REMEDIAL DESIGN
SAMPLING AND ANALYSIS PLAN

Big River Operable Unit 1

St. Francois County, Missouri

October 23, 2015

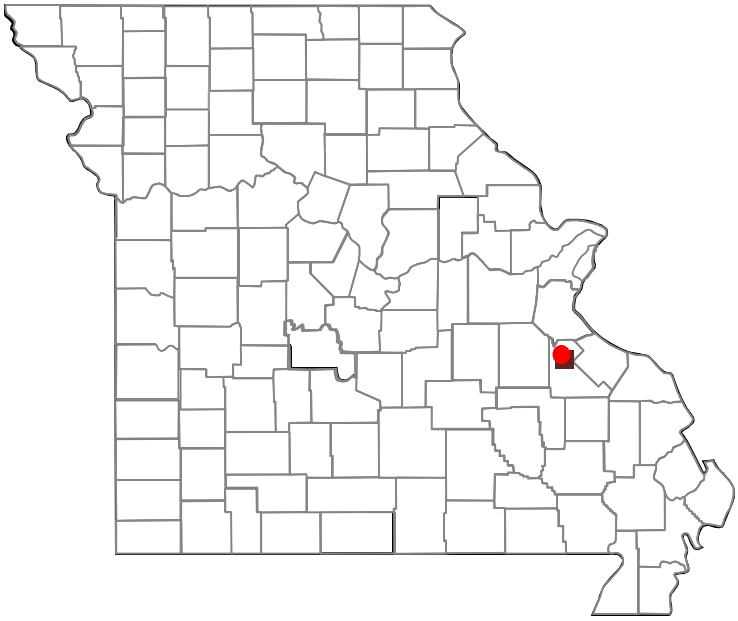

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Table of Contents

1.0 Introduction 1
2.0 Site Information 1
2.1 Site Location 1
2.2 Background 3
2.3 Previous Investigations 4
3.0 Data Quality Objectives 6
3.1 Problem Statement 6
3.2 Planning Team 6
3.3 Conceptual Site Model 6
3.4 Study Question 7
3.5 Inputs to Study Question 7
3.6 Study Boundary 8
3.7 Decision Rules 8
3.8 Tolerable Limits on Decision Error 10
3.9 Sampling Design 11
4.0 Field Activities 11
4.1 Establishing Sampling Unit Boundaries 11
4.2 Locational Data Collection 12
4.3 In-Situ Soil Screening 12
4.4 Soil Sample Collection 13
4.5 Sampling Order 13
4.6 Soil Sample Conditioning 13
4.7 Soil Sample XRF Analysis 14
4.8 Soil Sample Laboratory Analysis 14
4.9 Number of Samples, and Container and Preservation 15
4.10 Chain-of-Custody 16
5.0 Data Management 16
6.0 Quality Control 17
6.1 Field Decontamination 17

6.2 Quality Assurance/Quality Control (QA/QC) Samples 18
6.2.1 Rinseate Blank 18
6.2.2 XRF Precision 18
6.2.3 XRF Accuracy 19
6.2.4 Field Duplicates 19
6.2.5 Laboratory Subsampling Duplicates 19
6.2.6 Laboratory Analysis 20
7.0 Investigation Derived Wastes (IDW) Plan 20
8.0 Site Safety 20
9.0 Reporting 21

Figures

Figure 1. Mine Waste Piles, Big River Mine Tailings Site……..2
Figure 2. Residential Properties Identified for Sampling…….…..9
Figure 3. Residential Yard Sampling Unit Layout……12

Tables 14,15,17

Table 1. XRF Reporting Limits for XRF Analysis……..14
Table 2. EPA SW-846 Method 6010B Reporting Limits for Soil Samples……15
Table 3. Sample Numbers, Containers and Preservation…….…..15
Table 4. Data Captured in XRF Analyzers and GPS Units……17

Appendices

Appendix A – Health and Safety Plan
Appendix B – QAPP
Appendix C – Field Sheets and Chain of Custody Forms
Appendix D – XRF SOP
Appendix E – Sample Processing SOP

1.0 Introduction

The Big River Mine Tailings Site is a Comprehensive Environmental Response Compensation and Liability Act (CERCLA) National Priorities List (NPL) site located in southeast Missouri entirely within St. Francis County. There are eight primary sources of mine waste at the site including the Federal Pile, which is located in what is now St. Francois State Park. On March 19, 2013, the Missouri Department of Natural Resources (department) Division of State Parks received a Special Notice Letter from U.S. EPA Region 7 naming the department as a potentially responsible party (PRP) to Operable Unit 1 (OU1) of the site and requesting negotiations to resolve the department's responsibilities regarding response actions at the site (USEPA, 2013). OU1 includes residential properties in St. Francois County affected by mine waste.

The department is currently in negotiations with EPA which will culminate in a Consent Decree outlining the department's responsibilities at the site. It is expected that part of those responsibilities will include the assessment of 110 residential properties located within 1 mile of the Federal Pile and subsequent soil cleanup at those properties where lead concentrations in yard soils exceed 400 mg/kg. The Division of State Parks has requested assistance from the Division of Environmental Quality, Hazardous Waste Program, Superfund Section in preparing a Sampling and Analysis Plan (SAP) and conducting sampling activities at these 110 properties. Sampling is planned for October 2015.

2.0 Site Information

2.1 Site Location

The Site is located in southeastern Missouri entirely within St. Francois County, approximately 70 miles southwest of St. Louis (Figure 1). The site consists of a series of eight mine waste piles and areas around those piles where mine waste has come to be located.

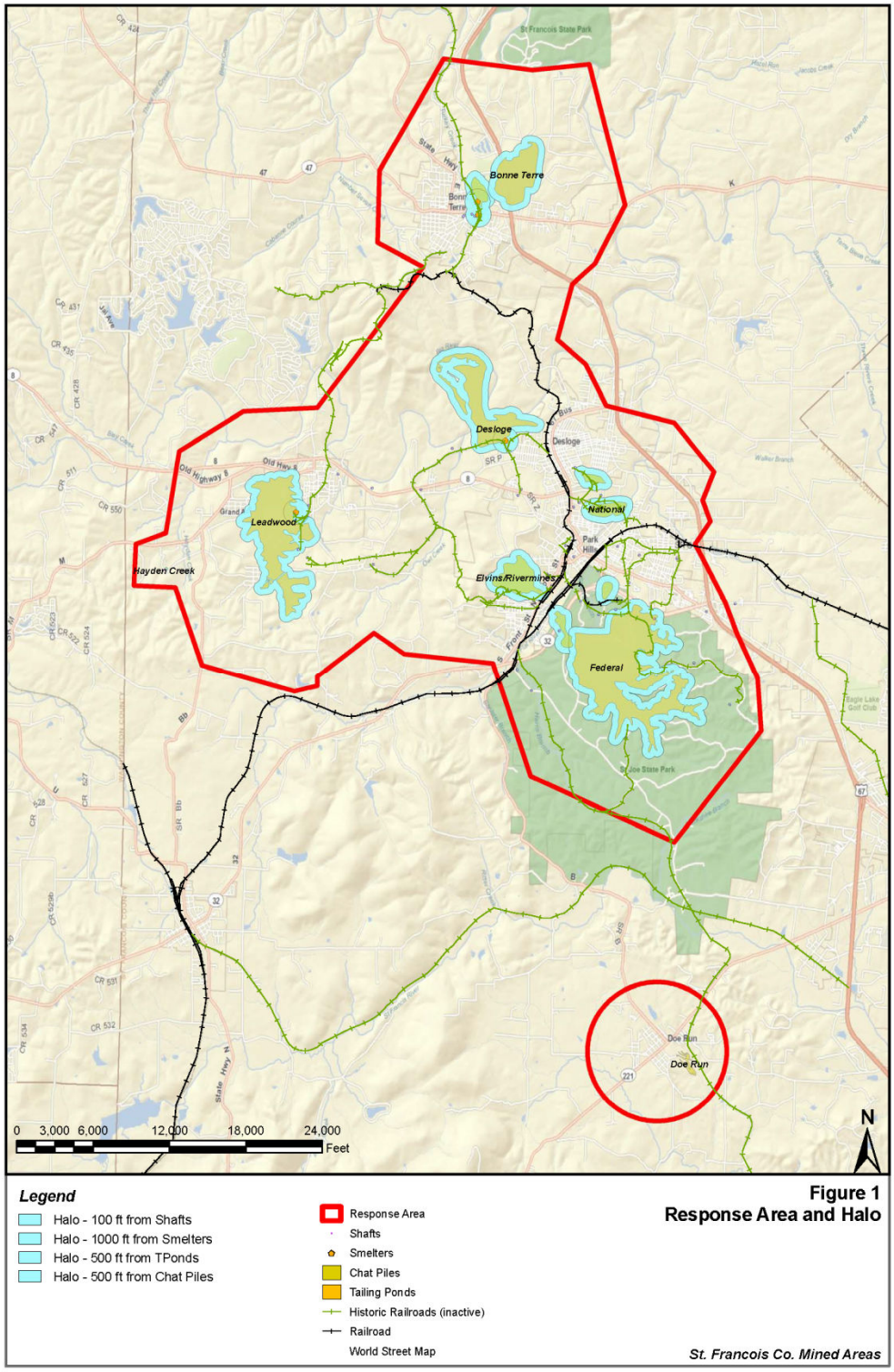

Figure 1. Mine Waste Piles, Big River Mine Tailings Site (Figure from Newfields, 2012)

2.2 Background

The first recorded mining in St. Francois County occurred between 1742 and 1762 in the area that became known as the Old Lead Belt. Mine output in the County peaked in 1942 when 197,430 tons of lead was produced. Mining ceased in the county in 1972 with the closing of St. Joe Lead Company's Federal mine.

The the Old Lead Belt which is on the northeastern edge of the Precambrian igneous core of the St. Francois Mountains. This area is one of the world's largest lead mining districts, having produced more than nine million tons of pig lead. It has been estimated that some 250 million tons of mill waste tailings and chat were produced in the Old Lead Belt from ore milling and beneficiation processes. The chat has been used extensively as aggregate for ballast in railroads, aggregate in concrete, and asphalt and fill. Some chat is used today as aggregate and fill. Tailings have been used as agricultural amendments due to the lime content.

To date, eight source areas of mine waste have been identified within the St. Francois County Site. These areas are shown on Figure 1. Chat deposits include sand- to gravel-sized material resulting from the crushing, grinding, and dry separation of the ore material. Tailings deposits include sand- and silt-sized material resulting from the wet washing or flotation separation of the ore material. The mine waste contains elevated levels of lead and other heavy metals which pose a threat to human health and the environment. These deposits may have contaminated soils, sediments, surface water, and groundwater. These materials also may have been transported by wind and water erosion or manually relocated to other areas throughout the county. It has been reported that mine waste may have been used on residential properties for fill material and private driveways, used as aggregate for road construction, and placed on public roads around St. Francois County to control snow and ice in the winter.

This project is focused on residential properties located within 1 mile of the Federal Pile (Figure 1). A detailed description of operations and an inventory of the mines and shafts at the Federal Pile were provided in the Initial Remediation Investigation (Fluor Daniel, 1995). The Federal Lead Company began operations in 1902 and constructed a large mill in 1907 at what is now the No. 3 mill at St. Joe State Park. In 1923, the St. Joe Minerals Corporation purchased all of the Federal Lead Company holdings which at the time included at least 12 shafts and the mill. Production at the mill at that time was 4,800 tons per day. Production at the mine ceased in 1970, and the mine/mill including 8,561acres of land were donated by St. Joe Mineral Corp. to the State of Missouri for use as a state park in 1975. The successor to St. Joe Minerals Corp. was renamed the Doe Run Resources Corporation in 1994. EPA entered into an Administrative Settlement Agreement and Order on Consent for Removal Action with Doe Run ant the State of Missouri in 2011 for stabilization of the Federal Pile, and work is ongoing.

The Big River Mine Tailings Site has been divided into several operable units (OUs) to make cleanup more manageable. OU1 includes the residential and high child-exposure area soils in St. Francois County. Residential yard cleanups at the Big River site have been conducted under two primary removal actions – the 2000 Interim Removal Action and the 2004 Halo Removal Action (USEPA, 2000 & USEPA, 2004). It was estimated in the ROD for OU1 that approximately 4,000 residential properties in St. Francois County will require remedial action (USEPA, 2011). This project will address lead contamination at 110 of those properties located within 1 mile of the Federal Pile.

2.3 Previous Investigations

Investigations of lead contamination in St. Francois county site have been ongoing since 1988. The Missouri Department of Health and Senior Services conducted studies including a Preliminary Public Health Assessment in 1994 and a lead exposure study in 1997 (ATSDR, 1998). These studies concluded that 17 percent of children_tested in the mining area of St. Francois County had elevated blood lead (EBL) levels. A comparable city with similar aged

housing stock was also studied as a control area, and found to have an EBL rate of only 3 percent.

In 2000, EPA entered into an AOC with the Doe Run Company for a soil testing and removal program and blood lead testing and control program within the Site (USEPA, 2000). This Order, called the Interim Order, provided that these programs would end when either EPA issued a ROD for residential yards or after four years. At the end of the Interim Program (March 30, 2004), 1,955 residential yards had been sampled.

In 2004, EPA entered into another AOC with Doe Run for a Removal Action to replace the expiring 2000 Interim Order (USEPA, 2004). The 2004 Administrative Order was called the Halo Removal Order. The Halo Removal Order covered six mine waste areas: National; Elvins; Bonne Terre; Federal; Desloge; and, Leadwood. It required testing and removal actions within the halo around each of these waste areas. The "halo" was defined as the area within 500 feet of chat and tailings waste, 1,000 feet from four identified smelters/calciners, and 100 feet from mine shafts. Of the total yards sampled, 387 were completely remediated by Doe Run (all areas < 400 ppm) and 188 were partially remediated (part of the yard remains > 400 ppm) by Doe Run. EPA has also remediated 218 yards, 19 schools, 28 daycares, and 2 head starts under its CERCLA removal authority, and 24 yards under its CERCLA remedial authority.

In 1997, EPA entered into an AOC for the development of a Remedial Investigation/Feasibility Study (RI/FS) for the Site with Doe Run and ASARCO. The RI//FS was completed and released in 2011 (NewFields, 2011). The FS developed the alternatives for the remedial action for the residential properties. As part of the FS, an investigation of lead contamination in the subsurface soils was conducted. The FS evaluated three remedial action alternatives: (1) No Action; (2) Soil removal with a 12 inch subgrade barrier and institutional controls; and (3) Soil removal with a 24 inch excavation with limited institutional controls. EPA issued the Record of Decision (ROD)

on September 30, 2011 (USEPA, 2011). The selected remedy in the ROD was Alternative 3. The selected remedy only concerns OU1, contaminated residential properties.

3.0 Data Quality Objectives

To help ensure precise, accurate, representative, complete, and comparable data, all field work and analyses will be conducted in accordance with the Quality Assurance Project Plan (QAPP) for Pre-Remedial/Pre-Removal and Targeted Brownfields Site Assessments Revision 7, December 7, 2012, and ongoing (Appendix B). The QAPP describes the general data quality objectives (DQO) for site assessment investigations conducted by the HWP and ESP. Those DQOs specific to this project are described below.

3.1 Problem Statement

One hundred ten residential properties located within 1 mile of the Federal Pile have been identified for sampling to determine whether the mean lead concentration in yard soils exceeds the cleanup level identified for the site of 400 mg/kg.

3.2 Planning Team

The planning team includes staff from the Missouri DNR HWP Superfund Section, ESP Field Services and Chemical Analysis Sections, Division of State Parks, US EPA Region 7, Missouri Department of Health and Senior Services, and St. Francois County Health Department.

3.3 Conceptual Site Model

Mining contaminant sources have affected the air, surface water, sediment, groundwater, and soil within the Big River Mine tailings site. These sources include tailings, tailings pond water, mine water, mill and process water, development rock, mill waste, ore concentrates, residual ore piles, smelter particulates, smelter gases, contaminated soil, contaminated duff and vegetation, and contaminated sediment. One or more of these contaminant sources that may have affected surface soils at residential properties identified for assessment.

Potential contaminant release and transport mechanisms within areas affected by historic mining include: floodplain deposition from contaminated streams; transport of mine waste to recreational areas for use as fill or incorporated as base into roadway materials; fugitive emissions from historic smelters waste piles or ore concentrates; ore concentrate spilled during loading and transportation; and storm water runoff from tailings, ore piles, or contaminated soils.

Lead in soil is considered to be the primary constituent of concern for the residents within OU1. Primary exposure pathways are incidental ingestion of lead in surface soils and inhalation of lead in dust generated from surface soil. Therefore, the exposure pathway of concern for adult and child residents is incidental ingestion of soil and dust in and about the home and yard.

3.4 Study Question

The primary study question is to determine whether the mean concentration of lead in the surface soil of sampling units established in 110 residential yards identified near St. Joe State Park exceed 400 mg/kg.

3.5 Inputs to Study Question

The primary inputs to the study questions include (1) sampling unit boundaries established for each residential yard, (2) estimates of mean lead concentrations in the surface soil of each sampling unit, (3) human health-based action levels for lead in soil, and (4) estimates of overall sampling and analysis precision. Sampling unit boundaries will be established in the yard, drip zone, play areas, vegetable gardens, and driveways within each residential parcel as described in the Handbook and further discussed in Section 4.1. Estimates of the mean concentration of lead in the surface soil of each SU will be obtained from composite soil samples collected within each SU as discussed in Section 4. The Record of Decision for Big River Mine Tailings Site established the cleanup action level for lead in soil at 400 mg/kg (USEPA, 2011). Estimates of

overall sampling and analysis precision will be obtained from field duplicate samples collected in selected SUs as discussed in Section 6.

3.6 Study Boundary

U.S. EPA Region 7 staff provided the department with a list of 130 parcels located within 1 mile of the Federal Pile that have not previously been sampled (Figure 2). The department requested access to sample from the owners of these properties, and access was granted for sampling at the 66 parcels shown in Figure X. Note that one of these parcels (Location ID 110) is a mobile home park containing 44 residences. Therefore, the total number of residences to be sampled is 110.

Sampling will primarily be limited to the upper one inch of surface soil as this is the depth interval most relevant for soil exposure risk scenarios. Collected soil composite samples will include the entire 0-1 inch interval and will be air dried, disaggregated and sieved to obtain the <2 mm particle fraction for analysis.

3.7 Decision Rules

Investigation data will be used to determine whether soil cleanup or other management actions are necessary to reduce the public's exposure to heavy metal contamination at the residential parcels. XRF analysis results for lead on composite soil samples collected from sampling units established in yards at each residence will be compared directly to the 400 mg/kg cleanup action level. If the result from any sampling unit at a residence exceeds 400 mg/kg, the yard will warrant a removal action; otherwise no further action will be taken. Note that if only the drip zone SU exceeds the cleanup action level at a residence, no further action will be taken.

3.8 Tolerable Limits on Decision Error

The hypothesis is that the mean concentration of lead in the surface soil SUs at a residence exceeds health based screening levels. Falsely rejecting that hypothesis, considered a Type I decision error, would mean mistakenly concluding that there is no health threat. Falsely accepting this hypothesis, considered the Type II decision error, would mean concluding that there is a health threat when in fact there is not. The Type I error would result in the taking no action when contaminants are actually present at levels that could pose a health threat. A Type II error would result in the unnecessary use of resources to conduct cleanup actions when none are warranted. The Type I error is considered more severe since it results in potential threats to human health.

Two primary measures will be taken to protect against making a Type I decision error. A conservative cleanup action level for lead of 400 mg/kg in soil was developed for the project (USEPA, 2011). The level was chosen to reduce the risk of exposure of young children to lead such that an individual child exposed to a mean concentration of 400 mg/kg or less lead in yard soil will have no greater than a 5% chance of exceeding a blood lead level of 10 ug/dl (the Center for Disease Control's recommended benchmark at the time of the ROD). The use of this protective cleanup action level will help protect against Type I errors.

There is a higher probability of underestimating the mean concentration of lead in soil within an identified sampling unit when using data from a small number of discrete samples or from composite samples consisting of a small number of increments (Crumbling, 2014). By collecting multiple increments of soil to form composite samples from each sampling unit, the probability of underestimating the mean will be reduced. The probability of underestimating the mean would be further reduced by using an upper confidence limit to represent the mean soil lead concentrations as this takes into account the precision of the sampling method. For this project,

the analytical result from the composite sample will be compared directly to the cleanup action level for decision-making. However, field replicate samples will be collected and overall sampling and analysis precision data will be available for consideration with the overall project data set.

3.9 Sampling Design

A composite soil sampling design will be used based on the Superfund Lead-Contaminated Residential Sites Handbook (Handbook) (USEPA, 2003). Sampling units will be established within each residential yard, and composite surface soil samples consisting of a minimum of 5 increments will be collected and analyzed from each SU. Samples will be conditioned and analyzed for lead by XRF, and results will be compared to the cleanup action level for decision-making.

4.0 Field Activities

4.1 Establishing Sampling Unit Boundaries

Sampling units will be established in yards, driveways, gardens, drip zones and play areas as described in the Handbook. A site sketch field form will be prepared for each property sampled consisting of a scaled aerial photograph of the property, and data fields for recording property information (Appendix C). The boundaries of each SU will be marked and labeled on the photograph. Where a discernable scaled aerial photograph is not available for a property, a hand-drawn field sketch will be prepared instead. Generally, the yard SUs will be established with SU Yard 1 in the front right portion of the yard (relative to an observer looking at the front of the residence), and then continuing in a clockwise direction around the yard as shown in the Figure 3.

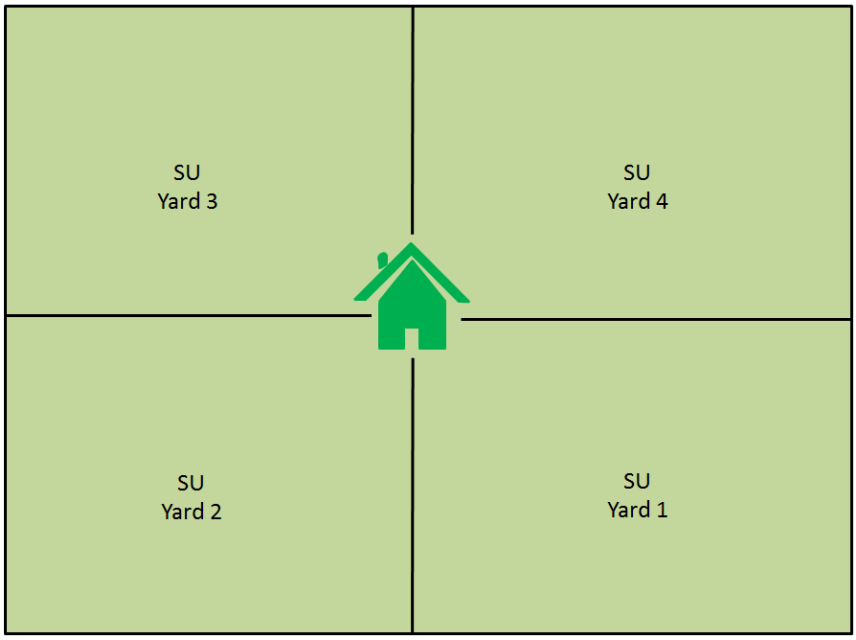

Figure 3. Residential Yard Sampling Unit Layout

Unless it is determined that the residence was constructed after approximately 1978 (after the discontinuation of use of lead based paint), a drip zone SU will be established around the residential structure between 6" and 30" from the exterior walls. Separate SUs will be established for any gravel driveways, children's play areas, or vegetable gardens observed.

4.2 Locational Data Collection

At each residence, a single locational data point will be collected in the approximate center of each SU. Locational data will be collected using a Trimble GeoExplorer GPS units using a 60-second logging time and data will be corrected using differential post-processing.

4.3 In-Situ Soil Screening

In-situ XRF analysis will be conducted in accordance with the SOP in Appendix D. Approximately five in-situ XRF readings will be collected from yard sampling units, equally

spaced across the SU. Note that the in-situ data will not be used for decision making; only to provide supplemental data and aid in delineating yard SUs.

4.4 Soil Sample Collection

An EVS™ or EnviroStat™ stainless steel incremental sampling tool will be used to collect a minimum of five equal-mass increments of soil at equal spacing across each yard SU. A 4-cm diameter, 5-cm long stainless steel sampling core will be used to obtain approximate 30-gram increments of soil. The sampling core will be advanced into the soil and ejected into a 2-gallon size heavy duty sealable plastic bag. Alternative sampling tools may be used as soil conditions warrant. This process will be repeated at each increment collection location, and all increments will be combined together into one bag.

Bags will be labeled with the location ID #, sampling unit number, date, and collector initials using permanent marker. Each sample will be recorded on the soil sample log form shown in Appendix C. Field duplicate composite samples will be collected in identical fashion except that the increments will be collected in different locations within the SU.

4.5 Sampling Order

Though not always practical, attempts will be made to collect all samples in the order from least-to-most contaminated.

4.6 Soil Sample Conditioning

Soil samples will be returned to the laboratory and air dried in aluminum pans lined with wax paper. The air dried samples will be manually disaggregated to break up clumps of soil. Manual disaggregation may not be necessary where soil is highly granular, or has a significant component of gravel which will act to disaggregate the sample during agitation in the mechanical sieve shaker. The soil sample will then be placed in a 2 mm mesh stainless steel sieve and shaken for 5 minutes in a motorized sieve shaker. All of the soil passing through the sieve will

be transferred to a labeled thin-walled resealable plastic baggie for XRF analysis. The portion of the sample retained by the sieve mesh will be returned to the original sampling baggie and archived for a minimum of 3 months. The sample conditioning procedure is further described in the SOP provided in Appendix E.

4.7 Soil Sample XRF Analysis

Dried and sieved soil samples will be analyzed for lead, cadmium and zinc by XRF in the laboratory in accordance with the SOP in Appendix D. The reporting limits for in-situ and bagged XRF analysis are shown in Table 1.

Table 1.
XFR Reporting Limits for Soil Analyses

Metal	Reporting Limit[1], mg/kg	
	In-situ[2]	Bagged Samples[3]
Lead	10	5
Cadmium	20	10
Zinc	10	5

[1] Reporting limits may vary slightly depending on soil matrix
[2] Based on a 30-second analysis of a relatively interference-free soil matrix
[3] Based on a 60-second analysis of a relatively interference-free soil matrix

4.8 Soil Sample Laboratory Analysis

Approximately 10% of the collected soil samples will be submitted to the laboratory for confirmatory analysis following XRF analysis. Samples will be submitted for analysis of lead, cadmium and zinc. The entire dried and sieved sample will be submitted to the laboratory; no sample splitting or subsampling will be conducted. Composite samples selected for laboratory analysis will be submitted to the Department's laboratory in Jefferson City for inductively

coupled plasma – atomic emission spectroscopy analysis (ICP-AES) using EPA SW-846 Method 6010B. The reporting limits for Method 6010B are provided in Table 2.

Table 2.
EPA SW-846 Method 6010B Reporting Limits for Soil Samples

Metal	Reporting Limit, mg/kg
Cadmium	0.5
Lead	2.5
Zinc	0.5

4.9 Number of Samples, and Container and Preservation

One hundred ten (110) residential yards will be assessed as part of this investigation. Assuming an average of three sampling units per residence, composite soil samples will be collected from approximately 330 sampling units. With QC samples included, approximately 460 soil samples will be collected for analysis. Ten percent (46 samples) will be submitted for confirmatory lab analysis by ICP-AES. Table 3 provides a summary of the estimated number of samples, sample container types and preservatives to be used for the project.

Table 3.
Sample Numbers, Containers and Preservation

Sample Type	Analysis	Approximate Number	Container/Preservation
Surface soil composite (including field duplicates)	XRF	460	2-gallon polyethylene resealable bag/none
Laboratory confirmation (soil)	Lab	46	1-quart polyethylene resealable bag/none

Table 3. Sample Numbers, Containers and Preservation			
Sample Type	**Analysis**	**Approximate Number**	**Container/Preservation**
Rinseate blank	Lab	5	150ml Nalgene bottle/HCL to pH<2

Lead cadmium and zinc concentrations are generally stable in surface soil relative to time frames measured in months. Time considerations at this scale should not have a significant effect on results. Samples will therefore not be maintained on ice in the field or refrigerated during sample conditioning or XRF analysis.

4.10 Chain-of-Custody

The ICS soil samples will be stored in the plastic bags in which they were collected. Each bag will be labeled with the location ID #, sampling unit number, date, and collector initials using permanent marker. The samples will be recorded on a separate COC form (Appendix C). The samples will remain in the custody of ESP field personnel during sample processing and XRF analysis. Those samples identified for laboratory analysis will be placed into appropriate sample containers and entered onto an ESP COC form (Appendix C) to be relinquished to a sample custodian at the state's environmental laboratory for analysis.

5.0 Data Management

The location ID will be a unique identifier assigned in advance to each of the 110 residential yards to be assessed. In the event that new location IDs need to be assigned in the field, each sampling team will be assigned a different block of three digit numbers and will sequentially assign location IDs from this block of numbers beginning at the start of sampling and continuing

through to the end of field work. The data fields shown in Table 4 will be used to capture in-situ XRF screening and locational data electronically in the XRF analyzers and GPS units.

Table 4 **Data Captured in XRF Analyzers and GPS Units**		
Data Field	**Data Field Type**	**Data Field Contents**
Analyst	Dropdown List	Names of staff using the XRF or GPS
SRM (XRF only)	Dropdown List	4-digit number identifying the SRM
Location ID	Alphanumeric - Manual Entry	Three digit number unique to each residential yard
Sampling Unit Type	Dropdown List	Yard, Drip Zone, Driveway, Play Area, Veg Garden, Other (specify in comments)
Sampling Unit Number	Alphanumeric – Manual Entry	Number
Comments	Alphanumeric – Manual Entry	Miscellaneous comments

6.0 Quality Control

6.1 Field Decontamination

Clean disposable latex gloves will be worn by sampling personnel and clean or field decontaminated equipment will be utilized for each sample location to minimize the possibility of cross-contamination. Reusable soil sampling tools will be cleaned between sampling locations as follows:

- Brushing with stiff-bristle nylon brush to remove visible soil debris;
- Cleaning with Simple Green® detergent and further brushing;
- Rinsing with deionized (DI) water;
- Wiping dry with clean paper towels

6.2 Quality Assurance/Quality Control (QA/QC) Samples

The following samples will be collected as part of the quality control/quality assurance procedures for the investigation. Quality control procedures for use of the XRF analyzers in the field and in the lab are included in the XRF SOP provided in Appendix D.

6.2.1 Rinseate Blank

Following decontamination of soil sampling tools between SUs, a rinseate blank will be collected by capturing DI rinse water as it flows off the tool into a 150 ml Nalgene container preserved with HCL to pH <2. Rinseate blanks will be submitted to the laboratory for analysis of lead, cadmium and zinc. One rinseate blank will be collected per sampling tool for the sampling event.

6.2.2 XRF Precision

Instrument precision for in-situ XRF analyses will be measured once per day per XRF analyzer in the field by collecting seven replicate XRF readings at a single soil sampling location without moving the analyzer between analyses. The percent relative standard deviation between the seven results for lead should be less than 15.

Instrument precision for bagged sample XRF analyses will be evaluated by conducting multiple analyses for lead on selected samples at a frequency of once per day per analyzer. The precision sample will be selected based on lead concentrations. Samples will be chosen to reflect the full

range of lead concentrations observed, however, special emphasis will be placed on selecting samples near the action limits if possible. The selected sample will be analyzed seven separate times without moving the bagged sample between each analysis. The percent relative standard deviation among the multiple analyses for lead should be less than 15.

6.2.3 XRF Accuracy

Standard reference materials (SRMs) containing certified concentrations of metals in a soil matrix will be analyzed each day XRF analysis is conducted. Results for lead will be plotted on a control chart and must be within 2 standard deviations of the control chart average.

6.2.4 Field Duplicates

Field duplicate composite soil samples will be collected to measure precision of the overall soil sampling and analysis process. Within a minimum of 20% of SUs sampled, field duplicate composite samples will be collected in an identical manner, except the increment locations will be off-set as much as possible from each other within the SU. To the extent possible, SUs will be chosen for field duplicate sampling to represent the variety of different SU types and yard conditions observed.

A relative standard deviation among the lead results in field duplicate samples of less than 30% will generally indicate acceptable precision; however the degree of precision required depends on how close the estimated mean concentration is to the lead action level. More data variability may be tolerable if the concentrations measured are either well above or well below the action levels.

6.2.5 Laboratory Subsampling Duplicates

Laboratory subsample replicates will be requested on ten selected composite samples submitted to the laboratory. The laboratory will subsample the container two times and conduct two separate analyses. This procedure measures the within-sample container matrix heterogeneity

and the error associated with the laboratory subsampling procedure. Samples will be identified for laboratory subsampling duplicates by indicating in the Comment field of the ESP COC form.

6.2.6 Laboratory Analysis

Laboratory precision and accuracy will be assessed as described in the QAPP for Pre-Remedial/Pre-Removal and Targeted Brownfields Site Assessments Revision 7, December 7, 2012, and ongoing.

7.0 Investigation Derived Wastes (IDW) Plan

Efforts will be made to minimize IDW generation. IDW may include soil, sediment, decontamination fluids, disposable sampling equipment, and disposable personal protective equipment (PPE).

Field personnel will attempt to return unused soils to their source immediately after generation or, if warranted, containerize and return to the ESP laboratory for proper disposal. Disposable PPE and disposable sampling equipment will generally be handled as solid waste, containerized, and properly disposed. Wash and rinse waters generated during equipment decontamination will generally be discharged to the ground on-site or, if warranted, containerized and returned to the ESP laboratory for proper disposal.

8.0 Site Safety

A safety briefing will be held on-site prior to initiating field activities and field personnel will be required to read and sign the site-specific health and safety plan. The site safety plan is attached as Appendix A.

9.0 Reporting

The Environmental Services Program will prepare a Sampling Report and provide it to the Hazardous Waste Program. The HWP will prepare and submit to the Division of State Parks summary tables of XRF and laboratory analytical results, locational data, data summary maps, photographic logs, field forms, and chains of custody.

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