SITE INSPECTION/REMOVAL SITE EVALUATION REPORT

Shapiro Brothers Salvage
Jefferson County, Missouri

September 25, 2012

Missouri Department of Natural Resources
Division of Environmental Quality
Hazardous Waste Program

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REMOVAL SITE EVALUATION FORM

DATE	**September 28, 2012**
PREPARED BY	**Michael Stroh**
	Missouri Department of Natural Resources
SITE	**Shapiro Brothers Salvage Site**
	Jefferson County
C.A. NUMBER	**V997381-07**

1.0 INTRODUCTION

The Missouri Department of Natural Resources (department), through a Cooperative Agreement with the U.S. Environmental Protection Agency (EPA), conducted a Site Inspection/Removal Site Evaluation (SI/RSE) at the Shapiro Brothers Salvage Site in Jefferson County, Missouri. The purpose of this investigation was to collect information needed to support scoring the site under the Hazard Ranking System (HRS), and to determine the need for a Removal Action.

The scope of the investigation included review of historical documents and sampling of soil, dust, sediment and surface water. The SI/RSE investigation was initiated on November 15, 2011 and included sampling events in January 2012 and April 2012.

2.0 SITE DESCRIPTION

2.1 Location

The site is located at the intersection of 12th Street and Vine Street in east-central Festus, MO. It is a rectangular 15-acre area, oriented primarily north-south, along the boundary that separates Festus and Crystal City, MO (red boundary in Figure A1).

2.2 Description

The site has been operated as metal scrap processing and recycling facility since 1946. Prior to September of 2011, the site was owned and operated as Shapiro Brothers Salvage, a privately owned salvage company. In September 2011, the site was purchased by M.W. Recycling, LLC, a

wholly owned subsidiary of PSC Metals INC. In addition to scrap metal processing, the operation also includes demolition services, dismantling of out of service railroad cars, and transportation services to clients for scrap metal materials. Materials brought to the 15-acre facility are processed by cutting with a torch, or with a 450 horsepower shear or 3500 horsepower shredder. The metal is processed and compressed into sizes that are transported to a steel mill for recycling. All non-metal items are separated out. This material is referred to as auto fluff (Photo 5, Appendix B) and it is taken to a sanitary landfill for disposal.

Most of the facility operations are conducted in unpaved gravel-covered areas, areas with exposed bare soil or soil mixed with gravel (Photo 1). During periods of wet soil conditions, trucks leaving the facility would likely have historically tracked mud through the streets on their way to U.S. Highway 61. There are two gates into the facility; a main south gate and a north gate (Photos 2 and 3). Most of the traffic into and out of the facility occurs through the south gate, while fluff pile material is loaded onto trucks which may exit through the northern gate. A truck wash system was installed in the fall of 2011 to clean the undercarriage and wheels of trucks leaving through the southern gate (Photo 2). The facility started operating a street sweeper in the roads around the facility in 2011 to remove residual material tracked into the streets by trucks (Photo 8).

Prior to the spring of 2011, trucks approached the facility by traveling along 12th Street to and from Truman Blvd. (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 (Photo 9). Since then, trucks have traveled south from the facility on the residential street Delmar Ave. before connecting with Truman Blvd. via 6th Street.

Runoff from the facility enters a drainage that flows south to Plattin Creek. The drainage carries storm water runoff and is carried by underground conduit resurfacing in various areas along its route to Plattin Creek. Figure C2 shows the route of the drainage between where it begins just

north of the facility to where it discharged into Plattin Creek near the waste water treatment plant located 2 miles downstream. Plattin Creek then flows for about 1.8 miles to its mouth at the Mississippi River.

2.3 History/Contaminants of Concern

The site came to the departments' attention following complaints made to the City of Festus by nearby residents regarding the dust created at the facility and by trucks hauling material in and out of the facility. The department conducted a facility inspection in September 2011 and identified violations of hazardous waste management and water pollution laws (MDNR, 2011a; MDNR, 2011b; MDNR, 2011c). The facility is working with the department to address these violations under an Abatement Order on Consent (in draft at time of this report).

During the September 2011 inspection, surface soil samples were collected from various areas in the facility, and a sample of the truck wash solids was collected from the newly installed system at the south gate. Soil samples were analyzed for the eight metals regulated under the Resource Conservation and Recovery Act (RCRA metals). Elevated levels of lead, cadmium and other metals were found in every soil sample collected as well as in the truck wash solids. The City of Festus and a contractor working for Shapiro Brothers both collected separate samples of street sweeper debris collected from roadways surrounding the site (9th, Delmar, and Vine) in August 2011 (SLTL, 2011; NPN, 2011). Results for both samples show elevated levels of cadmium, lead and other metals in similar proportions to those found in facility soils and truck wash solids. The sample collected by the M W Recycling contractor contained over twice as much lead (4,860 mg/kg) as the sample collected by the City (2,240 mg/kg). However, lead in the City's sample was found to be more leachable and would classify the collected street sweepings as hazardous waste under state and federal law.

Samples of surface water from upgradient and dowgradient of the facility were also collected

during the September, 2011 inspection. Results documented discharge of lead and cadmium in surface water runoff from the facility at levels in violation of state and federal law. No sediment sampling was conducted in the unnamed stream running north to south along the facility's eastern boundary due to the lack of sediment. However, metal debris obviously originating from metal processing operations at the site was observed in the creek bed along this part of the creek (Photo 18). On December 20, 2011, staff walked the creek between the 12th Street bridge and where it emerges upstream from two subsurface culverts. Staff continued north along the eastern facility boundary to the northeastern corner of the facility, directly across from the main shredding operation. Metal debris was observed between the facility boundary and the adjacent Joachim Plattin Ambulance District building. Multiple holes were observed in the metal walls of the ambulance building (Photo 13) and the building manager stated that they were caused by metal debris projectiles which are periodically ejected from the facility shredder (Photo 14).

On December 14, 2012, Jefferson County Health Department staff conducted dust wipe sampling on floor and window well surfaces at the daycare facility located 200 feet east of the Shapiro facility at 1302 Kenner Street. Four of the 5 wipe samples were non-detect for lead, and one floor sample contained 75 ug/ft^2. A sample was also collected of the gravel/soil in the outside play area and found to contain 270 mg/kg lead.

Department staff returned to the facility in January 2012 to resample the truck wash solids and street sweepings for waste characterization confirmation. Based on three samples, the truck wash waste, while containing lead levels up to 3,980 mg/kg, was characterized as non-hazardous under RCRA. A sample of the street sweepings containing 2,400 mg/kg lead was also characterized as non-hazardous waste.

Staff also collected soil samples at the facility to be analyzed for a broader range of potential contaminants during the January 2012 site visit. Results from those samples show that in addition to lead, the metals arsenic, cadmium, chromium, copper, nickel and zinc are present at

elevated levels (MDNR, 2012). Other non-metal contaminants detected include PCBs, polynuclear aromatic hydrocarbons (PAHs), phthalates, toxaphene, dioxins/furans and 4-chloro-3-methyl phenol. However, the concentrations of these other contaminants relative to commonly used soil screening levels are not nearly as significantly elevated as for lead. Although not analyzed for in the facility soil, polybrominated biphenyl ethers (PBDEs) were identified as a potential concern. PBDEs are flame retardant chemicals added to plastics, upholstery coatings and urethane foams such as would be expected to be present in the auto fluff material. There is growing evidence that PBDEs persist in the environment, accumulate in living organisms and may be associated with liver, thyroid and developmental toxicity (USEPA, 2010).

In June 2012, M.W. Recycling conducted a Phase II Environmental Site Assessment (PSC, 2012) which included surface, subsurface, shallow groundwater and surface water sampling. Similar metals and PCBs as those observed in the Department samples discussed above were detected in both surface and subsurface sampled from various areas of the facility. In addition, petroleum hydrocarbons and lead were detected in soil and shallow (<16 feet below ground surface) groundwater. No chlorinated solvents were detected in soil or shallow groundwater at significant concentrations.

3.0 WASTE CHARACTERISTICS

3.1 Lead - Properties and Toxicity

Information in this section was taken from the Toxicological Profile for Lead (ATSDR, 2007). Lead is a naturally occurring bluish-gray metal found in small amounts in the Earth's crust. It has no characteristic taste or smell. Lead has many uses, the most important in production of some types of batteries. It is also used in ammunition and ceramic glazes. Some chemicals containing lead, such as tetraethyl lead and tetramethyl lead, were once used as gasoline additives to increase octane rating.

Other chemicals containing lead are used in paint. The amount of lead added to paints and ceramic products, caulking, gasoline, and solder has been reduced in recent years to minimize lead's harmful effects on people and animals. It is used in large variety of medical equipment (radiation shields, fetal monitors, and surgical equipment). Lead is also used in scientific equipment (circuit boards for computers and other electronic circuitry) and military equipment (jet engine turbine blades, military tracking systems). Most lead used by industry comes from mined ores (primary) or from recycled scrap metal or batteries (secondary). Human activities have spread lead and substances that contain lead to all parts of the environment. Lead is in air, drinking water, rivers, lakes, oceans, and soil.

The effects of lead are the same whether it enters the body through breathing or swallowing. The main target for lead toxicity is the nervous system, both in adults and in children. Long-term exposure of adults to lead at work has resulted in decreased performance in some tests that measure functions of the nervous system. Lead exposure may also cause weakness in fingers, wrists, or ankles. Some studies in humans have suggested that lead exposure may increase blood pressure, but the evidence is inconclusive. Lead exposure may also cause anemia; a low number of blood cells. The connection between the occurrence of some of these effects (e.g., increased blood pressure, altered function of the nervous system) and low levels of exposure to lead is not certain. At high levels of exposure, lead can severely damage the brain and kidneys in adults or children. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth. Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed

to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. Some of these effects may persist beyond childhood.

4.0 CONCEPTUAL SITE MODEL

Elevated levels of arsenic, cadmium, copper, lead, nickel, and zinc have been measured in surface and shallow subsurface soils at the facility. These same metals have also been measured in solids collected from the truck washing station near the facility entrance and in street sweepings samples collected from residential roads adjacent to the facility. Based on a comparison of the concentrations measured relative to common screening benchmarks, it is clear that the primary contaminant of concern for the site is lead. Levels of lead exceeding 37,000 mg/kg have been measured in surface soil at the facility, and concentrations up to 4,800 mg/kg of lead has been measured in street sweepings collected from residential streets nearby. These levels far exceed most screening benchmarks for lead in residential yards which are in the range of 260-400 mg/kg.

Site-related contaminants may have been released in a number of ways. Fine particulates from contaminated soils disturbed at the facility or from the material processing activities themselves could be transported off-site via wind during operations at the facility. Contaminated soils clinging to trucks leaving the facility could be released to roadways in residential areas where it could be transported as dust, or with runoff following rain events. This mechanism of release may have been significantly reduced since the installation of the truck washing station at the south entrance and the initiation of street sweeping, but historical releases via this mechanism would have been likely. Contaminated facility soils transported and released to roadways could be ground down into fine particulates through subsequent truck traffic. Fine particulates could

then be deposited on yard soil or on various exterior surfaces, or be transported into residences through open windows or via tracking in on shoes or other means. The facility is located directly across from residential housing to the east, west, and south (Photo 4). Residents could be exposed to contaminated particulates through direct contact with contaminated yard soil, dust on surfaces, or inhalation of particulates in ambient air.

Contaminants deposited on residential yard soils through air deposition would be expected to show a spatial pattern with higher concentrations nearer to the facility or haul road. 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. The nation's only primary lead smelter is located approximately 2 miles north of the Shapiro facility and may be an additional source of lead contamination due to air deposition from the smelter. Aerial deposition would be expected to result in a distribution of lead across contiguous yards at similar concentrations with some pattern of decreasing concentration with distance from the smelter. It has been also suggested by M.W. Recycling that smelter slag may have been used in the past as road base or for traction control on streets of the City of Festus and Crystal City in the winter. This source would be expected to result in similar lead concentrations and patterns of spatial distribution in residential yards along such streets where this occurred.

Contaminants could be released from the facility to downstream surface water and sediments in a drainage leading to Plattin Creek and to Plattin Creek itself. Human exposure could occur with direct contact to stream water and sediment or through ingestion of fish living in contaminated stream reaches, although this is relatively unlikely due the nature of this urban drainage.

Metal containers (drums, tanks, railcars, gas tanks) which previously held solvents or other liquid chemical products may have been processed at the facility in the past. Should such containers have held residual product, it may have been released to the surface during the processing of the containers. Historical releases of residual solvents may migrate vertically through soil contaminating

shallow groundwater. The drinking water source for the residents of Festus and Crystal City is a 94-feet deep public well located 1.4 miles northeast of the salvage yard along the Mississippi River. This well draws water from the Ozark Aquifer which is unconfined in this region. Volatile contaminants reaching shallow groundwater in the immediate area, may also migrate and result in vapor intrusion into buildings near the site. The Phase II investigation conducted by M.W. Recycling included several subsurface soil samples and two shallow groundwater samples, none of which contained significant levels of chlorinated solvents. Although these are potential pathways of concern, they are considered a lower priority for this phase of investigation and sampling for this pathway was not included in this phase of the investigation.

5.0 WASTE SAMPLING

5.1 Transformer Soil Sampling

Visibly stained soil was observed along Vine Street west of the facility barrier wall beneath a transformer. A single 30-increment composite sample was collected from this area and submitted for PCB analysis.

5.2 Soil Sampling at Facility

Soil sampling was conducted previously at the facility and is described in the RCRA/Superfund Site Investigation Report (MDNR, 2012e). A sample of the soil collected from beneath the fluff pile during this previous event was retrieved from archive and submitted for analysis of dioxins and polybrominated diphenyl ethers to assess whether these may be additional contaminants of concern for the yard sampling.

5.3 Street Sweeper Sampling

A sample of bagged street sweepings was also collected by the Department on January 11, 2012 during the Department's RCRA waste characterization sampling. A sample of street sweepings was collected previously by NPN Environmental on behalf of Shapiro Brothers on December 1, 2011. Both of these samples were collected following cleaning of streets near the facility (primarily Vine Street and portions of Delmar and 12th Street). A sample of street sweepings was also collected on April 12, 2012 by the department as part of this investigation. That sample was collected from a City of Festus street sweeper after it had cleaned streets in the vicinity of the background residences used for this investigation (Ridge, Woodlawn, and Central Avenues).

5.4 Results

No PCBs were detected in the transformer soil sample. Several dioxin congeners and 3 PBDEs were detected in the soil beneath the fluff pile. The results were compared with the EPA Regional Screening Levels (RSLs) developed for residential soil (Table C10). The soil concentrations measured were below the RSLs.

The street sweepings samples collected by Shapiro Brothers from roadways near the facility contained 4,860 mg/kg lead, while the sample of bagged street sweepings collected by the department contained 2,440 mg/kg lead. The street sweepings sample collected by the department from roadways near the background residences contained 190 mg/kg lead.

6.0 GROUNDWATER PATHWAY

6.1 Hydrogeologic Setting

Information provided in Section 6.1 is taken from a hydrogeologic summary provided by the

department's Division of Geology and Land Survey (MDNR, 2012f). The general stratigraphy and hydrology in this part of Missouri is shown in Table C1. Stratigraphic unit descriptions are based on logged wells located within a 2-mile radius of the site.

6.1.1 Soil and Residuum

The soil under the Shapiro Brothers Salvage site is the Menfro silt loam. The soil, which can be up to 65 feet thick in some areas, is composed of roughly 18 to 30 percent clay. The unconsolidated sediments range in thickness from 50 to 65 feet near the site. Menfro silt loam is acidic to neutral (pH 5.1 to 7.3) and hydraulic conductivity is roughly 1.4×10^{-3} to 4×10^{-4} centimeters per second (cm/sec). Overburden groundwater flow direction is most likely toward the southeast, which is the topographic down slope direction.

6.1.2 Hydrogeology

The Ordovician-age rocks beneath the site range from 900 feet to 920 feet thick and consist predominantly of sandstone, dolomite, and cherty dolomite. Beneath this formation is the 430 to 500 feet thick Cambrian-age Eminence and Potosi Dolomites consisting of medium to coarsely crystalline dolomite with mostly nodular chert. Together, these formations form the Ozark Aquifer.

The hydraulic conductivity of the Ozark Aquifer ranges from 1×10^{-4} to 1×10^{-5} cm/sec. Of the wells of record within the 4-mile target area, all 357 are reportedly completed in the Ozark Aquifer. There is no site specific groundwater flow data for the Ozark Aquifer. However, the ground-water flow direction within this aquifer is likely influenced locally by pumping wells.

Beneath the Ozark Aquifer lies the Cambrian-age Derby-Doerun Dolomite and Davis Formations of the St. Francois Confining Unit. This sequence of alternating shale and argillaceous dolomite

is locally greater than 50 feet thick. The St. Francois Confining Unit, with a hydraulic conductivity as low as 1 x 10^{-8} cm/sec is an effective barrier to downward groundwater movement. None of the reported wells extend into this formation.

Nine known sinkholes exist between 1.5 to 4 miles north of the site. However, these sinkholes exist within a different stratigraphic unit than that found below the site. Therefore, the site does not appear to lie within a karst setting. This is supported by the presence of a classified gaining stream just east of the site.

6.2 Groundwater Targets

The Ozark Aquifer provides water for all of the 357 recorded non-monitoring wells and produces up to 1,500 gallons per minute within 4 miles of the site. The local wells do not draw water from greater than 1,375 feet in depth.

The DGLS databases contain records of sixteen municipal, nine community public, eighteen non-community public, eleven industrial, one irrigation, and 302 domestic wells in Missouri within a 4-mile radius of the Shapiro Brothers Salvage site. The DGLS database indicates that the nearest known domestic well lies within 100 feet west of the site; however the residence at this location (Location ID 116) was included in this investigation and the owner stated they do not have a well on their property. This would place the nearest domestic well approximately 1 mile northeast of the site near the Mississippi River. The nearest public well lies approximately 0.9 mile southwest of the site. This well is City of Festus Public Well #9, which is currently only used as an observation well (MDNR, 2012g). The City of Festus and Crystal City obtain drinking water from the Jefferson County Water Authority (JCWA) which draws water from a 94 feet-deep alluvial well along the Mississippi River approximately 1.4 miles northeast of the site (MDNR, 2012h). This well serves a population of 12,465 people. However, due to recent drought conditions, the City of Festus has been supplementing their supply with drinking water from one

of its previously inactive backup public wells (Well#8) located approximately 2 miles south of the site. The City of Festus has been supplementing its supply from JCWA by pumping 0.5 million to 1 million gallons per day from Well #8 for 1-2 days per week over the past few months (MDNR, 2012i).

Figure 1 of reference (MDNR, 2012f) illustrates the approximate locations of the 357 known non-monitoring wells within a 4-mile radius of the site. Table 1 of reference (MDNR, 2012f) lists specific technical attributes (total and casing depth, static water level, date drilled, yield, etc.) of the non-monitoring wells found within 4 miles of the site.

Prior to 1987, registry of private wells was not required. Therefore, existing older wells may not be included in the database. Also, proper well registration may not have been submitted for some wells. Because of these exceptions, the databases may not accurately depict water well usage in this area. While, public water supply districts cover a large portion of the well survey area, many rural residents still use private wells.

6.3 Conclusions

The residents of the City of Festus and Crystal City obtain drinking water from a public water supply well located 1.4 miles from the site, which is routinely tested for the contaminants of concern at this site and has not been impacted by releases at the site. Sampling of the shallow groundwater beneath the site has demonstrated a release of lead and petroleum hydrocarbons. Volatile hydrocarbon compounds within the petroleum release could pose a potential threat through the vapor intrusion pathway, but are unlikely to impact the public well which draws water from the alluvium beneath the Mississippi River.

7.0 SURFACE WATER PATHWAY

7.1 Hydrologic Setting

The nearest surface water is a tributary to Plattin Creek that flows along the east side of the site. This is an unnamed gaining stream (MDNR, 2012f). The precise potential point of entry (PPE) is not clear since a number of potential discharge points were observed along the slope between the rail line bed and the creek at the eastern site boundary (Photograph 11). Surface water leaving the site flows south along the unnamed tributary for approximately 1.8 miles before reaching Plattin Creek. Through this stretch, the stream varies between an open drainage and an underground culvert. From where the tributary enters Plattin Creek, it flows roughly 1.8 miles east before entering the Mississippi River. After entering the Mississippi River, surface water flows south for approximately 12.4 miles before reaching the 15-mile downstream limit. The 15-mile downstream limit for this site lies at the Mississippi River Mile Marker 137.

There are no known surface drinking water intakes within 15 miles downstream of the site. Surface water drainage area up gradient of the site is approximately 100 acres. There are approximately 3,253 acres of wetlands within 4 miles of the site (Figure A1). The 2-year, 24-hour rainfall is approximately 3.55 inches.

7.2 Sample Collection

Surface water and sediment samples were collected at 3 locations in the unnamed tributary as shown in Figure A2. Sample location SW01/SD01 was at the southeast corner of the facility at the 12th Street bridge (Photo 19); SW02/SD02 was approximately 1,200 feet downstream of SW01 (Photo 19); and SW03/SD03 was approximately 3,000 feet downstream of SW01 (Photo 20). The tributary is enclosed in an underground culvert upstream of the site. Therefore no upgradient sampling location could be identified. Instead, a background sampling location (SW04/SD04) was identified in a similar size stream located in Sunset Park (Photo 23). Samples

were submitted to the department's Environmental Services Laboratory for analysis of arsenic, cadmium, copper, lead and zinc.

7.3 Results

All laboratory results and sampling documentation are included in the Sampling Report (MDNR, 2012x). A summary of the surface water results is provided in Table C2, and sediment results are summarized in Table C3. Sediment results for lead exceed the USGS probable effects concentration (PEC) in all samples, including the background location.

The site-related contaminants: cadmium, copper, and lead, were present in surface water and sediment at levels significantly above background levels in SW01/SD01 and in the downstream samples. Zinc was also present at levels significantly above background in in surface water at SW01/SD01. The surface water and sediment contaminant levels decrease with distance downstream however, dropping to near background levels at the SW02/SD02 and SW03/SD03 locations.

7.4 Conclusions

Data collected during this investigation and the previous facility investigation (MDNR, 2011a) document a release of lead and other metals from the site to surface water and sediments of the unnamed Plattin Creek tributary forming the eastern site boundary. Contaminant levels drop off fairly rapidly with distance falling to near background levels by approximately 1,200 feet downstream of the site. The receiving tributary is not classified under the Missouri Water Quality Standards for any protected uses, and primarily functions as an urban stormwater drainage feature. Direct contact exposure of nearby residents to water or sediments in the drainage is unlikely and it was not observed to be capable of supporting a food chain fishery.

8.0 SOIL EXPOSURE AND AIR PATHWAYS

8.1 Physical Conditions

The soil under the Shapiro Brothers Salvage site is the Menfro silt loam. The soil, which can be up to 65 feet thick in some areas, is composed of roughly 18 to 30 percent clay. The unconsolidated sediments range in thickness from 50 to 65 feet near the site. Menfro silt loam is acidic to neutral (pH 5.1 to 7.3) and hydraulic conductivity is roughly 1.4×10^{-3} to 4×10^{-4} centimeters per second (cm/sec).

8.2 Soil and Air Targets

The population living within various distance rings from the site are summarized in Figure A1.

8.3 Sample Collection

8.3.1 Residential Yards

In-situ XRF analyses were conducted in residential yards at established distances along transects perpendicular to the suspected source of contamination which was either the roadway or the Shapiro facility (Photos 15 and 16). Spatial trends in concentration were used to establish the boundaries of a relatively narrow sampling unit (SU1) within which higher lead concentrations were expected. In-situ XRF analyses were also conducted at various distances along transects established perpendicular to the residence foundations in order to identify the extent of any potential influences due to historic uses of lead paint.

Incremental composite soil samples (ICS) were collected at 42 target residences and 4 background residences (Photo 17). Field replicates were collected at 11 residences. At each residence, ICS were collected from SU1 and from a second sampling unit (SU2) consisting of the rest of the yard excluding the drip zone influence area. At some residences where no significant lead concentrations

were measured near the suspected source, no SU1 was established, and the entire yard (excluding the drip zone) was sampled as SU2. This process was repeated at the background residences. Children's' play areas were sampled separately; multiple in-situ XRF readings were collected from beneath play areas observed at Location IDs 124, 158, 161, 163, and 176. Where elevated lead levels were observed (Location IDs 124 and 176), a 15-increment ICS was collected from beneath the play area for further analysis.

The samples were processed as described in the SAP and analyzed for metals by XRF. Thirteen of the samples were submitted to the laboratory for confirmatory analysis of lead, arsenic and cadmium. In addition, the sample from SU2 in the yard at Location ID 110 was submitted for PAH analysis and the sample from SU2 in the yard at Location ID 103 was submitted for organochlorine pesticides. A sample was collected from in another yard located near the facility and submitted for PCB analysis, however due to a field transcription error, the Location ID was not recorded for this sample.

The background residential area was initially identified along portions of Warne and Moore Streets. However, during sampling a resident in that area indicated that metal scrap haul trucks had also been using these streets. Two residences (Location IDs 139 and 174) were sampled on Warne Street prior to this discovery. Following this discovery, background sampling in this area was discontinued and 4 additional background residences (Location IDs 218, 221, 222, and 224) were identified further to the southwest in an area believed to be free from haul truck traffic.

8.3.2 City Park Background Sampling

Background soil samples were collected from three City of Festus parks; West City, Sunset, and Billy Porter Memorial (Location IDs 300, 301 and 302). A 10,000 ft^2 area was identified in each park and a single 30-increment composite sample was collected from each area. The samples were processed as described in the SAP and analyzed for metals by XRF.

8.3.3 Exterior Surface Dust Wipe Sampling

A limited number of dust wipes were collected from exterior surfaces at selected residential properties near the facility (Location IDs 105, 117, and 216) and at background residences (Location IDs 218 and 224). During sampling activities, the owner of Location ID 179 requested a wipe sample be collected from the surface of his home and this was done; however this was not a planned wipe sample location. Wipes were only collected from non-painted surfaces or from surfaces known to be free of lead-paint such as vinyl siding.

8.4 Sample Results

Complete laboratory analytical results and chain of custodies are provided in the Combined Site Investigation/Removal Site Evaluation Report (MDNR, 2012d). Site sketches and sample log forms are provided in Appendix C. The raw XRF data is provided in Appendix D, and a summary is provided in Table C4. A summary of XRF and lab results for lead in drip zones, sampling units, dust wipes and yard-wide average concentrations is provided in Table C5. Graphs of lead concentration vs. distance from the suspected source area are provided in Figure A4. A summary of the calculated 95% upper confidence limits (UCLs) for the yard sampling units and yard-wide averages is provided in Tables C6, C7 and C8. Figure A3 is a map of lead results for residential yards as color-shaded polygons based on estimates of yard-wide mean lead concentration.

Lead was measured at 45 mg/kg in the surface soil of West City Park, 55 mg/kg at Sunset Park, and 99 mg/kg in Billy Porter Park. The mean lead concentration in the three park background samples and in the four background residential yards is 60 mg/kg and 137 mg/kg respectively (Table C9). A comparison of lead results for the background yards, city parks and target residential yards is provided in the box plots of Figure A7.

Results from the in-situ XRF analyses conducted in SU1 were used to prepare graphs of lead

concentration with distance from the suspected source for each residence (Figure A4).

Results from XRF analysis of the ICS were used to develop estimates of the mean lead concentrations in each SU and estimates of yard-wide lead concentration for each residence. For SUs where field replicates were collected, the three results were used to calculate a 95% upper confidence limit (UCL) which was used as the estimate of the mean (Table C6). For SUs where no replicates were collected, the measure of variability (standard deviation) was extrapolated from SUs where replicates were collected (based on the lead concentration range) and used to calculate a UCL (Table C6).

Yard-wide area-weighted mean lead concentrations were calculated as UCLs in a similar fashion from the SU data using the measured ICS result together with the area of each SU (Tables C7 and C8). UCLs were calculated using the Student's *t* approach described in the ITRC Incremental Sampling Methodology Guidance, and calculator tools provided in that guidance (ITRC, 2012a). This calculation approach is recommended for incremental sampling data when the skewness of the underlying contaminant distribution is relatively low (ITRC, 2012b). Data from in-situ XRF analysis conducted in SU1 follow a near-normal distribution with a low level of skewness as shown in histogram of Figure A6.

Estimates of the yard-wide mean lead concentrations exceed the EPA Non Time-Critical Removal Action Limit (RAL) of 400 mg/kg in 10 yards - primarily those located near the facility (Table C5 and Figure A3). No yard-wide means exceeded the Time-Critical RAL of 1,200 mg/kg. For the majority of these 10 yards, the lead concentration in the SU1 portion of the yard was responsible for elevating the yard-wide average above 400 mg/kg. At another 7 residences, although the yard-wide average lead concentration was below 400 mg/kg, the levels in the SU1 portion of the yard exceeded 400 mg/kg. Most of these additional 7 residences are located near the facility, however 2 of them, Location IDs 159 and 160, are located further away and are separated from the facility by several yards shown to be uncontaminated (Figure A3). Therefore,

it is not clear that the elevated lead observed in these 2 yards are attributable to the facility operations.

In total, the estimate of mean lead concentration in the SU1 portion of the yards exceeded the Non Time-Critical RAL in 17 yards and the Time Critical RAL in 6 yards. The estimate of mean lead concentration in the SU2 portion of the yards exceeded the Non Time-Critical RAL in 7 yards.

Dust wipe samples collected on exterior surfaces contained lead in varying concentrations from <20 ug/cm^2 at a background residence to 4,900 ug/cm^2 at a residence near the facility (Table C5).

Elevated lead was measured in the drip zone at several houses, including the background residences, as would be expected for homes build prior to 1978. These effects were generally limited to within several feet of the homes, and soil from these areas was not included in the SU ICS samples.

No PCBs, or organochlorine pesticides were detected in the residential yard soil samples. Several PAHs were detected in the sample collected at Location ID 110 (Table C10). Two PAHs, Benzo(a)pyrene and indeno(1,2,3-cd) pyrene, were detected at levels above commonly referenced soil screening benchmarks (Table C10).

8.5 Discussion

As shown in the graphs of Figure A4, at most residences - especially those nearest the facility - a trend is observed that is consistent with the conceptual site model (decreasing concentration with increased distance from the suspected source). For yards where both an SU1 and SU2 were sampled, the concentration of lead was greater in SU1 than in SU2 at a frequency of 75%. These trends are largely absent at residences further from the facility and at the background residences.

Street sweepings collected from near the facility contain lead levels in the 4,000 mg/kg range compared with 190 mg/kg in those collected from the background area. This finding is consistent with the assumption that lead-contaminated soil from the facility is released to the nearby residential streets via truck traffic leaving the facility. The dust wipe results also show a general trend consistent with the conceptual site model. Dust wipe samples collected from surfaces near the facility contained significantly more lead (up to 4,900 ug/cm^2) as compared with surfaces further away or from the background residences.

Although two PAHs, benzo(a) pyrene and indeno(1,2,3-cd)pyrene were detected in both the facility soil samples and in a residential soil sample, since they were present at lower levels in the facility soil samples, it is not clear that they are attributable to the site. Further, these compounds are ubiquitous in urban soils and the values measured in the residential soil sample, while above some of the commonly referenced screening levels, are similar to those that have been measured in urban background soils elsewhere (Bradley, 1994).

West City Park is the closest sampled city park to the Herculaneum smelter. It is located approximately 15,000 feet southwest of the Smelter (Figure A1). The sampled residential houses adjacent to the Shapiro Brothers Salvage yard are approximately 11,600 feet southwest of the smelter. The lead concentration in a 10,000 ft2 area of West City Park contained 45 mg/kg lead. This finding together with the observation that the other background park and residences also contained significantly lower lead concentrations than residences located adjacent to the salvage yard suggests that the lead influence from the smelter in the vicinity of the Shapiro Salvage yard is relatively minor.

Contributions of lead from the historic use of leaded gasoline, or from use of smelter slag either as road base or for traction control in winter would be expected to result in similar lead distributions in residential yards across multiple areas; not just those residences adjacent to the facility or along historic haul roads. However, as observed, the lead concentrations in yards of

the background area and for many yards along Delmar Avenue south of the facility are not significantly elevated.

Taken together, these multiple lines of evidence support attribution of the lead contamination observed in residential yards near the salvage yard to contaminated soil released from the facility or direct air deposition from the facility to nearby yards.

9 DATA QUALITY ASSESSMENT

9.1 Soil Sampling

XRF accuracy was evaluated using control charts and standard reference materials (SRMs) containing known concentrations of lead as described in the Standard Operating Procedure included in the SAP. Analyzer precision was evaluated by charting results from daily analysis of SRMs on a previously established control chart. Results for the SRMs were generally within 2 standard deviations established as the control chart criteria for precision indicating that the analyzers were operating properly (Control Chart Graphs in Appendix D).

XRF precision was assessed by conducting 7 replicate analyses each day on a processed soil sample, without manual mixing of the bag between analyses. These results are included in Table C4. Precision, measured as the percent relative standard deviation (%RSD) among the seven replicate analyses, was below 6% for all data sets, indicating acceptable precision.

Replicate analyses were conducted on each bagged soil sample to improve the estimate of the mean lead concentration. The precision of these replicates was measured by %RSD. Evaluation of the %RSD between the replicate analyses demonstrated that the sample processing measures (drying, disaggregation, sieving) generated soil samples with a relatively homogenous distribution of lead (Table C4).

Three field replicate samples were collected in each of 21 sampling units at 11 residences. The

%RSD in lead concentrations was calculated for each set of three field replicates as a measure of overall sampling and analysis precision (Table C11).

Calculated RSDs were well below 30% for all sets of replicate samples and below 10% for all but three of the replicate sets, demonstrating that sampling process was reproducible and that the number of increments collected per SU was sufficient to capture the heterogeneity of lead within the SU.

9.2 Surface Water and Sediment Sampling

One duplicate surface water and one duplicate sediment sample were collected at the 12th Street Bridge sampling location. The relative percent difference (RPD) was calculated for each analyte detected in both pairs of duplicate samples, and this is summarized in Tables C12 and C13. The RPDs were generally below 30% for most analytes, except for total lead and total cadmium in the surface water sample/duplicate. Since the RPD between dissolved metal concentrations in the sample pair were significantly lower, this higher RPD observed in total metals is likely due to differences in suspended solid content of the notedly turbid samples and the difficulties in obtaining a representative sample in the field and subsample in the lab.

9.3 Equipment Rinseate Blanks

Rinseate blanks were prepared following decontamination of the soil sampling tools on each of the three days of soil sampling. The rinse water was analyzed for arsenic, cadmium, copper, lead and zinc. Zinc was measured in two of the blanks at 1.27 ug/l and 1.94 ug/l. No other metals were detected.

10.0 SUMMARY AND CONCLUSIONS

The Shapiro Brothers Salvage Site is a 15-acre metal scrap and recycling facility located in a

residential area of Festus, Missouri. The operation has been active since the 1940s, and is currently owned by M.W. Recycling, a wholly owned subsidiary of PSC Metals INC. The salvage yard is unpaved, and lead concentrations up to 37,000 mg/kg have been measured in facility soils. Prior to 2011 when a truck washing station was installed, trucks entering and exiting the facility would likely have tracked contaminated soil from the facility to nearby residential streets. High levels of lead in samples of street sweepings from roads near the facility used by haul trucks confirm this suspected release mechanism. An SI/RSE Investigation was initiated to assess potential risks to human health and the environment posed by facility activities.

Soil sampling was conducted in yards at 42 residences located near the facility or along truck haul routes and at 4 background residences and 3 city parks. The yard wide average lead concentrations at 10 residences exceeded both background levels and the EPA Non Time-Critical Removal Action Level of 400 mg/kg. The average lead concentrations in at least part of the yard (SU1) exceeds 400 mg/kg at an additional 7 residences, 5 of which are located near the facility. Multiple lines of evidence gathered as part of the investigation support attributing the source of this contamination to the facility. Based on these findings, a Non Time-Critical Removal Action is warranted to address lead-contaminated soil at these 15 yards; all of which are located adjacent to or near the facility.

Surface water and sediment sampling documented releases of lead and other metals into an unnamed tributary to Plattin Creek that forms the eastern site boundary. The concentrations decrease with distance downstream to near background levels by approximately 1,200 feet downstream of the site. The tributary serves primarily as an urban stormwater runoff drainage and varies between being in subsurface culverts and daylighting at various points along the flow path. Direct contact exposure or use of the surface water as a fishery are unlikely.

11.0 RECOMMENDATIONS

The Department is currently negotiating with M. W. Recycling, LLC to conduct additional yard sampling to identify the extent of yard contamination in the area near the facility and to conduct removal actions at the 15 above-referenced residences with state oversight through an Abatement Order on Consent (AOC) under participation in the State's Superfund Cooperative Program. Should those negotiations fail to result in a signed AOC within the next three months, the site will be referred to USEPA with a recommendation for additional investigation and a Non Time-Critical Removal Action.

Shapiro Salvage Yard Site

Site Inspection/Removal Site Evaluation Report

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