the survey project manager (PM) and will manage site operations. The PM is responsible for oversight of contractor personnel and will coordinate with the RSO and other department leads to ensure overall quality, schedule and cost, survey project staffing, subcontractor management, and health, safety, and regulatory compliance are maintained for activities conducted under this plan. He will be responsible for implementing all contracts from award through survey project completion. He will coordinate the preparation of the survey project plans and required permits. With regard to Health and Safety and Quality Control, the PM will be the line manager with responsibility for compliance. The Radiation Protection Operations Manager and the survey Project Engineer will report to the PM.

3.3 Radiation Safety Officer (RSO)

The RSO will provide technical oversight of the survey and sampling effort. He will assist the Project Manager in overall quality, schedule and cost, survey project staffing, subcontract management, health, safety and regulatory compliance. He will provide technical direction relating to radiation protection and surveying issues to the Radiation Protection Operations Manager (RPOM), survey Project Engineer and Health Physics Staff.

3.4 Radiation Protection Operations Manager (RPOM)

The RPOM will coordinate and supervise all field survey activities for this survey project. The RPOM will directly oversee day-to-day survey project activities and will be responsible for the implementation of the survey project tasks. In addition to safe production, the RPOM will ensure that the work is performed in accordance with the quality objectives. Activity planning and preparation and subcontractor management are also the responsibility of the RPOM. He will assure that samples are collected and archived according to this plan and related work packages.

3.5 Project Engineer

The Project Engineer for this survey project will be responsible to implement the design and technical approach. He will coordinate all survey data, analytical results and sampling location information. He will ensure that all surveys and sampling are scheduled, performed and documented, and will take the lead in onsite data/document management. The Project Engineer will be in the field whenever significant survey project work is being performed and will coordinate with the RPOM and the PM to provide direction to the field crews including Health Physics Technicians (HPTs), labor support, rad waste specialist and drilling contractors. The Project Engineer will interface directly with the PM, RSO and RPOM in technical matters.

3.6 Health Physics Technicians

The health physics technicians (HPT) will perform walkover gamma surveys and radiation surveys of the boreholes and cored soil. The HPTs will data log each core hole at approximately one foot intervals. For each core section removed, the HPTs will record the depth, radiation levels, type of material or soil removed on boring logs provided in the work packages. HPTs will determine the need for biased samples. The HPTs will scan equipment and materials to support decontamination efforts for free release and to minimize the spread of contamination. HPTs will establish chain-of-custody for samples which will be archived until selected for analysis by the Project Engineer. The HPTs will record the core bore number on IDW containers.

3.7 Quality Assurance (QA)

The Quality Assurance representative will be responsible for the implementation of the Quality Assurance Plan. He is responsible for planning and supervising QC activities. He will interface directly with the PM and RPOM in matters related to quality.

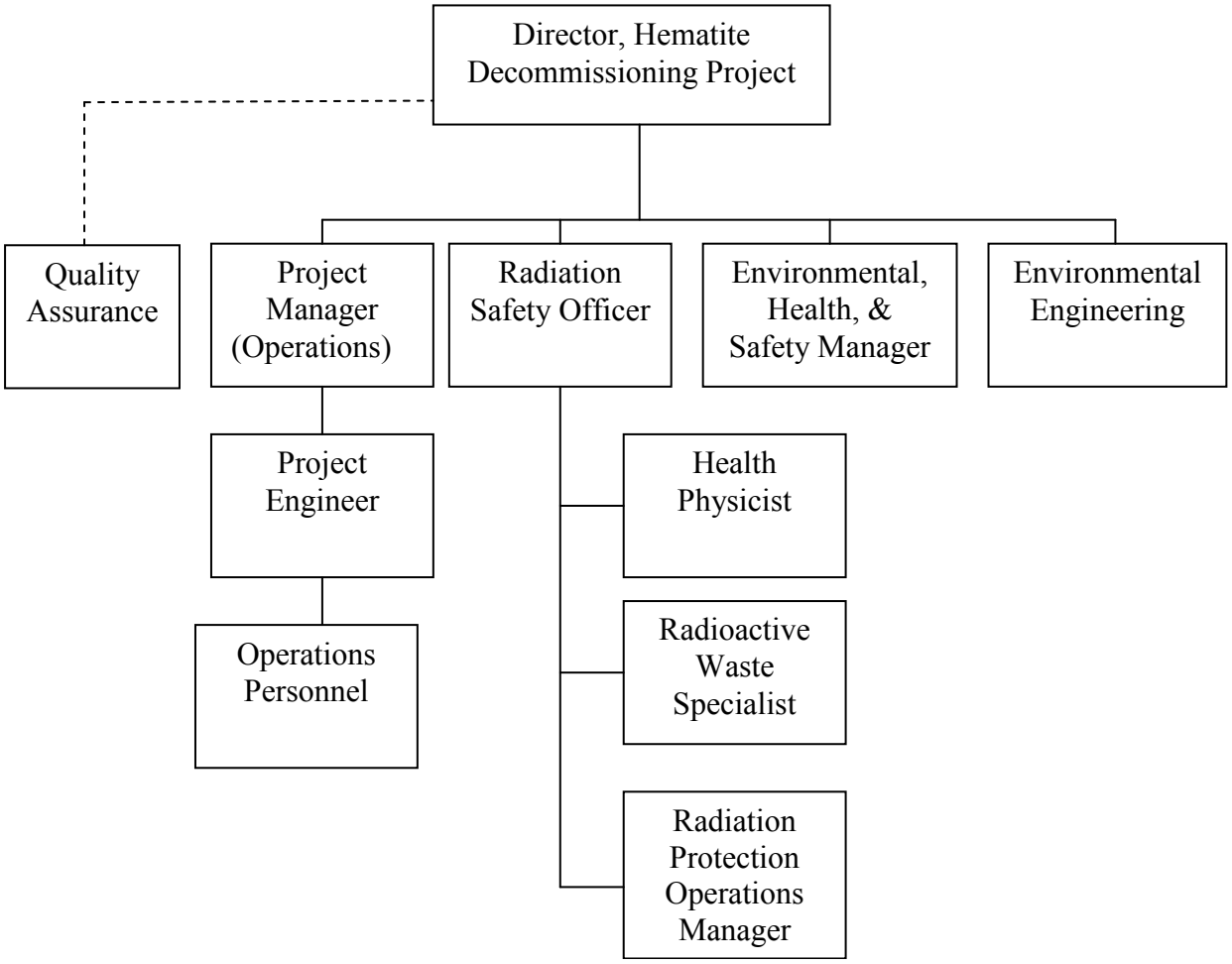
3.8 Environmental Health and Safety (EH&S) Manager

The EH&S Manager will be responsible for day-to-day compliance monitoring of the Health and Safety Plan, including site-specific personnel training, maintenance of the medical monitoring program, Health and Safety programs implementation, personal protection equipment, respiratory protection and decontamination operations, and safety related operations support to the on-site work force.

3.9 Various Support

- Health Physicist – The Health Physicist will assist the Project Engineer and RPOM in the interpretation and implementation of this plan and related work packages. He will coordinate with the Criticality Engineer when radiation survey results approach the action levels requiring investigation. He will assist in the writing of the report during operations and after samples are analyzed.
- Rad Waste (Specialist) – Rad Waste will be responsible for managing the waste segregation, material control; this includes logging IDW into the Material Control Area.
- Operations – (Labor) Operations will provide the labor required for support of decontamination of tools and management of generated waste.

FIGURE 3-1
ORGANIZATIONAL CHART



4.0 HEALTH AND SAFETY

The surveys governed under this survey plan will be performed in accordance with the Activity Hazard Analysis and the Radiation Protection Plan (Reference 14-3) but the following items are emphasized.

4.1 Stop Work Procedures

The Hematite procedure PR-EHS-004, Stop Work Authority (Reference 14-4) will be implemented in the event of imminent danger or when an individual recognizes an unsafe condition that cannot be corrected safely, quickly and effectively without work being stopped, or if further evaluation of a suspected unsafe condition is required. Imminent danger is defined in the Hematite procedure as a hazard that could result in death, serious injury, environmental impairment or significant damage, and when immediate action is required.

Since survey project personnel will be given unescorted status, all personnel will have Stop Work authority and be trained in this procedure. When a stop-work order has been given, the following actions shall occur:

- All work in the affected activity shall stop as soon as possible.
- The work place shall be placed in a safe condition.
- Workers shall notify the RPOM.
- Work shall not resume until appropriate safety reviews are performed and restart is authorized by the Project Director.

4.2 Utility Location

No active utilities are reported to be present in the area to be surveyed with the possible exception of a natural gas pipeline. WEC with the help of the gas company will clearly mark the location of the natural gas line. WEC will verify the absence of other utilities by contacting the Utility Locator service as well as by conducting a visual reconnaissance of the area. The overhead railroad signal wires along the proposed spur will be confirmed as abandoned and removed as necessary to provide access for the sampling rig. Should a previously unidentified utility be encountered, a Stop Work will be issued until any associated hazards are adequately addressed.

5.0 DATA QUALITY OBJECTIVES

In order for the data associated with this survey effort to potentially be used as final status survey data, the survey must be performed with data quality objectives consistent with the draft final status survey plan. Since the final status survey plan has not been approved, some of the parameters necessary for defining the data quality objectives are not available. However, data quality objectives have been developed with what is expected to be conservative assumptions to ensure the data collected during this survey will be accepted as final status survey data assuming that areas requiring further investigation and/or remediation are not identified.

Since conservative assumptions are being made to ensure that the data collected during this survey can be accepted as final status survey data, the design of this survey has by definition not been optimized and none of the requirements of this plan should be interpreted as precedent setting for the final status survey plan.

5.1 Problem Description

A rail spur is to be installed within an impacted area of the site and additional survey and sampling data is needed prior to its installation to support the release of the area for unrestricted use or a determination made as to the scope of potential subsurface contamination that will require remediation following the completion of rail shipping.

5.2 Decision Identification

The purpose of this survey is to collect data that will meet the requirements of the final status survey plan and can be used to release the area for unrestricted use or can be used to determine if future remediation is required.

Once the final status survey plan has been approved and the data quality objectives for implementing the plan defined the design of this survey will be evaluated in order to verify that the minimum requirements of the approved final status survey plan have been met and that the requirements for release for unrestricted use have been met.

5.3 Inputs to the Decision

A gamma walkover survey will be performed to identify potential areas of elevated activity that require investigation.

The minimum detectable activity for the gamma walkover survey will be less than 150 pCi/g of total uranium assuming 20% enrichment.

Biased soil samples will be collected at any areas of elevated activity identified during the gamma walkover survey.

Systematic soil samples will be collected at unbiased locations throughout the two predefined survey units. The number of systematic soil sampling locations within each survey unit is expected to exceed the minimum number to be required by the approved final status survey plan. At each systematic soil sampling location samples will be collected at depths of 0 to 15 cm, 15 cm to 1.5 m, and 1.5 m to 4.5 m.

All soil samples will be sent off-site for analysis. At a minimum each soil sample will be analyzed for, Tc-99, and gamma-emitting radionuclides by gamma spectroscopy.

The minimum detectable activities specified for the off-site sample analyses are expected to be a small fraction (< 10%) of the site-specific DCGLs.

Split samples will be collected from approximately every twentieth sample in order to monitor accuracy of the off-site laboratory.

5.4 Boundaries of the Study

The boundaries of the propose rail spur encompass an area of approximately 3200 square meters that runs adjacent to the existing rail. The area will be divided into two survey units of approximately equal size.

5.5 Decision Rule

The survey results obtained during this survey will be evaluated against the approved DCGLs using hypothesis testing in accordance with the statistical requirements of the approved final status survey plan.

5.6 Limits on Decision Errors

The limits on the decision error will be as specified in the approved final status survey plan.

5.7 Design for Data Collection

The survey units are conservatively classified as a Class 1 areas. Each survey unit will require a walkover gamma scan of 100 % of the accessible areas, and, will be gridded using a triangular grid to identify 22 systematic soil sampling locations in each survey unit. At each soil sampling location a minimum of three soil samples will be collected at predefined depths. It is expected that design of this survey will result in the collection of data that will satisfy the requirements of the approved final status survey plan.

6.0 AREA OF INTEREST

The area of interest for this survey is located northwest and adjacent to the existing rail line that traverses the site. Per an access agreement with Union Pacific Railroad all sampling activities must remain beyond 15 feet from the closest (outer) rail. Union Pacific Railroad will also issue a penetration permit allowing for subsurface sampling. The rail spur is expected to terminate at the site fence, approximately 50 feet east-northeast of the evaporation ponds. The planned rail spur will extend approximately 970 feet in an east-northeast direction adjacent to and approximately parallel to the existing rail line**.** The area of interest is shown on Figure 6-1 and consists of approximately 3,200 m^2. Previous site characterization efforts have identified contamination at depths greater than 6 inches, therefore it will be assumed that there is a potential for subsurface contamination in the area of interest which will be addressed during the performance of this final status survey. The following discussion on area classification and survey units are based on guidance contained in the Multi-Agency Radiation Survey and Site Investigation Manual, MARSSIM (Reference 14-1).

6.1 Area Classification

The area of interest will be conservatively classified as a Class I Impacted Area. Impacted areas are classified as Class I, II, or III based on their potential for containing residual contamination relative to the DCGLs. Class I Areas are areas in which the contamination levels are potentially greater than the DCGLs.During the final status survey, Class I Areas are surveyed with the highest frequency of measurements and/or sampling of the three impacted areas.

6.2 Survey Units

To ensure adequate coverage during the performance of final status surveys, the various classes of survey units are limited in size. For open land survey units in Class I Areas, survey units are limited to 2,000 m2. Since the area to be affected by the proposed rail spur is approximately 3,200 m^2, the area will be divided into two Class I Survey Units for the purpose of this survey.

Due to the number of survey units to be established throughout the final status survey of the site it will be extremely important to ensure that all survey units be properly identified. To ensure that the survey units surveyed under this plan can be readily identified the following protocol will be used to assign survey unit numbers.

FS-AC-SPN

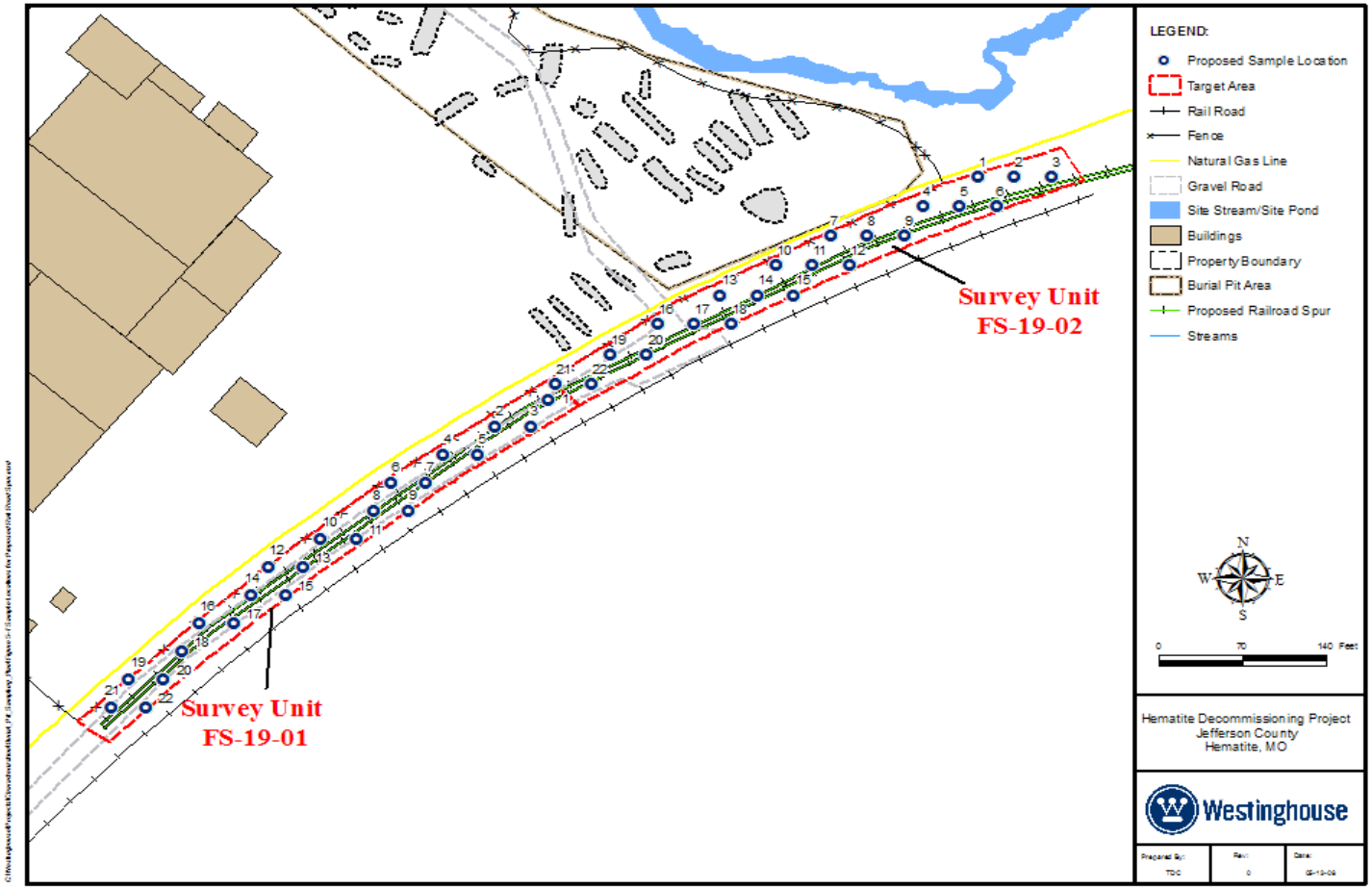
Where: FS is the designation for final status survey
AC is the designation for the area of concern (19)
SPN is the designation for the survey package number (1 or 2)

The two final status survey units to be established for the survey of the area to be affected by the proposed rail spur will be numbered as follows:

- FS-19-01
- FS-19-02

The location of these two survey units are shown on Figure 6-1

FIGURE 6-1
SURVEY UNITS



7.0 RADIONUCLIDES OF INTEREST

Based on the historical site investigation and previous investigation, the primary HDP radionuclides of interest are uranium-234 (U-234), U-235, U-238, and technicium-99 (Tc-99). Trace quantities of thorium-232 (Th-232), americium-241 (Am-241), neptunium-237 (Np-237), and plutonium-239/240 (Pu-239/240) may also be present.

8.0 SURVEY INSTRUMENTATION

Table 8-1 contains a list of instrumentation that may be used during this survey.

Table 8-1
Survey Instrumentation

Instrument/Detector	Detector Type	Primary Type Of Radiation Detected	Calibration Source	Use
Tennelec	Gas Flow Proportional	Alpha Beta	Th-230 Sr-90	Smear Counting
Ludlum Model 19	NaI (Tl)	Gamma	Cs-137	Exposure Rate Measurements
Ludlum Model 2360 with a 43-89 detector	Duel Phosphor	Alpha Beta	Th-230 Sr-90	Scans and Total Activity Measurements
Ludlum Model 2350 with a 44-2 or 44-10 detector	NaI (Tl)	Gamma	Cs-137	Gamma walkover surveys and gamma logging
Ludlum Model 2241 with a 44-2 or 44-10 detector	NaI (Tl)	Gamma	Cs-137	Gamma walkover surveys and gamma logging
Ludlum Model 3 with a 44-9 detector	GM	Beta	Sr-90	Scans and Total Activity Measurements

Note: To meet the required minimum detectable activity requirements related to gamma scanning the scans shall be performed with the 44-10 detector

All instrumentation used during this survey will have been calibrated within 6 months of its being used. Calibration labels showing the instrument identification number, calibration date, and calibration due date will be attached to all instruments. All instruments will be inspected and source checked daily prior to use to verify calibration status and proper operation. In addition, all field instrumentation will be source checked at the end of each days use to bound the data collected during that day. Control charts and/or source check criteria will be established for each instrument prior to its initial use.

All sources used for calibration and efficiency determinations will be chosen to be representative of the instruments response to the radionuclides of interest and will be traceable to the Nation Institute of Standards and Technology, NIST.

If the instrumentation listed in Table 8-1 is not available, alternative instrumentation may be approved for use by the RSO.

9.0 SURVEY PACKAGES

Survey packages will be developed for each survey unit. The survey packages will include sampling and survey instructions, sample locations including maps and GPS coordinates, sample identification numbers to be assigned to individual samples, and identified abnormal conditions or safety concerns that may be encountered during the final status survey.

As the survey of a particular survey unit progresses the survey results and related documentation are placed in a file along with a copy of the survey package. Due to the volume of paperwork associated with the reporting of sample analyses, hard copies of the sample analysis results provided by the off-site laboratory may be maintained in a separate file. However, a summary of the analytical results for a given survey unit will be placed in the file once it becomes available. An electronic copy of the analysis results should also be obtained from the off-site laboratory.

The original survey packages and a hard copy of the analysis results will be filed and maintained as permanent facility quality records in accordance with Hematite Decommissioning Project Procedures PO-QA-001 and PR-QA-009 (References 14-5 and 14-6 respectively).

10.0 SURVEY PROTOCOL

This survey will consist of a gamma walkover survey and the collection of systematic soil samples. If appropriate, biased soil samples will also be collected. Soil samples will be analyzed for the radionuclides of interest at an off-site laboratory. Samples for accessing chemical hazards may also be collected. Where conditions allow, following the collection of subsurface soil samples, the resulting bore hole will be gamma logged prior to filling the bore hole with an appropriate material.

10.1 Gamma Walkover Survey

A gamma walkover survey will be performed of each survey unit using a NaI (Tl) detector held at a distance of approximately 6 inches above the surface being surveyed. The meter will be moved in a serpentine pattern at a speed of approximately 1 meter per second. To meet the required minimum detectable activity requirements related to gamma scanning the scans shall be performed with the 44-10 detector

The gamma walkover survey will cover 100% of the accessible surface areas within the area of interest. If available a GPS system and data logger will be interfaced with the meter. The downloaded information will then be used to prepare maps showing relative exposure rates.

A biased soil sampling location will be located in any area with readings exceeding twice background. Biased soil sampling locations will be sampled in a manner similar to systematic soil sampling locations. The resulting data may be evaluated separately from the systematic soil sampling data for purposes of demonstrating compliance with the DCGLs once the DCGLs are approved.

10.2 Number Of Soil Sampling Locations

The minimum number of systematic soil sampling locations for this survey is being conservatively set at 22 locations per survey unit. In addition, biased soil sampling locations may also be specified. Multiple soil samples, at various depths, will be collected at each sampling location and sent to an off-site laboratory for radiological analysis.

In addition to the soil samples for radiological analysis, soil samples may be collected at selected sampling locations for chemical/hazards analysis. If soil samples are to be collected for chemical/hazards analysis directions on how to collect, preserve, and label the samples will be included in the appropriate survey package. Also included will be directions on which laboratory to ship the samples to, hold times, analyses to be requested, required sensitivities, required turn around times (TAT), etc.

10.3 Gridding

Open land areas associated with the Class 1 Survey Units will be gridded to help identify the systematic sampling locations. The Survey Units will be gridded using a triangular grid pattern. The grid pattern will ensure at least 22 grids per survey unit.

A random point generator will be used to establish a starting point and the triangular grid pattern will be based of this starting point. Each sample location will have associated GPS coordinates specified. In the case of inaccessible sampling locations additional pairs of random sample coordinates may be generated with the RSO's approval in order to identify an acceptable sampling location.

A map of the survey unit showing the sample locations with associated GPS coordinates will be provided in the individual survey packages.

10.4 Soil Sampling

At each soil sampling location a composite soil sample will be collected from each of the following depths using a split spoon sampling rig or equivalent.

- 0 to 15 cm
- 15 cm to 150 cm (1.5 m)
- 1.5 m to a maximum of 4.5 m

The sample to be collected between 1.5 and 4.5 meters may not extend to 4.5 meters if ground water is encountered or if the sampling rig encounters refusal per verbal direction from the Project Manager.

If refusal is encountered above 2 meters or if sample recovery is less than 50% the RSO may direct that an additional soil sampling location be designated within 1 meter of the original location.

As each split spoon is opened its contents shall be scanned with a photo-ionization detector to identify chemical contaminates and with an exposure rate meter and a beta sensitive meter. The location of any elevated readings (greater than twice background) marked and a biased sample collected from the location.

Composite samples will be collected by obtaining approximately two liters of soil from each of the designated depths and biased locations, if applicable. For the 15 cm to 150 cm and the 1.5 m to 4.5 m samples care should be exercised to ensure a representative sample is included in the respective composite samples. When collecting the composite samples vegetation and debris/rocks with a diameter greater than 3 cm should be discarded.

Each sample will be labeled in the field and then transported to a secure location for storage prior to being shipped to an off site laboratory for analysis. Prior to

being shipped off site each sample shall be recorded on a chain of custody form, a copy of which will accompany the sample to its final destination.

If requested, additional samples may be collected from the contents of the split spoon for determining if hazardous chemical are present and if present, their concentration. If samples for chemical analysis are collected they will be collected, packaged, labeled, stored, and shipped to an appropriate off-site laboratory as directed by the RSO or his designee.

10.4.1 Boring Log

At each soil sampling location a boring log shall be completed as the split spoon is advanced, withdrawn, and the subsequent samples collected. The following information, if available, will be recorded for each soil sampling location;

- Soil sampling location Identification Number
- Soil sampling location GPS coordinates
- Depth sampled to
- Depth of ground water
- Soil consistency
- Percent recovery
- Exposure rate survey meter used to scan contents of split spoon and results of survey
- Beta survey meter used to scan contents of split spoon and results of survey
- Name of individual filling out Boring Log

An example Boring Log is provided in Appendix A to this plan.

10.4.2 Sample Log

As samples are obtained and transported to a secure storage location a sample log will be maintained to provide an inventory of the samples. The following information, if available, will be recorded for each soil sample;

- Sample Identification Number
- Corresponding soil sample location Identification Number
- If elevated readings were identified and if identified at what depth
- If biased samples were collected and at what depth
- Number of samples recovered at each sampling location, their corresponding depths, and assigned sample identification numbers.
- Date sample was collected
- Name of Individual filling out Sample Log

An example Sample Log is provided in Appendix B to this plan**.**

10.5 Gamma Logging

To help ensure that elevated areas of activity do not remain unidentified each soil sampling location will be gamma logged following completion of sample collection at that location. An exposure rate meter will be advanced down the bore hole in one foot increments and a measurement recorded over a one minute counting interval. This process will continue at each soil sampling location until the bottom of the boring is reached, ground water is encountered, or some type of obstruction encountered. The following information, if available, will be recorded for each soil sampling location on a gamma logging worksheet;

- Soil Sampling Location Number
- Exposure rate meter used to obtain measurements
- Measurement result as a function of depth.
- If ground water or some type of obstruction was encountered
- Date measurements were obtained
- Name of individual obtaining the measurements.

An example Gamma Logging Worksheet is provided in Appendix C to this plan.

10.6 Sample Identification

Due to the number of samples to be collected during this survey project it will be extremely important to ensure that all samples and subsequent sample analyses can be identified. To ensure that the samples and subsequent sample analyses associated with this effort can be readily identified the following protocol will be used to assign sample numbers

FS-AC-SPN- TYP-SSL-MED-Z-DE

Where:	FS	is the designation for final status survey
	AC	is the designation for the area of concern (19)
	SPN	is the designation for the survey package number (1 or 2)
	TYP	is the designation for the basis for the sample (SYS, BIA, QA)
	SSL	is the Sample Location Number
	MED	is the designation for the type of media sampled
	Z	is the designation for the zone from which a composite soil sample was collected (1 or 2 or 3 or B), as applicable
	DE	is the designation for the median depth below ground surface, in meters, from which a biased soil sample, based on a survey of the split spoons content, was collected.

For this survey effort every sample number will start off with the designation "FS" for final status survey. The area of concern, AC, will be "19" for area of concern 19. The survey package number, SPN, will be assigned but is expected to be either "1" or "2" for this survey effort. The basis for the soil sampling location, TYP, will either be "SYS" for a systematic soil sampling location, "BIS" for a

biased soil sampling location, or QA for a quality assurance split. Most of the soil sampling locations for this survey effort will be systematic locations but biased locations may be identified based on the results of the gamma walkover survey. The Soil Sample Location Number will also be assigned but is expected to be a sequential number starting with "1". Soil Sample Location Numbers may be repeated for different areas of concern, survey packages, etc. The type of media sampled, MED, will be either "SO" for soil, "SL" for sludge, "GW" for ground water, "SW" for surface water, "BD" for building debris, or "OT" for other. The zone, Z, from which a composite soil sample, was collected will either be "1" for samples collected from 0 to 6 inches, "2" for samples collected from 15 cm to 150 cm (1.5 m), "3" for a sample collected from 1.5 m to 4.5 m, and "B" for a biased sample collected based on the results of surveys performed on the contents of the split spoon. If a biased sample was collected based on a survey of the split spoon's content, the depths below ground surface from which it was collected, DE, will be specified in meters. If such a sample was not collected the depth below ground surface, DE, is not applicable. If the sample media was other than a composite soil sample than both the zone, Z, and the depth, DE, will be marked as NA.

For example a composite soil sample collected between a depth of 1.5 to 4.5 meters, at systematic soil sampling location 12, under survey package 2, in area of concern 19, as part of the final status survey would be assigned a sample number of

FS-19-2-SYS-12-SO-3

10.7 Sample Analyses

All samples collected as part of this survey will be analyzed at an off-site laboratory for technetium-99 by liquid scintillation counting, and gamma emitting radionuclides (Th-232, Am-241, etc.) by gamma spectroscopy. Approximately 10 percent of the samples will be analyzed at an off-site laboratory for isotopic uranium (U-234, U-235, and U-238). Although potentially present, samples will not be analyzed for Np-237 or Pu-239/240 unless specific instructions to do so are provided by the RSO.

10.8 Minimum Detectable Activity

The minimum detectable activity (MDA) is defined as the smallest amount or concentration of radioactive material that will yield a net positive count with a 5% probability of falsely interpreting background responses as true activity. The MDA is dependent upon count times, geometry, sample size, detector efficiency background, and for scanning the scanning rate and the efficiency of the surveyor.

The MDA for the gamma walkover surveys will be based on detecting 20% enriched uranium. Based on 20% enriched uranium the MDA will be less than 150 pCi/g.

The equations used for calculating the MDA for gamma scans are provided below. However, a conversion factor is required to convert the $MDCR_{Surveyor}$ in terms of cpm to an activity concentration in terms of pCi/g.

$$MDCR_{Surveyor} = \frac{d' * \sqrt{b_i} * \frac{60}{i}}{p}$$

Where:
- $MDCR_{Surveyor}$ = Minimum Detectable Count Rate (cpm)
- d' = Decision error taken from Table 6-5 of MARSSIM
- i = Observation counting interval (scan speed divided by the detector width)
- bi = Background count per observation interval
- p = Surveyor Efficiency (typically 50%)

The first of the conversion factors needed to convert the $MDCR_{Surveyor}$ into an activity concentration is the exposure rate due to a volume of soil contaminated with the radionuclide of interest. This conversion constant in terms of pCi/g per uR/hr is derived using MicroShield. The second conversion factor that is needed is one that converts an exposure rate due to the radionuclide of interest to a count rate for the detector used during the scan, uR/hr per pCi/g which is provide by the instrument manufacturer.

$$MDA = \left(MDCR_{surveyor}(cpm)\right) * \left(\frac{uR/hr}{cpm}\right)\left(\frac{pCi/g}{uR/hr}\right)$$

Where: MDA = The minimum detectable activity (pCi/g)

Samples sent to an off-site laboratory for analysis will be analyzed to the minimum detectable activities, MDAs, listed in Table 10-1.

Table 10-1
MDAs For Off-Site Analyses

Radionuclide	MDA – pCi/g
Tc-99	3.0
U-234	0.5
U-235	0.5
U-238	0.5
Th-232	0.3
Am-241	0.3
Np-237	0.1
Pu-239/240	0.1

10.9 Quality Control Samples

A split sample will be collected from approximately every twentieth sample in order to monitor the accuracy of the off-site laboratory.

10.10 Follow-up Investigations

If potential elevated areas of activity are identified either as a result of surveys performed or samples analyzed, the RSO may specify follow-up investigations to determine if an elevated area of activity exists, quantify activity concentrations, and determine the size/volume of the impacted area. The need for follow-up investigations may be identified at the time that this plan is being implemented, as the sample analysis results become available from the off-site laboratory, or once the DCGLs and/or Decommissioning Plan is approved.

10.11 Management of Investigation Derived Waste

Until proven otherwise all waste (cuttings, spoils, excess sample media, used protective clothing, etc) generated during sample collection shall be considered potentially contaminated and handled as such.

11.0 QUALITY CONTROL

Numerous Quality Control measures will be in place to help ensure that all quality and regulatory requirements relative to this survey are satisfied. All activities that affect quality will be controlled by this survey plan or by the work package prepared to implement this survey plan. The following Quality Control measures are an integral part of this survey.

11.1 Selection of Personnel

The Project Engineer, who is certified by the American Board of Health Physics, has extensive experience in developing and implementing surveys plans. He has experience performing final status surveys at other NRC licensed facilities and in implementing the guidance contained in NUREG-1575 (Reference 14-1). He also has experience working with the radionuclides of concern and in operating the instrumentation/methodology used to detect these radionuclides.

The Health Physics Technicians who participate in this survey will have had previous experience performing and document surveys. They will be familiar with the instrumentation they may be expected to operate.

11.2 Training

All personnel participating in this survey will receive site specific training which will included a review of the requirements of this survey plan, a review of the applicable work instructions and implementing procedures, and any unique features and/or hazards associated with this survey.

11.3 Instrument Selection, Calibration and Operation

Survey instrumentation will be selected that has proven reliable in the past in detecting the radionuclides of interest. All instrumentation will be calibrated using approved procedures and sources traceable to the National Institute of Standards and Technology, NIST.

Source check criteria will be established for each instrument prior to its use for future reference and all instrumentation will be source checked daily prior to use to verify proper operation.

11.4 Survey Documentation

All of the survey results and related documentation will be placed in a file along with a copy of the survey package. A summary of the sample analysis results for a given survey unit will also be placed in the file once it becomes available. Each survey filed will include the date of the survey, the name of the responsible technician, the instrument type and serial number used, and the detector type and serial number used. Chain of custody forms will be included for all samples sent off site for analysis.

11.5 Chain of Custody

The custody forms will be used to help track custody of all samples collected for off-site analysis.

11.6 Duplicative Review of Survey Results

The survey packages and survey results for each survey unit will be reviewed by the responsible survey technician and the RSO, or deignee, to verify that all documentation is complete and accurate.

11.7 Sample Analysis

Quality control samples consisting of split samples will be collected from approximately every twentieth sample in order to monitor the accuracy of the off-site laboratory. In addition the off site laboratory will be expected to run matrix spikes and blanks to access their own performance and report the results of the analyses as part of a QA Summary to accompany the sample analysis results.

When evaluating the analysis results associated with the split the NRC Inspection Procedure 84750, “Radioactive Waste Treatment, And Effluent and Environmental Monitoring” (Reference 14-2) will be used.

12.0 SURVEY PLAN IMPLEMENTATION

This section of the survey plan provides guidance on how the activities outlined in this plan are expected to be implemented. The sequence of activities described may be altered and/or multiple activities performed in parallel if it is determined by the Project Manager that doing so would facilitate survey activities.

12.1 Work Prerequisites

The following prerequisites will be met before sampling begins.

- The RSO or a designated, authorized acting RSO shall be on site during field sampling activities.
- Permission from the gas line (Missouri Natural Gas).
- An adequate number of sampling locations will be marked to assure that work can commence.
- Verify instrument numbers, calibration to reference standards, calibration dates, and equipment operability according to WEC procedures.
- All contractors will review all applicable WEC polices and procedures.
- Dig-rite, a Missouri statewide wide call center concerning excavation, shall be notified and utilities marked prior to work.
- Penetration Permit shall be completed.
- Radiation Work Permit, RWP, shall be completed.
- A specific Accident and Hazards Analysis shall be completed for this survey project.
- A sample storage location shall be established.
- Training shall be completed for use of the PID.
- A pre-job briefing by the Project Manager or designee shall be completed for all personnel taking part in this activity prior to start.
- The Project Engineer will assemble and stage for use, sample containers, waste material containers (1 yd3), sample log sheets, and sampler decon materials.
- Heat Stress monitoring shall be in place, if applicable.
- First aid treatment kit shall be in place.
- All equipment, supplies and hand tools shall be inspected and ready for use.
- Appropriate PPE shall be staged and ready for use as applicable.

12.2 Required Equipment, Instruments, Material and Supplies

The following is a listing of the required equipment, instruments, material and supplies to perform this work effort:

- Hearing protection, eye protection, leather palm gloves, safety toe shoes, and hardhat.
- Radiological PPE as per the RWP or as directed by the Health Physics Technicians
- Portable eye wash station
- GPS meter, tape measures, or equivalent
- NaI Detector with Ludlum 2350 survey meter or equivalent (calibrated with a 25 feet cable and one with a 3-5 feet)
- Ludlum 43-89 Alpha/Beta Probe and survey meter or equivalent
- Ludlum 44-9 Geiger-Mueller probe with survey meter or equivalent
- Sampling Rig for use with three split spoon soil sampling devices or equivalent.
- Multi Rae Plus PID
- Decon supplies (spray bottles, rags, tubs, Alconox, etc.)
- Bentonite chips
- Marker, Flags, Stakes and Paint
- Rope marked at ~1 ft intervals for NaI logging work; hose clamp to connect rope to probe.
- Disposal bags (1 yd3); mini super-sacks or approved waste container
- Sample blending containers and final sample containers for radiological analysis
- Sample containers for chemical work
- Sample preparation tables (2) with plastic sheeting
- Spoon cleaning station table with plastic sheeting
- Communication radios

12.3 Locate and Mark Sampling Locations

- Proposed sampling locations will be defined in the survey unit specific survey packages.
- The sample locations will be marked using marking paint, construction flags, and/or stakes depending on the conditions where the sample will be taken. All locations markings will include the sample numbers as specified in the survey unit specific survey packages.

12.4 Gamma walkover survey

A gamma walkover survey will be performed over 100% of the accessible surfaces in order to identify areas of elevated activity that may require biased sampling. Areas of elevated activity will be marked using marking paint, construction flags, and/or stakes as appropriate as they are identified.

12.5 Surface Samples

Using hand tools, a surface sample (0 to 15 cm) will be obtained from the sample location. The sample will be placed into a standard zip lock bag and labeled with the sample identification number, and depth below ground surface. The sample information will be recorded on a sample log sheets.

If conditions allow the surface sample may be obtained by using the sampling rig to obtain a core sample as discussed below.

12.6 Obtaining Core Samples

After a surface sample is collected, a sampling rig will be used to obtain subsurface samples.

- Advance the sampler to the desired depth and retrieve the sampler. The length of the core will be variable and may be collected in acrylic sleeves or in a split spoon sampler.
- Scan the core, if a sleeve is present open the sleeve first, using a PID to detect the presence of VOC; and using G-M detector or other approved instrumentation to detect the presence of radioactivity.
- Record the soil characteristic information on the log sheet and identify the portion of the core showing the highest for VOC and radioactivity, and
- Within each of the depths of interest and if there is an elevated count on the core, collect a sample for radiological analysis at the location of most elevated count rate.
- Prior to homogenizing the soil obtained from that depth of interest, collect any additional sample(s) that may be required for analyzing for chemical hazards as appropriate.
- Collect a composite sample of the soil from the depth of interest and homogenize.

- Clean sampling equipment by brushing with water and phosphate-free soap. Rinse with clean water.
- IDW material will be placed into the mini super-sack or other approved container.
- Continue the steps above to the required sampling depth.
- If possible, gamma log each bore hole by advancing a gamma detector down the bore hole and record the count rate obtained at approximately 1 foot intervals on the log sheet.
- After sampling and the gamma logging at a location is complete, the hole will be filled with Bentonite chips to preclude the vertical mobility of any contaminants via the sample hole.
- Samples will be moved to the sample storage location and logged into the inventory in compliance with WEC-Hematite QAPP Section 7.8.
- After all sampling is completed; all sampling equipment will be cleaned and surveyed for unconditional release prior to removal from the site.
- At the completion of all work indicated the original survey records, including work instructions, will be submitted to the Project Manager.

13.0 FINAL REPORT

Following completion of this survey effort and the availability of all off-site sample analysis results a final report will be written summarizing the survey effort and documenting the survey results. Assuming that the area of interest is suitable for release for unrestricted use, the level of documentation will be such that the report can be used to support future license termination either directly or indirectly by re-analysis of the data contained in accordance with the yet to be approved Final Status Survey Plan.

14.0 REFERENCES

14-1 U.S. Nuclear Regulatory Commission, NUREG 1575, Revision 1, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)"; August 2000, including the June 2001 updates.

14-2 U.S. Nuclear Regulatory Commission, NRC Inspection Manual – Inspection Procedure 84750, "Radioactive Waste Treatment, and Effluent and Environmental Monitoring," March 15, 1994.

14-3 Hematite Decommissioning Project Procedure, PO-HP-001, "Radiation Protection Plan."

14-4 Hematite Decommissioning Project Procedure, PR-EHS-004, "Stop Work Authority."

14-5 Hematite Decommissioning Project Procedure, PO-QA-001, Hematite Quality Assurance Program Plan."

14-6 Hematite Decommissioning Project Procedure, PR-QA-009, Records Management."

APPENDIX A

EXAMPLE BORING LOG

EXAMPLE BORING LOG

Survey Unit #:_____ **Sample Location #:**_____

Drilling Company: _____

Name of Driller: _____

Date: _____

Depth BGS (feet)	Description of Material (percent recovery, etc.)	PID Reading (ppm)	Beta Activity (cpm)	Gamma Scan (cpm)

Depth to Ground Water (if applicable): _____

Photo Ionization Detector Model #:_____ **Serial #:**_____

Survey Meter Model #: _____ **Serial #:** _____

Survey Meter Model #: _____ **Serial #:** _____

Gamma Detector Model #: _____ **Serial #:** _____

Name (print):_____ **Signature:** _____

APPENDIX B
EXAMPLE SAMPLE LOG

EXAMPLE SAMPLE LOG

Survey Unit Number: _____

Sample Location Number: _____

Date: _____

Sample Number	Depth BGS (feet)	Matrix	Number of Containers	Date	Time

Name (print):_____ **Signature:** _____

APPENDIX C

EXAMPLE GAMMA LOGGING WORKSHEET

EXAMPLE GAMMA LOGGING WORKSHEET

Survey Unit #:_____ **Sample Location #:**_____

Depth BGS (feet)	Exposure Rate* (uR/hr)	Gamma Count Rate* (cpm)
0 (background)		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

* **The gamma logging readings may be recorded in units of uR/hr or cpm as appropriate**

Depth to Ground Water (if applicable): _____

Survey Meter Model #: _____ **Serial #:** _____

Gamma Detector Model #: _____ **Serial #:** _____

Name (print):_____ **Date:** _____ **Signature:** _____