Remedial Action Plan/Sampling and Analysis Plan for Residential Area near the Shapiro Brothers Festus Site

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ACRONYMS AND ABBREVIATIONS

cm	centimeter
COC	chain of custody
DHSS	Department of Health and Senior Services
DQO	data quality objectives
DU	decision unit
EU	exposure unit
HRS	Hazard Ranking System
ICS	incremental composite sampling
IDW	investigation derived wastes
MDNR	Missouri Department of Natural Resources
mg/kg	milligrams per kilogram
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PBDE	polychlorinated biphenyl ethers
PPE	personal protection equipment
QAPP	Quality Assurance Project Plan

RAL	Removal Action Levels
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SU	sampling unit
USEPA	U.S. Environmental Protection Agency

1.0 Introduction

On behalf of MW Recycling Inc, AMEC is submitting this Sampling and Analysis Plan (SAP) and Remedial Action Plan (RAP) for proposed residential soil sampling and remediation as required by the Missouri Department of Natural Resources (MDNR)[1]. The SAP/RAP has followed the initial plan outline prepared by MDNR for the Integrated Site Inspection/Removal Site Evaluation Sampling and Analysis Plan. The scope of the AMEC investigation will include the collection and analyses of surface soil samples and the remediation of selected residential properties.

2.0 Site Information

2.1 Site Location

The facility is located at the intersection of 12th Street and Vine in Festus, Missouri. It is a rectangular 9-acre area, oriented primarily north-south, along the boundary that separates Festus and Crystal City, Missouri (Figure 1). The Site consists of residential properties that require site characterization and/or remediation located to the east, south and west of the facility.

2.2 Description

The Shapiro Brothers Festus yard has been used as a metal scrap processing and recycling facility since the 1940s. Prior to fall of 2011, when a truck wash system was installed in to clean the undercarriage and wheels of trucks leaving the southern gate, trucks left the unpaved facility unwashed. During periods of wet soil conditions, trucks would historically have tracked mud from the facility onto nearby streets. In late 2010, Shapiro Brothers began operating a street sweeper in the roads around the facility to remove residual material tracked into the streets by trucks, and this practice continues to present.

Prior to the spring of 2011, trucks primarily approached the facility by traveling along 12th Street to and from Truman Boulevard (U.S. Highway 61). A heavy spring flood event in 2011 washed out the culvert beneath 12th Street near the facility making the road impassable. Since then, trucks have traveled south from the facility on the residential street (Delmar Avenue) before connecting with Truman Boulevard via 6th Street.

[1] MW Recycling disputes MDNR's conclusions that remediation of the residential homes is necessary based upon the soil lead levels found. Further, MW Recycling believes that the lead contamination in the yards and potentially the residential homes is not from the Shapiro yard. Nevertheless, MW Recycling has agreed to undertake this remediation as a good corporate citizen and neighbor and to avoid the cost and expense of litigation.

2.3 History/Contaminants of Concern

In July and September 2011, the Missouri Department of Natural Resources conducted a series of environmental inspections at Shapiro Brothers Inc. (Site). The inspections were conducted in response to a complaint received from the city of Festus concerning soil being tracked onto city streets from the site. Sampling conducted by the city indicated elevated lead levels in street sweepings collected from roadways near the facility which resulted in additional sampling being conducted by MDNR as part of a CERCLA Combined Site Inspection/Removal Site Evaluation. The Department's investigation identified elevated lead levels in the soils of residential yards adjacent to the facility and along haul residential roads used by trucks leaving the facility. Based on the results of the sampling events, lead has been determined to be the contaminant of concern in the residential areas near the Site.

3.0 Data Quality Objectives

To help ensure precise, accurate, representative, complete, and comparable data, all field work and analyses will be conducted in general accordance with a site-specific QAPP included as an appendix to the SOW. The sampling design used for this effort will conform to that described in the **MDNR Integrated Site Inspection/Removal Site Evaluation Sampling and Analysis Plan** to ensure compatibility with data previously generated by MDNR in April 2012**.**

3.1 Conceptual Site Model

Based on review of the previously collected data from the Shapiro Brothers Site and the residential properties near the Site, lead will be the only contaminant of concern for the residential sites. MDNR remedial action decisions for residential yards are typically conducted on an exposure unit (EU) by EU basis. Therefore, yard decision units (DUs) for this investigation will be set the same as the EUs. However, to aid in evaluating source attribution and to evaluate sub-areas within the yard DUs that may have special exposure concerns (e.g., children's play areas); sampling will be conducted in sampling units (SUs) smaller than the DU. The sampling design is further discussed in this section and is designed to mimic the previous residential sampling performed in this location, so sampling results can be compared.

Contaminants deposited on residential yard soils through air deposition would be expected to show a spatial pattern with higher concentrations nearer to the facility/haul road, and MDNR believes that this pattern was observed during the MDNR SI/RSE Investigation. Lead poses some unique challenges since it may also be present near residential structures due

to past use of lead paint, and near roadways due to fallout from vehicle exhaust during the period when leaded fuel was used. Additionally, there may be other sources of the lead present in the soils, including that the nation's only primary lead smelter is located approximately 2 miles north of the Shapiro facility and the residential neighborhood, or from past use of smelter slag as traction control on streets of Festus in the winter as indicated in a conversation with the City Manager and Mayor of the City of Festus.

Exterior dust was sampled as part of the MDNR SI/RSE investigation and elevated levels of lead were observed at residences near the facility. The MDNR has indicated to us that they will be conducting indoor dust sampling at residences identified for yard cleanup.

3.2 Decision Units

The primary study goal for this investigation is:

- To define the boundary of the surficial residential lead contamination outward away from the facility during the planned second phase of Residential sampling (Figure 3, light blue/purple parcels) by determining the mean concentrations of lead in the fine fraction of surface soil (0"-1") in residential yard DUs adjacent to the facility and/or along or near haul routes and comparing the mean lead concentrations to the health-based screening levels of 400 mg/kg.

3.3 Study Boundary

Figure 3 shows the locations of each residential property for which access was requested as parcels with light blue/purple boundaries.

3.4 Decision Rules

Removal Assessment

If the estimate of the mean lead concentration for any sampling unit exceeds the EPA Remedial Action Level (RAL) of 400 mg/kg, a yard cleanup action will be initiated; otherwise no further soil cleanup action will be taken for that residence. MW Recycling will cleanup dust, as outlined herein, for those residential homes where the lead soil levels in SU1 and/or SU-2 exceed 400mg/kg.

3.5 Tolerable Limits on Decision Error

The null hypothesis is that the additional yards to be sampled contain average yard-wide lead concentrations above 400 mg/kg. Falsely rejecting that hypothesis, considered a Type I decision error, would mean mistakenly concluding that yards are clean. Falsely accepting this hypothesis, considered the Type II decision error, would mean concluding that the yards are contaminated when in fact they are not. The Type I error would result in taking no action at yards actually contaminated at levels that could pose a health threat to residents. A Type II error would result in the unnecessary use of resources to conduct removal and/or removal action at yards that do not warrant it. The Type I error is considered more severe since it results in potential threats to human health.

A sampling design has been chosen to control error and minimize the likelihood of making a Type I decision error. In-situ XRF analyses will be used to obtain a high density data set about concentration gradients for lead with distance from each residence. The use of field analytical techniques such as XRF allows much higher density data sets than is practical with conventional discrete soil sample/laboratory analysis. Large data sets will increase confidence about conclusions drawn from the data and decrease the likelihood of committing either type of error.

An incremental composite sampling (ICS) approach will be used to collect soil samples in each SU. ICS is designed to obtain single soil sample that contain contaminants in the same proportion in the sample as they are present in the SU (e.g. are representative samples). This is achieved through inclusion of many increments of adequate-mass soil across each SU. Representative sampling will decrease the likelihood of committing either type of error. The ICS sampling procedure will be replicated and results of the replicates will be used to provide a conservative estimate (95% UCL) of the true mean lead concentration. By using a conservative estimate of mean concentration, we will protect against underestimating the true mean, and therefore potentially walking away from a residence that is actually contaminated.

3.6 Sampling Design

Based on the CSM, higher contaminant concentrations are expected closest to the suspected source of contamination (the facility or the haul road). This assumption will be tested by conducting in-situ XRF analyses along transects set up in each yard perpendicular to the suspected source. Several transects will be set up at each residence, and 3-5 30-second in-situ XRF readings will be collected at several distances along each transect. At all residences, the XRF results will be used to identify a sampling unit (SU1) as a rectangle parallel to the suspected source across the entire yard. For residences whose back yards are adjacent to the facility (e.g. those along Kenner Street), SU1 will be established parallel

to the facility across the back of the property. Dimensions of this SU will depend on yard size and configuration and observed concentration trends from in-situ XRF analysis.

For yards where in-situ XRF is conducted, but no elevated lead concentrations (> 100 mg/kg) are observed, no SU1 will be established; a single 30-increment ICS will be collected from the entire yard (excluding the drip zone DU as discussed below). For those residences at which SU1 is established, the area of the SU in square feet (ft2) will be recorded on the field sheet, and a 16-increment ICS will be collected from this SU. When an SU1 is established at a property, a second SU (SU 2) will be established as the rest of the yard (excluding SU1 and the drip zone, SU3) as shown in Figure 4. A 25-increment ICS will be collected from this SU. The area of SU2 will be measured using GIS tools after the field work is complete. If a special-use exposure area is observed in a yard such as a children's play area, its area in square feet will be recorded on the field sheet and it will be sampled as a separate SU. The number of increments collected from a special use area will be determined in the field based on the SU size, but will contain no less than 15 increments. When an SU1 is not established at a yard, the entire yard (excluding the drip zone SU) will be sampled as a single decision unit with a 30-increment ICS.

Most of the homes in the study area were built prior to the banning of lead-based paint in 1978. Therefore it is possible that lead levels in soil near the structures may be elevated due to that potential source. This will be assessed through in-situ XRF analysis conducted along transects extending away from the house in 4 directions. The drip zone transects will be conducted at target residences.

Each SU and DU ICS will be air dried, disaggregated, sieved (0.25mm, #60), and analyzed for lead by XRF. For yards where an SU1 and SU2 sample are collected, an estimate of the contaminant concentration for the entire DU (yard) will be made by mathematically combining results for the ICS collected in SUs 1 and 2. A weight-averaging approach will be used.

20%replicate ICS will be collected in the sampling units. The replicate data from each SU will be used to calculate 95 % upper confidence limits (UCLs). Cleanup decisions will be made based on UCL of the mean lead concentration for each SU in each yard. For yards where replicates are collected, a measure of variability will be directly available for UCL calculation. However, since field replicate will be collected in only a percentage of the SUs, the measure of variability required for UCL calculation will be extrapolated from yards where replicates are collected to those where they are not collected for the purposes of calculating a UCL. For such yards, the arithmetic mean standard deviation from among sets of replicate data will be used as the measure of variability.

3.7 Decision Rules

Investigative data will be used to make decisions to assess the need for a yard cleanup and to determine if the boundary of lead impacts on residential properties has been delineated.

3.7.1 Yard Assessment

- If the 95% upper confidence level (UCL) on the mean lead concentration in a yard sampling unit exceeds 400 mg/kg, yard cleanup activities will be initiated; otherwise no further soil cleanup action will be taken for that residence.

3.7.2 Indoor Dust Assessment

MW Recycling will cleanup dust, as outlined herein, for those residential homes where the lead soil levels in SU1 and/or SU-2 exceed 400mg/kg.

3.8 Field Decontamination

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

- Scraping with putty knife or similar tool to remove soil clumps;
- Brushing with stiff-bristle nylon brush to remove visible soil debris;
- Immersion in a 5-gallon bucket of soapy water and further brushing;
- Rinsing tool with deionized water; and
- Wiping dry with clean paper towels.

3.9 Quality Assurance/Quality Control Samples

The following samples will be collected as part of the quality control/quality assurance procedures for the investigation.

3.9.1 Equipment Rinsate Blank

An equipment rinsate blank will be collected after decontaminating the soil coring tool between DUs once per day of sampling. Following decontamination of the tool, deionized water will be rinsed over the core cylinder and into a sample container, properly preserved with nitric acid in an 8 oz plastic or 250 mL glass bottle, and will travel with the other samples back to the laboratory for analysis. If disposable soil coring tools are used, no equipment rinsates will be collected.

3.9.2 Replicate Field ICS

Replicate ICS will be collected to measure precision of the overall soil sampling and analysis process, and to provide data for calculating a UCL on the mean lead concentration. For 20% percent of the SUs, three independent ICS will be collected in an identical manner, except the increment locations for each ICS will be off-set as much as possible within the SU/DU. The replicate sample will be labelled with the DU/SU name and "replicate". SUs will be chosen for replicate sampling based on the proximity of the yard to the facility, in-situ XRF results if available, and other field observations. An effort will be made to conduct replicate sampling at residences both near the facility and further away along haul routes.

3.9.3 XRF Precision Samples

The precision of bagged sample XRF analyses will be evaluated by conducting multiple analyses of selected samples at a frequency of 5 percent for bagged sample analysis and once per day per analyzer for in-situ analysis. For bagged samples, the precision samples will be selected based on lead concentrations. Samples will be chosen to reflect the full range of concentrations observed. However, special emphasis will be placed on selecting samples near the action level if possible. The selected sample will be analyzed seven separate times without moving the bagged sample (without moving the analyzer for in-situ analysis) between each analysis. The relative standard deviation among the multiple analyses will be assessed as an indication of instrument precision.

3.9.4 Laboratory QC

Laboratory precision and accuracy will be assessed as described in the QAPP.by a laboratory that has been selected and is an approved National Environmental Laboratory Accreditation Program (NELAP) per the Site specific QAPP. Laboratory duplicate analyses will be requested at a frequency of 10% of samples submitted for lead analysis.

3.10 Data Gap Investigations

Following completion of the MDNR SI/RSE investigation, 15 additional residences were identified for sampling to identify the extent of contaminant influence from the facility. The additional residential locations proposed are shaded in light blue/purple in Figure 3. The additional 17 residential properties (301, 308, 305, 311, 314, 303, 306, 313, 307, 309, 310, 315, 304, 312, 316, 317 and 302) will be sampled along with resampling at one previously sampled Phase I residential location (216) resulting in a total of 18 proposed locations. Sample location 216 is being resampled because based on the results for the parcel are not clear if the property was properly sampled based on the dimensions of the parcel and the

fact that MDNR field personnel identified the parcel as only having one sampling unit (SU). Therefore, based on the hand drawn map of the parcel (sketch by Shelly), the Site results and the one SU, AMEC proposes to resample the parcel per Section 3.6. If a proposed property location does not grant access for residential sampling, MW Recycling and MDNR will categorize this property as denied access with no further action required. In addition, any property(s) that has met the Performance Standard (see Section 4.6) and requires an Environmental Covenant (Under the Missouri Environmental Covenant's Act) or soil removal activities due to the presence of lead at depth will require property owner's consent. If consent is not granted for the Environmental Covenant, MW Recycling and MDNR will categorize this property as denied legal covenant access with no further action required. Depending on the findings of this additional yard sampling, and whether it allows for identification of a clean perimeter around the facility, it may be necessary to conduct sampling in more than the 18 proposed perimeter yards in order to fully characterize the extent of influence the alleged from the facility.

4.0 Field Activities

The sampling event will include collection of surface samples and XRF data from 18 parcels, if AMEC is granted access. No background sampling is planned during this sampling event.

All sample locations, descriptions, and field notes will be recorded on field sample collection forms, with a blank field sample collection form included in Appendix B of the QAPP.

Site sketches and in-situ XRF readings at each residence will be recorded on the field sample collection form (Appendix B), and all samples collected will be recorded on chain of custody forms (Appendix C, as an addendum to this Plan after a NELAP Laboratory is chosen). The sample locations and SUs will be recorded with an iPad with geospatial software, GPS and high resolution aerial photographs of each potentially impacted land parcel. Photographs will be taken to document the sampling event with the iPad or digital camera.

4.1 Sample Collection

4.1.1 Surface Soil Sampling

In-situ XRF analyses will be conducted along transects set up perpendicular to the suspected source to help establish the width of SU1. The boundary of SU1 will be set at a distance where distinct drops in lead concentration are observed with distance from the road. If trends in this distance are observed after several residences, in-situ XRF analysis may be discontinued and the width of SU1 will be set based on previous observations, if there are no other factors which would alter expected deposition patterns. An iPad with

geospatial software, GPS and high resolution aerial photographs of each potentially impacted land parcel will be used to record the approximate dimensions of SU1/SU2/SU3/DRIP ZONES and information for the field log. The use of Apple iPad tablets has the potential not only to save time collecting data in the field through the streamlined data collection, but also to drastically improve accuracy. The use of iPads in the field allows the field team to locate sample points using the iPad GPS software, record XRF data, link the data to the sample location, and conduct real time data analysis. The use of hard maps requires preparation of hard copy maps at the office, often at multiple scale levels; the use of iPad to collect data allows the user to zoom on screen to place data points without carrying around cumbersome large maps and pens.

Surface soil ICS samples will be collected as follows. An EVS™ or similar stainless steel or disposable polyethylene incremental sampling tool will be used to collect equal-mass increments (aliquots) of soil at equal spacing across each. Each increment will contain approximately 30 grams of soil. The sampling core will be advanced into the soil and ejected into a 2-gallon size heavy duty sealable plastic bag or other suitable container. This process will be repeated at each increment collection location, and all increments within the SU will be combined together into one sample container. Sample containers will be labelled with the Location ID, SU#, date, time, & sampler's initials.

The boundaries of the drip zones will be determined using XRF data as described in Section 4.1.2. Past experience has indicated that drip zone lead effects can extend out 6 feet or more from residential structures. For this study in-situ XRF analyses will also be used initially to establish the boundaries of the drip zone SU.

Transects will be set up extending out from the edge of the suspected source. Along each transect, 30-second in-situ XRF readings will be taken at 2-foot intervals starting at 30 inches from the edge of the road, extending outward from the road, until a distinct significant drop in the lead concentration is observed or until the levels drop near background. ICS samples will be conditioned as described in Section 4.3 and analyzed for lead by XRF. A portion of the samples will also be submitted for laboratory confirmation analysis. All field sample collection and analysis will be conducted in conformance with the Health and Safety Plan (HASP).

4.1.2 In Situ XRF Analysis

The XRF analyzer will be calibrated and standardized as per the manufacturer's instruction. Known reference standards containing certified concentrations of lead at various levels will be analyzed prior to initiating field work. Results will be documented on an XRF data field sheet for each residence. The serial number of the analyzer(s) used at each residence will be noted on the field sheet. Prior to XRF analysis, the Location ID, SU, transect, distance and analyst will be entered into the XRF analyzer. Excessive soil moisture interferes with

XRF. If soil conditions are saturated (>25% moisture), in-situ XRF analyses will not be conducted and field work will stop until conditions are dry enough for work to commence onsite.

At each distance interval from the house along the transects, the surface vegetation will be removed. Any soil clinging to the vegetation roots will be shaken back out over the bare soil. The soil will be flattened out, large debris (rocks, sticks, etc.) removed, and a 30 second in-situ analysis will be performed. The Location ID and SU# will be entered into the XRF prior to each analysis. The results will be recorded on the field sheet. Two to four additional in-situ analyses will be conducted at the same distance interval perpendicular to the transect at 2-foot spacings. The results will be recorded on the field sheet, and the averages for each distance interval will be calculated.

When a distinct drop is observed in the average lead concentration along a transect, no further in-situ readings will be taken for that transect, and a flag will be placed to mark the boundary of the SU for that transect. For the drip zone, the process will be repeated for the other transects to form a polygon around the house considered the “drip zone” of influence from lead-based paint.

In-situ XRF precision will be evaluated once per day per XRF analyzer by collecting seven replicate XRF readings at a single location without moving the analyzer. The XRF data will be downloaded from each analyzer upon returning from the field and will be QC-checked and validated.

4.2 Sampling Order

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

4.3 Sample Conditioning and Analysis

Soil and sediment samples will be returned to the laboratory and air dried in aluminum pans lined with wax paper. The samples to be submitted for that analysis will be dried and processed under a hood to minimize potential for contamination of the samples. The air dried samples will be returned to their original bags, placed inside an additional bag, and then disaggregated by striking the sample 30 times with a mallet to disaggregate clumps of soil. The soil sample will then be passed through a 0.25 mm sieve to obtain the target particle size. The soil passing through the sieve will be placed inside a thin-walled resealable plastic baggie. XRF analysis will be conducted on the dried/sieved soil samples following the XRF SOP, which will be supplied in Appendix A of the SAP when the XRF

make/model is selected from the models available in the AMEC inventory. Following the XRF analysis, the soil samples will be archived by AMEC for potential further analyses. After ex-situ XRF analysis, the representative SU lead results will be mathematically combined to arrive at the representative lead concentration for the DUs. Should the investigation indicate that a removal action is warranted, it may be of interest to know whether yard soil would need to be handled as hazardous waste should it be excavated. Instructions will be relayed to analytical personnel on selected DU ICS samples that toxicity characteristic leaching procedure (TCLP) analysis will be performed.

Number of Samples, and Container and Preservation

The estimated number of samples for laboratory analysis is provided in Table 1 below. Note that samples receiving in-situ XRF analysis only are not included. The actual number of samples submitted will depend on lead concentrations observed during XRF analysis and visual observations made during collection of the samples. Soil samples sent for offsite confirmation testing will be at the rate of 10% of XRF samples. The test method will be USEPA SW-846 Method 6010B Metals ICP. In addition, 17 parcels will have samples collected for laboratory analysis. The sample collected from each SU will be submitted to an approved laboratory for analysis of lead. Laboratory duplicate analyses will be requested on 10% of the SU samples submitted for laboratory analysis.

Table 1
Summary of Sampling Locations

Sample Type	Analysis	Number of Parcels	Total
SU1 Soil	Lead	17	17
SU2 Soil	Lead	17	17
Replicate Field Sample* *(replicates in 20% of SUs)	Lead	13	13
Total XRF Analyses on Bagged ICS samples			47
Laboratory Confirmation	Lead	10	
Laboratory Duplicates	Lead	1	
Total Laboratory Analyses		**11**	

Refer to the Table 2 for container and preservation requirements on all samples. Note that soil samples will initially be collected in large resealable plastic bags for transport to Pace. Once samples have been air dried, disaggregated, sieved, and analyzed by XRF, they will be submitted for laboratory analysis. All samples will be collected in certified-clean containers and preserved in the field as appropriate.

Table 2
Preservation Methods

Soil Samples			
Parameters	**Container(s)/Volume**	**Preservative(s)**	**Holding Time**
Total Metals (Pb)	One or more 8-oz glass jars or a 1-gallon resealable baggie	Cool, 2^0C	6 months

4.4 Chain-of-Custody

The ICS soil samples will be stored in the plastic bags in which they were collected. Each bag will be labelled with a unique DU identifier, date, collector initials, and depth using permanent marker. The samples will be recorded on a separate chain of custody (COC) form (Appendix C). The samples will remain in the custody of AMEC 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 NELAP Laboratory Approved COC form to be relinquished to a of sample custodian at the environmental laboratory for analysis. Samples remaining at AMEC for ex-situ analysis will have the COCs completed by AMEC personnel.

4.5 Remediation Assessment and Guidance

Based on the results of the Phase I Residential sampling, remediation will be required in at least fifteen (15) sampling units (see Figure 3). Sections 4.5, 4.6 and 4.7 will detail the identification of the lead impacted parcels, the excavation and removal action, confirmation sampling, contractor requirements, O&M Plans, and Institutional Controls (if required).

Based on the results of the proposed Phase II residential sampling, additional sampling units may require additional site characterization and/or remediation. The sampling units identified for remediation in the MDNR Phase I Residential sampling are:

- Sampling Unit 1:
  - 120, 119, 217, 103, 127, 106, 116, and 117;
- Sampling Unit 2:
  - 216*, 146 and 143;

- Yard wide remediation:
    - 125, 110, 115, and 105.

* Denotes resampling to confirm Phase I results.

Residential Site Remediation for SU1, SU2 and yard-wide non-time critical lead impacted areas greater than 400 mg/kg will follow these remediation goals with performance standards. The Performance Standards shall mean the cleanup levels (400 mg/kg) required in each of the remediation area(s) that must be met by Respondent in conducting the removal actions as provided for in this document:

1) SU1, SU2, and Yard Wide Residential Soils (12" soil impact zone):
    - Remove the top 6" of soil in the lead impacted zone and after removal acquire XRF readings for the measurement of lead impact on the soil floor.
    - 15 in-situ XRF analyses will be collected from the floor of the excavated area. If the average in-situ XRF readings in the soils floor are less than 400 mg/kg, then clean borrow soil will be added to the area to bring the ground surface of the excavated area level with the yard.
    - If the average in situ XRF readings in the soil floor are greater than 400 mg/kg, then another 6" lift of impacted soil will be removed from the lead-impacted excavation area. If average in-situ XRF readings in the soils floor are less than 400 mg/kg, then clean borrow soil will be added to the area to bring the ground surface of the lead-impacted excavation area level with the yard.
    - If average in-situ XRF readings are still greater than 400 mg/kg at the depth of 12" below ground surface (bgs), the performance standard will be met and no further excavation will be required.
    - In those area(s) where average in-situ XRF readings are greater than 400 mg/kg at 12" bgs, a witness barrier (i.e. an orange snow fence barrier) will be laid down to identify the extent and vertical boundary of excavated lead-impacted materials for future soil removal activities. Clean borrow soil, defined as borrow source soil with an average lead concentration (as measured by a NELAP approved laboratory) less than 100 mg/kg, will be added to the area to bring the ground surface level with the yard. A single ICS of 30 increments per 500 cubic yards of borrow source soil will be collected and analyzed. If the average ICS XRF readings in the 100 cubic yards of soil are less than 100 mg/kg, then the borrow source will be deemed to meet standards.
    - If the average in-situ post-excavation soil samples indicate that the mean lead concentration in remaining soil will exceed the EPA remediation action level of 400 ppm, MW Recycling (MWR) and/or MDNR may request the

Owner to execute an Environmental Covenant pursuant to the Missouri Environmental Covenants Act.

2) Garden Soils (24" soil impact zone):

- Remove the top 6" of soil in the lead impacted zone and after removal acquire XRF readings for the measurement of lead impact on the soil floor. A 15-increment ICS will be collected from the floor of the excavated area.
- If the average in-situ XRF readings in the soils floor are less than 400 mg/kg, then clean borrow soil will be added to the area to bring the ground surface of the excavated area level with the yard.
- If the average in-situ XRF readings in the soil floor are greater than 400 mg/kg, then another 6" lift of impacted soil will be removed from the lead-impacted excavation area and another 15-increment ICS will be collected. If average in-situ XRF readings in the soils floor are less than 400 mg/kg, then clean borrow soil will be added to the area to bring the ground surface of the lead-impacted excavation area level with the yard.
- This 6" removal action will continue until the XRF floor soil sampling is less than 400 mg/kg or a depth of 24" has been achieved.
- If average in-situ XRF readings are less than 400 mg/kg at any lift depth less than 24" below ground surface (bgs), the performance standard will be considered to be met and no further excavation will be required.
- If the lifts continue to a depth of 24", those area(s) where XRF readings are greater than 400 mg/kg, a witness barrier will be laid down to identify the extent and vertical boundary of excavated lead-impacted materials for future soil removal activities. Clean borrow soil will be added to the area to bring the ground surface level with the yard.
- If the average in-situ post-excavation soil samples indicate that the mean lead concentration in remaining soil will exceed the EPA remediation action level of 400 ppm, MW Recycling (MWR) and/or MDNR may request the Owner to execute an Environmental Covenant pursuant to the Missouri Environmental Covenants Act.

4.6 Excavation of Lead Impacted Soils to Facilitate Soil Cap

The following summarizes the proposed remedial action activities at the Site that have been developed in general accordance with the EPA Superfund Lead-Contaminated Residential Site Handbook, August 2003. No changes related to the foundations of built structures or flatwork (sidewalks and driveways) within the Site will occur. No new structures will be constructed.

1. A clean soil cap will be placed over the portions of SUs as described above. The current structures (houses, driveways, sidewalks, and other impenetrable hardscape) will remain in place. Excavations shall start adjacent to all concrete sidewalks, walkways, drives, and other structures and shall extend to the extent of the SU boundary. All excavations that start adjacent to all concrete sidewalks, walkways, drives, and other structures will be excavated by hand as deep and SAFELY as possible and will only employ mechanical means when it is determined by the Site Manager that a safe distance from the concrete structures has been achieved as not to impact the structural integrity or physical appearance of such structures.
2. A qualified remediation contractor (Remediation Contractor) will be contracted to provide all labor, materials, services and equipment necessary for the excavation, relocation, and/or off-site disposal of impacted soil.
3. AMEC will oversee and manage the implementation of the remedial action plan. AMEC will be present during excavation, backfilling and restoration activities in order to closely monitor the work being performed.
4. It is currently assumed that all shrubs and bushes will need to be removed and properly disposed offsite. Larger trees will remain in-place undisturbed.
5. Once the excavated material is ready for off-site disposal, the excavated material shall be loaded, hauled, and properly disposed of at a permitted waste disposal facility.
6. When possible, excavated impacted soil will be placed directly into a licensed special waste hauler's trucks. Excess soil and debris will be removed from the sides of the vehicle, wheels and undercarriage prior to leaving the Site. The load will be transported directly to an approved sanitary landfill permitted to accept special waste. The waste hauler will be required to cover all loads of lead-impacted soil leaving the Site and will be required to ensure that no soil is spilled onto public rights-of-way.
7. TCLP testing of representative areas of the soil excavation will be performed as necessary to determine if the soil should be classified as a hazardous waste.
8. Based on the results of testing at the Site, the Contractor may assume that the excavated materials can be handled and disposed as a non-hazardous special waste. The landfill facility shall be permitted by the State of Missouri to accept such material. The Contractor will be required to provide documentation of the anticipated landfill with their bid. All truckloads of material shall be properly manifested.
9. If required by the landfill disposal facility, additional samples needed for landfill characterization purposes depending on disposal facility requirements will be collected.
10. Temporary stockpiling of soils may be required. On-site storage methods will consist of stockpiling on 10-mil minimum polyethylene sheeting and securely covered in the same in a manner that will minimize access to the soil and prevent any precipitation infiltration or leaching.
11. If groundwater should be encountered during excavation or if a significant precipitation event should occur during excavation which requires the removal of the water, the water will be sampled and characterized in order to determine appropriate handling and

disposal alternatives. Excavations will be conducted in a manner which minimizes the potential for surface run-off. Based on the shallow depths of the excavation, groundwater is not anticipated to be encountered.

12. Project activities requiring the disturbance of the impacted soils will be conducted in a manner that minimizes the potential for airborne lead emissions. Engineering controls will be implemented to minimize the potential for airborne lead emissions. The primary technique will consist of misting the exposed fill material areas with a fine water spray throughout the duration of the project. The misting will not be excessive as to create any surface run-off. If periods of high winds persist that render dust suppressant techniques ineffective, project activities will be temporarily suspended. Perimeter dust particulate monitoring will be performed to document effective dust control measures are employed throughout the duration of the project.
13. It is anticipated that houses near or within the excavation and capping zone will be occupied during remediation activities. Fugitive dust emissions will be monitored in-the-field using a Total Suspended Particulate counter, such as a MiniRam or equivalent instrument. The site-specific action level will be determined by calculating the maximum amount of particulates that can be in the air without exceeding the National Ambient Air Quality Standard (NAAQS) for lead of 0.15 ug/cubic meter measured as an eight-hour Time Weighted Average. A MiniRam or equivalent will provide real-time data, and allow for immediate corrective actions if necessary to adequately protect residents and the general public from the hazards of lead contaminated suspended dusts. Measurements will be taken near, or on, residents' front porches, and also downwind from active work areas at the property line. If the action level is exceeded, additional engineering controls will be implemented.
14. Throughout the duration of the project, the initial level of safety is assumed to be Level D Modified. Level D Modified protective equipment shall consist of hardhats, coveralls, gloves and boots/shoes (leather or chemical resistant) with steel toe and shank.
15. Tools, machinery, vehicles or other equipment used on Site that comes into direct contact with lead-impacted soils will be wiped clean of any excessive soil or debris upon completion of work activities and prior to leaving the Site. Any resulting lead-impacted soil and debris will be segregated, contained and characterized in order to determine appropriate disposal alternatives. If washing, rinsing or steam cleaning of equipment is deemed necessary, the rinsates will be contained and characterized in order to determine appropriate disposal alternatives.
16. A Site Health and Safety Plan will be developed that addresses all applicable safety precautions associated with the project. All safety precautions in accordance with the project specific Site Health and Safety Plan will be followed during excavation activities.
17. All work shall be performed in a manner that minimizes transfer of lead-impacted soils beyond the excavation areas. Cleanup of any soils or debris that may collect on adjoining surface areas including, but not necessarily limited to, driveways, patios, sidewalks or public right-of-ways will be performed.

4.7 Post-Excavation Sampling

One 30-increment ISM sample per property will be collected from the floor of excavated areas, prior to placement of the witness barrier (if necessary) and the clean soil cap to document the lead levels remaining beneath the soil cap. Analysis of the soils will be as follows:

- Total Lead (EPA Method 6010)

The collection of samples will be performed in accordance with the site specific Quality Assurance Project Plan (QAPP).

In order to assess the potential for continuing facility operations to cause recontamination of residential yards following the cleanup activities, post-excavation sampling will be conducted approximately 1 year following the yard cleanups. The follow-up sampling will include in-situ XRF analysis in the SU1 portion of each yard that received a cleanup. 30 in-situ XRF readings will be collected from evenly spaced locations across the SU1 area. The average lead concentration from these readings will be calculated and compared to the lead concentration documented in the clean fill soil used as backfill during the excavation to assess the degree of recontamination (if any).

4.8 Soil Cap (Backfill) and Witness Barrier

1) Backfilling with clean fill will commence as soon as possible following removal of impacted soils surrounding each house. Exposed excavations will not be allowed more than 24 hours in duration without prior permission from the Owner of the Parcel. In the event the excavation is exposed for a period greater than 24 hours, the excavation will be cordoned off with orange construction fencing and notifications.
2) A witness barrier, consisting of orange-mesh plastic webbing will be placed upon completion of excavation and relocation of soils. The fabric will cover the entire excavation not already covered by impermeable surfaces including excavation areas, on-site relocation areas, and areas that will have only the clean soil cap. The cloth will be rolled into place, overlapped at the edges, and anchored into position.
3) Backfilling will start adjacent to all concrete sidewalks, walkways, drives, and build structures and shall extend to the yard boundary.
4) The soil barrier cap shall be a minimum of 12 inches compacted in thickness and after compensating for settling, shall return the Site grade to its previous state in areas around existing structures.
5) The fill material used for the barrier soil cap shall come from a clean fill source, and be capable of compaction and supporting new grass growth. The fill material will be

free of large rocks, debris, vegetation, and dirt clumps. The source of the fill material has not been determined. Written documentation will be provided of the source of the clean fill and proof by laboratory analysis. If another fill source is utilized, the frequency and type of analysis required may vary depending upon the source of the fill material and heterogeneous nature of the material. Laboratory analysis will generally be provided on a frequency as follows:

- A soil sample will be collected for every 500 cubic yards borrow source material. Analysis will be for Barium, Cadmium, Lead, and Arsenic by EPA Method 6010B ICPMS.

Prior to the initiation of excavation and fill activities, samples from the proposed borrow area to be used as fill materials will be sampled to prevent the placement of contaminated soils on the Site. The levels of lead, barium, arsenic and cadmium will be compared to Missouri Risk Based Target Levels, Departmental Guidelines for Type 1 soils, Ingestion, Inhalation, and Dermal Contact pathway; where applicable. No backfill material with lead concentrations greater than 100 mg/kg for lead will be allowed on-site after testing and acceptance by the Site Manger. The backfill will be placed in a manner that is consistent with Site grading plans and should provide for slopes away from buildings.

6) Compaction will be performed by tracking and tamping with heavy equipment that will effectively eliminate the potential for future settling of materials.
7) The soil barrier cap will be prepared for a sod cap which will be laid in place based on specifications and timeframe by the distributor of the sod to complete the warranty of the sod.
8) Watering will be provided following the sod as required to establish the turf. MW Recycling will provide watering of the sod up to a maximum of 24 times, dependent upon temperature, humidity and moisture.
9) If it is dry during excavation and backfill activities, MW Recycling will employ water spray from mobile devices that will not allow water to accumulate or runoff, but will control fugitive dust.

4.9 Verification of Cap Thickness

Confirmation that the clean soil cap thickness is a minimum of 12 inches (in the presence of a witness barrier) will be achieved by a combination of work practices including the following:

1. Upon the completion of the excavation of soils and the relocation areas of soils, and following the placement of the witness barrier, stakes will be driven into the ground until 12 inches of the stake remains exposed above grade; when required. The stakes will be positioned as points of reference outside of the track areas of earth moving equipment so as to retain their position and avoid disturbance. Following the

placement of the cap adjoining these reference points, areas around the stakes will be filled in. The compacted soil cap will be considered of satisfactory thickness when the stakes are no longer exposed.

Following the completion of the excavation and relocation of soils, and the placement of the witness barrier, elevation surveys based on an established reference datum (i.e. manhole cover, concrete slab, etc.) will be performed as needed to measure the cap thickness following compaction and confirm a thickness of 12 inches. To ensure the locations of pre/post measuring points are duplicated, the locations of the original measurements locations will be calculated by measuring distances from points of reference (i.e., homes).

4.10 Contractor Requirements and O&M Plan

1) All work shall be performed in accordance with the project specific OSHA compliant Site Health and Safety Plan in accordance with all applicable local, state and federal laws and regulations.
2) To limit access to the Site during project activities, the Remediation Contractor may be required to secure the Site including appropriate fencing (e.g. plastic orange fencing) and warning signs prepared in number and content satisfactory to AMEC placed at regular intervals along the work area perimeter.
3) Prior to initiating field activities, the Contractor will be required to furnish the following information:
    a) Work plan summary describing the manner in which the project will be completed.
    b) List of all equipment to be used on the project.
    c) List of off-site disposal facilities to be used.
    d) List of workers including name, length of service with the company and evidence of
    participation in a 40-hour Personnel Protection and Safety Course which meets the requirements of Title 29 Code of Federal Regulations (CFR) Section 1910.120 - Occupational Safety and Health Administration's (OSHA) Hazardous Waste Operations and Emergency Response Standard. The workers used on the project shall be skilled and experienced as evidenced by participation in at least two environmental remediation projects of similar scope and scale.
    e) Site specific health and safety plan.
    f) Copies of all necessary permits, insurance certificates, worker certifications, waste hauler certifications and the designated off-site disposal facility.

g) Solid waste handling, characterization, disposal plan.
h) The remediation contractor will be responsible for notifying the Missouri One Call System prior to any excavation.

4.11 Community Relations Plan

Upon approval of this Remedial Action Plan, a Community Relations Plan (CRP) will be developed and implemented by MDNR for the residents of the City of Festus, Missouri, if required, by the City Manager Happy Welch, Mayor Mike Cage and MDNR.

5.0 Investigation Derived Wastes (IDW) Plan

Efforts will be made to minimize IDW generation. The 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. 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 be discharged to the wheel washing station at the Shapiro Brothers facility.

6.0 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.

7.0 Reporting

Pace will provide a copy of the chain of custodies and laboratory result sheets. AMEC will prepare an Investigation Report for the additional sampling results.

8.0 MDNR References

Festus, 2011. St. Louis Testing Laboratory, Report of Test Results – Street Sweepings Sample, City of Festus, August 12, 2011.

MDNR, 2007. Missouri Department of Natural Resources, QAPP for Pre-Remedial, Pre-Removal and Targeted Brownfields Assessments, December 7, 2007.

MDNR, 2009. Missouri Department of Health and Senior Services, Lead Poison Prevention Manual, 2009. http://health.mo.gov/living/environment/lead/manual/index.php

MDNR, 2011a. Missouri Department of Natural Resources, RCRA Site Investigation Report, September 14, 2011.

MDNR, 2011b. Missouri Department of Natural Resources, Report of Compliance Inspection November 23, 2011.

MDNR, 2011c. Missouri Department of Natural Resources, RCRA and Missouri Hazardous Waste Management Law Compliance Evaluation Inspection Report, November 22, 2011.

MDNR, 2012. Missouri Department of Natural Resources, Data from January 2012 Sampling Event (not yet published).

NPN, 2011. Letter to Mr. Greg Shapiro, Shapiro Brothers/MW Recycling, from David B. Rowe, NPN Environmental, December 12, 2011.

USEPA, 1990. U.S. Environmental Protection Agency Hazard Ranking System, 40 CFR Part 300, Appendix A, 55 FR 51583, December 14, 1990, http://www.thefederalregister.com/d.p/2007-05-25-E7-10055.

USEPA, 1992. U.S. Environmental Protection Agency Hazard Ranking System Guidance Manual, EPA/540/R-92/026, November, 1992. http://www.epa.gov/superfund/sites/npl/hrsres/index.htm

AMEC, 2013. Conference with Mayor Cage and City Manager Welch regarding historical removal of snow/ice on roadways.

Figures

Figure 1. Site Location Map- Shapiro Brothers Facility, Festus, MO

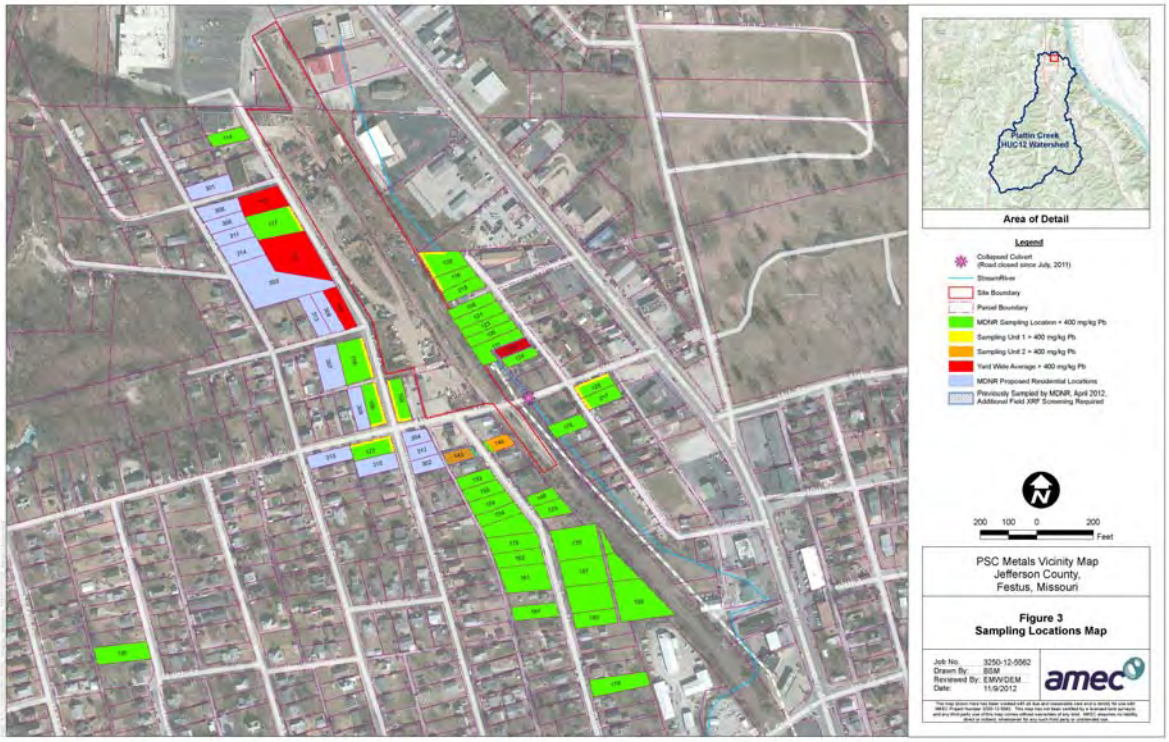

Figure 3. Residential Sampling Map

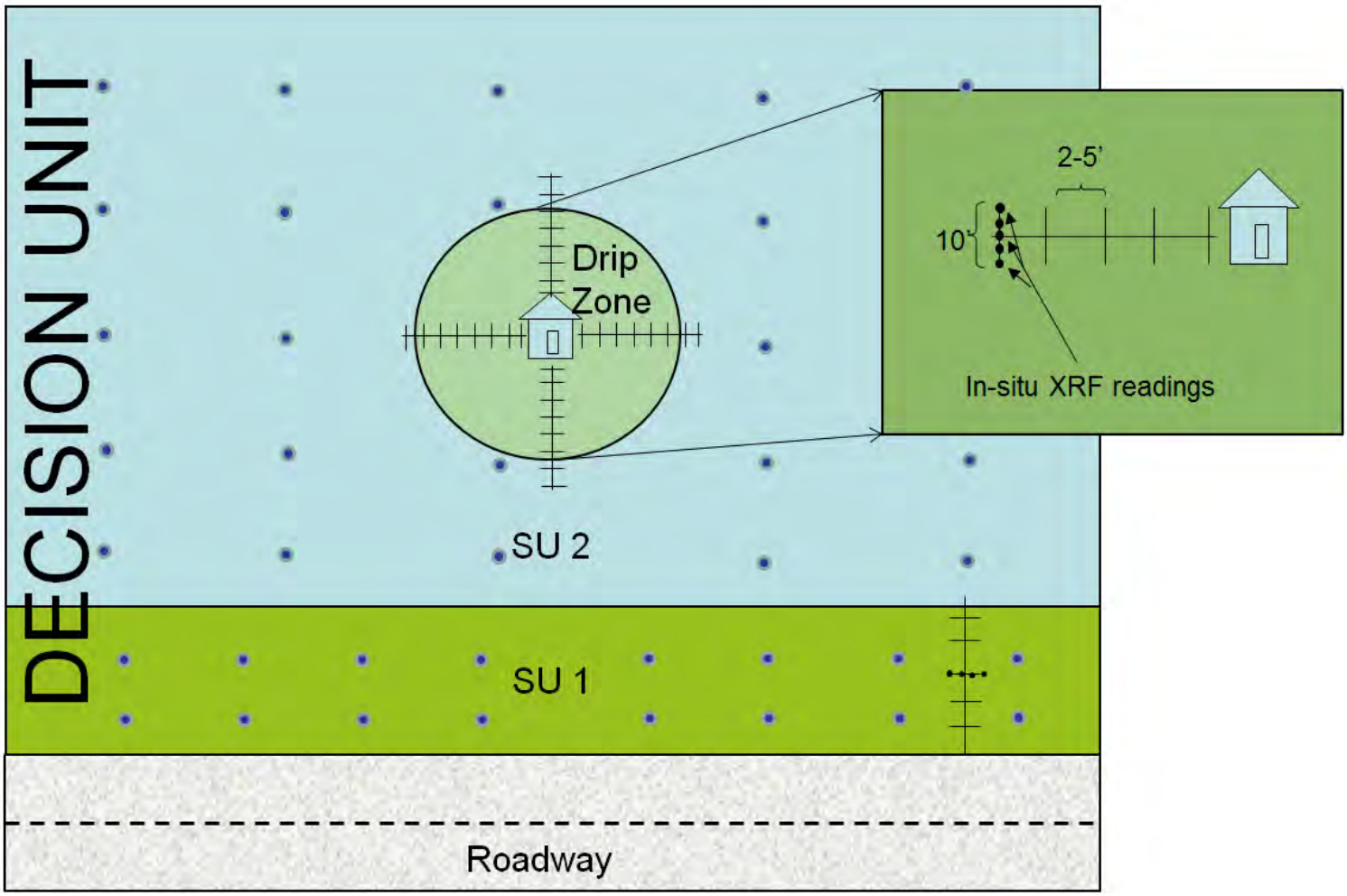

Figure 4. Sampling Design

Appendix A

1. Purpose

The purpose of this Radiation Protection Program (RPP) is to keep radiation exposures to workers using a portable, X-Ray Tube based Thermo NITON Analyzer XL3t at Environmental Restoration to levels that are as low as reasonably achievable (ALARA), and

Ensure that use of the NITON Analyzers is in compliance with all applicable State and Federal regulations.

2. Scope

This RPP applies to any use of NITON Analyzers at Environmental Restoration, *LLC.*

3. Responsibilities

Luke Wisniewski shall be designated as the individual in charge of the RPP. Luke Wisniewski will be responsible for maintaining and implementing the RPP which will minimize the risks associated with using portable X-Ray producing machines and which will ensure compliance with the regulations of the Nebraska.

The specific actions to be performed by the individual in charge are as follows:

- Receive Radiation Safety Training at a one day course provided by Thermo NITON Analyzers or by a qualified expert. This will be documented by a certificate of completion which is to be kept on file with other RPP documents
- Maintain a list of authorized users and ensure that only authorized users operate the Analyzers.
- *Notify staff of additions to or subtractions from the authorized user list.*
- Schedule and/or conduct training for employees prior to authorizing their use of the NITON Analyzer without direct supervision. Maintain records of training including a copy or a summary of the training material. Training shall include Radiation Safety, Operational, and Emergency Procedures.
- *If personal exposure monitoring (dosimetry) is part of the RPP, then the Individual in charge will be responsible for maintaining dosimetry records.*
- Ensure that all users are following appropriate operating procedures while using Analyzers.
- Maintain manufacturer provided instruction manuals, and operations and maintenance records.
- Ensure proper disposal of unneeded Analyzers.
- Ensure that labels on Analyzers are intact and legible. Notify NITON for assistance with labeling that is damaged or illegible.
- *Review, as needed, the RPP content, implementation, and effectiveness.*

Authorized Workers are responsible for using only approved safe techniques and procedures in operations involving the Analyzer. The specific actions to be performed are as follows:

- Follow proper operating procedures as described in training and ensure other individuals also adhere to these requirements.
- Ensure that the label on the Analyzer is in tact and legible.
- *Ensure proper use of dosimetry, if dosimetry is issued.*
- Be familiar with emergency procedures and know how to recognize and terminate unsafe operations.

4. Safe Operating Procedures

A copy of the Users Manual or Operating and Emergency Procedures shall be made available to all workers using the NITON Analyzer. A copy will be kept with the Analyzer and another copy shall be kept on file with other RPP records.

Only authorized personnel with training on state regulations, operating and emergency procedures shall be allowed to operate the NITON Analyzer. All authorized personnel are responsible for complying with the requirements of this RPP and will report any and all incidents involving the NITON Analyzer to the individual in charge.

The operator is responsible for ensuring that no part of a person's body is at or near the measurement point, and no closer than one foot during a measurement (trigger finger excluded).
The operator must be aware that the NITON Analyzer is emitting radiation when lights are flashing.
The operator must be aware that radiation in the primary beam could eventually cause physical harm if the device is used improperly and must be able to recognize the symptoms which would begin with skin reddening in the exposed area and at higher doses would appear as a burn or localized tissue damage.
Prior to each use:

- The operator will inspect and maintain the Kapton window and all labels on the NITON Analyzer
- *The operator will fill out the utilization log (if required)*

Environmental Restoration will maintain a log documenting use of the Analyzer that contains, at a minimum, the unit serial number, date/time removed, date/time returned, and responsible individual. At the front of this log will also be a list of authorized users. Refer to Appendix A for example.

5. Emergency Procedures

In any case where one suspects that the x-ray tube remains on when the measurement is terminated:

- Disconnect the battery pack immediately to turn off the x-ray tube, and
- Call Thermo Electron Corporation's Service Department in the United States, toll free, at (800) 875-1578.

Suspect accidental exposure to primary beam
Notify the Individual in Charge and RSO at 314 280-8328
Individual in charge will asses impact and call NITON RSO for assistance if necessary
Severe Physical Damage
There is no radioactive material so a fire or severe damage poses no radiation hazard.

6. Radiation Safety Training

The Individual in charge will be responsible for receiving Radiation Safety Training from Thermo NITON Analyzer LLC 1 day training, or a qualified expert. It will then be this individual's responsibility to train the rest of the workers, whether the workers are trained by the individual in charge, Thermo NITON Analyzer LLC, or by a qualified expert. This training will be documented by a sign-off sheet that includes the topics covered in the radiation safety training which is to be kept with all the RPP documents.

7. Personnel Monitoring

Personal exposure levels may, as determined by the responsible individual or as required by state regulations, be monitored utilizing dosimetry providers accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). Badges are not transferable. The following are a few examples of NVLAP accredited labs:

- *Environmental Restoration will use AEIL, 9251 Kirby Drive, Houston, TX 77054*
- *Dosimeters shall only be worn by the individuals they are issued to and shall only be worn during occupational hours.*
- *Never wear the badge during non-occupational exposures such as during medical x-rays or any medical procedures involving radiation.*
- *Dosimeters should be protected from extremes of heat, moisture, and pressure.*
- *Dosimeters shall be stored in a protected area to prevent loss, damage, and other sources of radiation.*

8. Posting and Labeling

There is a relatively low radiation hazard associated with the Analyzer, and because the authorized user will be with the Analyzer at all times it is operational, posting radiation area signs will not be necessary. A copy of the Nebraska Notice to Employees will be kept in the Analyzer case as well as on file with other RPP documents and will be available for review at any time.
The label on the Analyzer will be checked periodically by the Individual in charge as well as the workers using the Analyzer. The label will be checked for integrity and legibility. If the label becomes faded, worn, damaged, or defaced, the Analyzer will be promptly returned to Thermo NITON Analyzers LLC for relabeling.

9. Record Keeping

The individual in charge will be responsible for all the records associated with the RPP. These records will be kept in an identified location and will be made available for review by any worker or state official upon request. The following is a list of records that will be kept at minimum:

- Personnel training records
- Manufacturer provided instruction manuals and service & maintenance records
- Authorized Users
- State Analytical X-Ray Regulations and Notice to Radiation Workers
- *Analyzer usage log*
- *Personnel Dosimetry Records, if dosimetry is required*

10. Quality Assurance / Annual Review

At the minimum, items on the following list will be done annually:

- *Radiation Safety Review for all workers*
- *Operational & Emergency Procedures Review for all workers*
- *Audit of the RPP content, implementation, and effectiveness*

11. References:

- DOE G 441.1-5 “Radiation-Generating Devices Guide”
- Thermo NITON Analyzers Sample Radiation Safety Program
- NBS Handbook 111, Revised 1977
- Radiation Safety Topics “Writing a Radiation Protection Program For the Industrial X-Ray Program For a Facility with Cabinet Radiographic or Analytical X-Ray Machines”
- Table 11.4.9 “Good Work Practice for X-Ray Diffraction and X-Ray Fluorescence Units” The Health Physics and Radiological Health Handbook

Appendix A
Utilization Log

Serial #	Date	Time Out	Time Returned	Reason	Responsible Individual

Appendix B

DESIGN MEMORANDUM

Client: _____ Sheet _____ Of _____

Project: _____ Date: _____

Data For: _____ Work Order: _____

Prepared By: _____ Checked By: _____ File No: _____

Note: This form must be used for project calculations and original filed in project files

Appendix C

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

Section A
Required Client Information:

Company:	
Address:	
Email To:	
Phone:	Fax:
Requested Due Date/TAT:	

Section B
Required Project Information:

Report To:
Copy To:
Purchase Order No.:
Project Name:
Project Number:

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location
STATE: _____

Requested Analysis Filtered (Y/N)

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

ITEM #	Section D Required Client Information	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COLLECTED: COMPOSITE START TIME	COLLECTED: COMPOSITE END/GRAB DATE	COLLECTED: COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	Preservatives: H_2SO_4	Preservatives: HNO_3	Preservatives: HCl	Preservatives: NaOH	Preservatives: $Na_2S_2O_3$	Preservatives: Methanol	Preservatives: Other	Analysis Test Y/N	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY):

Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.