



October 11, 2018

Mr. Todd Davis
Site Assessment Manager
U.S. Environmental Protection Agency
11201 Renner Boulevard
Lenexa, Kansas 66219

**Subject: Preliminary Assessment Report
Proposed NGA Site, St. Louis, Missouri
U.S. EPA Region 7, START 4, Contract No. EP-S7-13-06, Task Order No. 0104.006
Task Monitor: Todd Davis, Site Assessment Manager**

Dear Mr. Davis:

Tetra Tech, Inc. is submitting the enclosed Preliminary Assessment report regarding the above-referenced facility. If you have any questions or comments regarding this submittal, please contact the Project Manager at (816) 412-1767.

Sincerely,

A handwritten signature in blue ink that reads 'Mike Williams'.

Michael Williams, CPG
START Project Manager

A handwritten signature in blue ink that reads 'Ted Faile'.

Ted Faile, PG, CHMM
START Program Manager

Enclosures

cc: Debra Dorsey, START Project Officer (cover letter only)

**PRELIMINARY ASSESSMENT AT THE
CASS AND JEFFERSON AVENUE SITE
(PROPOSED NATIONAL GEOSPATIAL INTELLIGENCE AGENCY SITE)
ST. LOUIS, MISSOURI**

**Superfund Technical Assessment and Response Team (START) 4 Contract
Contract No. EP-S7-13-06, Task Order 0104.006**

Prepared For:

U.S. Environmental Protection Agency
Region 7
Superfund Division
11201 Renner Boulevard
Lenexa, Kansas 66219

October 11, 2018

Prepared By:

Tetra Tech, Inc.
415 Oak Street
Kansas City, MO 64106
(816) 412-1741

CONTENTS

<u>Section</u>	<u>Page</u>
1.0 INTRODUCTION	1
2.0 SITE INFORMATION	2
2.1 SITE LOCATION/DESCRIPTION	2
2.2 SITE HISTORY	2
2.3 GEOLOGY	3
2.4 SOILS	3
2.5 HYDROGEOLOGY	3
2.6 HYDROLOGY	4
2.7 PREVIOUS INVESTIGATIONS	4
2.7.1 Environmental Covenant and Soil Management Plan	4
2.7.2 Phase I Environmental Site Assessment	4
2.7.3 Preliminary Environmental Assessment	5
2.7.4 Phase II Environmental Site Assessment (SCI Engineering, Inc.)	5
2.7.5 Phase II Targeted Brownfields Assessment	6
2.7.6 Phase II Environmental Site Assessment Asbestos-Containing Material Inspection Report	6
2.7.7 Asbestos Drywall Material Inspection Report Phase #1 and #2	6
2.7.8 Groundwater Investigation	7
2.7.9 Radiological Sampling	7
2.7.10 Summary of Analytical Results	7
2.8 WASTE CHARACTERISTICS	28
2.8.1 Asbestos-containing Material	28
2.8.2 Chlorinated Volatile Organic Compounds	28
2.8.3 Metals	29
2.8.4 Polycyclic Aromatic Hydrocarbons	32
2.8.5 Petroleum Hydrocarbons	32
3.0 HAZARD RANKING SYSTEM FACTORS	34
3.1 SOURCES OF CONTAMINATION	34
3.2 SOIL EXPOSURE AND AIR PATHWAY	34
3.2.1 Soil and Air Pathway Targets	36
3.2.2 Soil and Air Pathway Conclusions	36
3.3 GROUNDWATER PATHWAY	36
3.3.1 Hydrogeological Setting	36
3.3.2 Groundwater Targets	37
3.3.3 Groundwater Pathway Conclusions	38

CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
3.4 SURFACE WATER PATHWAY	39
3.4.1 Surface Water Targets.....	39
3.4.2 Surface Water Conclusions	39
4.0 REMOVAL ACTIONS.....	40
4.1 REMOVAL ACTION OVERVIEW.....	40
4.2 REMOVAL ACTIONS BY CITY BLOCK	41
4.2.1 City Block 1078	42
4.2.2 City Block 1079	43
4.2.3 City Block 1080	44
4.2.4 City Block 1081	45
4.2.5 City Block 1082	46
4.2.6 City Block 1083	46
4.2.7 City Block 1084	48
4.2.8 City Block 1085	48
4.2.9 City Block 1092	49
4.2.10 City Block 1093	50
4.2.11 City Block 1094	51
4.2.12 City Block 1095	52
4.2.13 City Block 2314	54
4.2.14 City Block 2315	55
4.2.15 City Block 2316	57
4.2.16 City Block 2317	58
4.2.17 City Block 2318	59
4.2.18 City Block 2319	60
4.2.19 City Block 2324	61
4.2.20 City Block 2325	62
4.2.21 City Block 2326	63
4.2.22 City Block 2327	64
4.2.23 City Block 2328	65
4.2.24 City Block 2329	66
4.2.25 City Block 2345	67
4.2.26 City Block 2346	68
4.2.27 City Block 2347	69
4.2.28 Streets.....	70
5.0 SUMMARY	72
6.0 REFERENCES	76

CONTENTS (Continued)

APPENDICES

Appendix

- A FIGURES
- B TABLE
- C VAPOR INTRUSION SCREENING LEVEL RESULTS

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA), Region 7, under authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), tasked Tetra Tech, Inc. (Tetra Tech) to conduct a preliminary assessment (PA) of the Proposed National Geospatial Intelligence Agency (NGA) site (the Site), northeast of Cass Avenue and Jefferson Avenue in St. Louis, Missouri, under Superfund Technical Assessment and Response Team (START) 4 Contract Number EP-S7-13-06, Task Order 0104.006.

The Site covers approximately 97 acres and was zoned mostly residential, with some commercial/industrial usage (Figures 1 and 2). Purposes of this PA were to: (1) review available information regarding the Site and its environs to assess threat(s), if any, posed to public health, welfare, or the environment; and (2) identify data gaps and determine if further investigation under CERCLA is warranted. The scope of this PA included a review of information available from federal, state, and local agencies, and development of a report that summarizes findings.

EPA Hazard Ranking System (HRS) criteria often are applied in a PA to assess the relative threat associated with actual or potential releases of hazardous substances at a facility. The HRS is the primary method of determining a site's eligibility for placement on the National Priorities List (NPL). The NPL identifies facilities at which the EPA may conduct remedial response actions. For the Site, HRS scoring is not necessary because the Site is enrolled in the Missouri Voluntary Cleanup Program, and remedial actions have been completed. This PA summarizes findings of previous investigative activities and need for additional data acquisition, if any, beyond current remedial actions.

The following sections address the background and history of the Site, describe previous environmental investigations and ongoing remedial activities, present and evaluate analytical results, discuss findings, and offer conclusions.

2.0 SITE INFORMATION

The Site's location, description, and history are discussed below, as well as waste characteristics and previous investigations.

2.1 SITE LOCATION/DESCRIPTION

The Site is northeast of Cass Avenue and Jefferson Avenue in St. Louis, Missouri. The Site includes approximately 550 parcels in 27 city blocks, encompassing an area of approximately 97 acres. Multiple structures of mixed industrial/commercial and residential uses were present on the Site, but most structures have been removed.

The Site is bounded north by St. Louis Avenue, east by 22nd Street, south by Cass Avenue, and west by Jefferson Avenue/Parnell Street. The Site is included on the Granite City, Missouri U.S. Geological Survey (USGS) 7.5-minute topographic series map (USGS 1993). Coordinates at the approximate center of the Site are 38.648523 degrees north latitude and 90.209320 degrees west longitude (Tetra Tech 2016). Figures 1 and 2 (Appendix A) illustrate the Site location and boundaries.

2.2 SITE HISTORY

The Site hosted various commercial and light industrial operations, residences, and vacant land. Commercial operations included the following: varnish factory, iron works, foundry, washing machine factory, filling stations, automotive repair facilities, junkyards, dry cleaners, shoe manufacturing, trucking operations, and metal stamping facilities. Houses ranged from roughly 1,200 to 4,000 square feet, two to four stories, with brick or partial brick exteriors. Many parcels were vacant, unimproved lots with grass, weeds, and trees. In 2017, a remedial action under the Missouri Brownfields Voluntary Cleanup Program (BVCP) began, and all structures and foundations have been removed. The top 3 feet of soil has also been excavated sitewide, and has been replaced by clean fill material according to the Risk Management Plan for Subgrade Site Conditions (Environmental Operations, Inc. [EOI] 2016). The Site is being graded and prepared for construction of the new NGA facility.

Table 1 (Appendix B) lists 550 Parcels identified in the Phase I ESA, occupying 27 city blocks (EOI 2015). Parcels are listed with site address, city block, legal description, year build, and environmental concern.

2.3 GEOLOGY

St. Louis is in east-central Missouri and lies within the gently rolling Central Lowland physiographic province. Sedimentary rocks beneath the region of the Site consist primarily of Mississippian rocks that crop out in a wide to narrow band extending from southwestern Missouri to just north of the Missouri River in central Missouri, and as a second, less extensive band in northeastern Missouri parallel to the Mississippi River. Mississippian strata are mostly limestone (commonly cherty), but include some beds of sandstone and shale (USGS 1997).

Limestone bedrock is most likely the St. Louis Limestone. It occurs at depths ranging from 20 to 30 feet below ground surface (bgs) (480 to 490 feet above mean sea level [amsl]). It is characterized as gray, moderately hard, medium to thick bedded, and finely crystalline.

2.4 SOILS

According to the U.S. Department of Agriculture (USDA) soil survey of St. Louis, Missouri, most soils at the Site are characterized as Urban land, upland formed on hills. The rest of the soils at the Site are characterized as Urban land-Harvester complex, consisting of moderately well-drained, silty-clayey loams formed on loess material (USDA 2016).

Soil overburden consists of 5 to 15 feet of clayey fill with intermixed debris, such as construction materials. Native soil—mainly clay and silt—lies below the fill to depth of 14 to 33 feet bgs, where bedrock is encountered.

2.5 HYDROGEOLOGY

The surficial aquifer system of the region consists of unconsolidated sand and gravel, and is divided into three parts: stream-valley aquifers, the Mississippi River Valley alluvial aquifer, and glacial-drift aquifers. The Site is in between stream-valley aquifers, which consist of narrow bands of fluvial and alluvial sediments that fill or partly fill the valleys of meandering to braided streams that have eroded shallow channels into loess, glacial deposits, alluvium, residuum, or carbonate bedrock. The unconsolidated sand and gravel deposits that compose the stream-valley aquifers are thicker, more widespread, and more productive in the valleys of the larger rivers than those of smaller streams.

In Missouri, the stream-valley aquifers along the Missouri and the Mississippi Rivers and their tributaries are important sources of fresh water for many communities and industries. The stream-valley aquifers

consist mostly of sand and gravel of Holocene age, but locally include sediments of Pleistocene age. Most water in the stream-valley aquifers is under unconfined, or water-table, conditions. The stream-valley aquifers are in direct hydraulic connection with adjacent streams, and water levels in the aquifers are thus closely related to river levels. Chemical quality of the water in the stream-valley aquifers generally is suitable for most uses. Typically, the water is hard and a calcium bicarbonate type (USGS 1997).

According to the U.S. Army Corps of Engineers (USACE), groundwater in St. Louis flows either north toward the Missouri River or East toward the Mississippi River (USACE 2017).

2.6 HYDROLOGY

The Site is within the Cahokia-Joachim watershed (USGS Cataloging Unit 07140101) (EPA 2016a). Runoff from the Site generally follows regional topography to the west-northwest (Environmental Data Resources [EDR] 2015). However, most of the runoff would likely be captured by storm water inlets near the property. The Site is not within the 100-year floodplain (EDR 2015).

2.7 PREVIOUS INVESTIGATIONS

Previous investigations described below have characterized fill material, surface soil, subsurface soil, groundwater, subsurface objects, and commercial and residential structures.

2.7.1 Environmental Covenant and Soil Management Plan

An Environmental Covenant, dated May 9, 2013, was recorded with the City of St. Louis on August 20, 2013. The Covenant established a Soil Management Plan for the property at 1615 North 25th Street, St. Louis, Missouri. This address corresponds with property formerly owned by Reed Rubber Company, but now owned by Faultless Linen Supply Company. The property includes Parcel 150 in Block 2317 and Parcel 299 in Block 2318. Based on previous investigations and remedial actions in 2011 and 2012, the property was accepted into the Missouri BVCP (Land Clearance for Redevelopment Authority of the City of St. Louis [LCRA] 2013). Additional details are discussed in Sections 2.7.10.16 and 2.7.10.17 of this report.

2.7.2 Phase I Environmental Site Assessment

LCRA, overseen by the Saint Louis Development Corporation (SLDC), contracted EOI to perform a Phase I Environmental Site Assessment (ESA). The Phase I ESA identified historical petroleum, auto repair, dry cleaning, chemical mixing, electroplating, and salvage facilities throughout the Site. A detailed

summary of recognized environmental conditions (REC)—shown by city block and parcel identification—appears in the Phase I ESA (EOI 2015), and is included in Table 1 in Appendix B.

2.7.3 Preliminary Environmental Assessment

USACE contractor CH2M Hill conducted a Preliminary Environmental Assessment in March 2016, results of which will support the National Environmental Policy Act Environmental Impact Statement (EIS). The Preliminary Environmental Assessment found evidence of several areas requiring additional evaluation (CH2MHILL 2015). An environmental site assessment (ESA) will be performed by USACE once all areas are accessible.

2.7.4 Phase II Environmental Site Assessment (SCI Engineering, Inc.)

Based on evidence of possibly present contamination from historical activities described in the Phase I ESA, SCI Engineering, Inc. (SCI) was contracted by Missouri Department of Natural Resources (MDNR) to perform a Phase II ESA at the proposed NGA Site (SCI 2016). SCI's investigation of soil and groundwater revealed evidence of contaminant concentrations on the Site exceeding MDNR Default Target Levels (DTL) and Tier I Residential, Non-Residential, and Construction Worker Risk-Based Target Levels (RBTL). These exceedances were primarily from concentrations of arsenic, lead, petroleum hydrocarbons, and polycyclic aromatic hydrocarbons (PAH), and mostly in surficial soil samples. During trenching activities, buried rubble including bricks, concrete, trash, and other debris was encountered. Samples of suspected asbestos-containing materials (ACM) were collected in the trenches for laboratory analysis, which revealed presence of several ACMs on the Site.

At two of three lots where ground penetrating radar (GPR) surveys occurred, anomalies were detected in the subsurface to 8 feet bgs. Five objects were identified at the northwest corner of 22nd Street and North Market Street. During trenching activities, SCI uncovered four USTs that appeared to have been closed in place. One object was identified running east to west across the northwest corner of 23rd Street and Maiden Lane.

According to SCI, results from soil samples collected during soil boring activities indicated that soil and fill material on the Site would be considered special waste if sent for disposal to a Missouri-licensed landfill. Because several of the samples contained contaminants at concentrations exceeding one or more MDNR DTLs, soil on the Site was not considered clean fill and could not be used as fill at another property without acquisition of a special/beneficial use permit from MDNR (SCI 2016).

2.7.5 Phase II Targeted Brownfields Assessment

The Tetra Tech Superfund Technical Assessment and Response Team (START) conducted a Phase II Targeted Brownfields Assessment under contract to EPA Region 7 in February 2017. START collected 41 surface and 43 subsurface soil samples from soil borings throughout the Site. Seventeen groundwater samples were collected at 12 of the soil boring locations. Four undisturbed soil samples were collected from dedicated geotechnical soil borings to determine soil type.

Elevated levels of arsenic and lead were found in surface and subsurface soils at several parcels. Arsenic and lead levels were above DTLs and RBTLs for residential sandy soils. In some samples, arsenic and lead levels exceeded RBTLs for non-residential sandy soils. Target levels for sandy soils are considered the most restrictive (i.e., protective of human health and the environment).

The START assessment also found elevated levels of the following PAHs in surface soils: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Some PAH concentrations in subsurface soils on the Site exceeded DTLs.

START concluded that additional sampling and/or mitigating actions to prevent contact with arsenic, lead, PAHs, and benzene-impacted media at the Site may be desirable depending on future use of the Site (Tetra Tech 2017).

2.7.6 Phase II Environmental Site Assessment Asbestos-Containing Material Inspection Report

Seagull Environmental Technologies, Inc. (Seagull) was tasked by MDNR Brownfields Voluntary Cleanup Section (BVCP) to conduct an ACM inspection at the proposed NGA site. Seagull inspected 40 properties for presence, quantity, location and type of ACM. Properties included vacant, unoccupied, and commercial buildings. Results are conveyed in Section 2.7.10 of this report (Seagull 2016).

2.7.7 Asbestos Drywall Material Inspection Report Phase #1 and #2

EOI was retained by LCRA Holdings to conduct asbestos sampling of drywall in buildings on the Site. The sampling was conducted in two phases. Phase #1 included the following location: 2520 Warren, 2544 Warren, 2224 Montgomery, 2343 Montgomery, 2516 Montgomery, 2208 Benton, 2210 Benton, 2213 Benton, 2216 Benton, 2217 Benton, 2220 Benton, 2221 Benton, 2222 Benton, 2519 Benton, 2528 Benton, 2537 Benton, and 2541 Benton. No sample tested during Phase #1 contained ACM (EOI 2016a).

EOI investigated the following locations during Phase #2: 2500 North Market, 2508 North Market, 2510 North Market, 2512 North Market, 2209 Madison, 2221 Madison, 2517 Madison, 2211 Howard, 2321 Mullanphy, 2323 Mullanphy, 2325 Mullanphy, 2327 Mullanphy, 2332 Mullanphy, and 1505 North 22nd Street. Again, none of the samples tested positive for ACM (EOI 2016b).

2.7.8 Groundwater Investigation

In May 2017, USACE installed, sampled, and later abandoned nine groundwater monitoring wells located across the Site. The wells were sampled for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), the eight Resource Conservation and Recovery Act (RCRA) metals, cyanide, hexavalent chromium, and polychlorinated biphenyls (PCB). Results were screened against Maximum Contaminant Levels (MCL). USACE found two exceedances—PCE at concentration of 32 micrograms per liter ($\mu\text{g/L}$) in MW-06 and arsenic at 11 $\mu\text{g/L}$ in MW-02. The arsenic exceedance is thought to be from turbid groundwater, and is likely naturally occurring (USACE 2017).

2.7.9 Radiological Sampling

At the request of the City of St. Louis, R.M. Wester and Associates, Inc. (Wester) conducted a limited radiation survey of backfill material at 2233 Cass Avenue, Parcel 545 (City Block 2314) (see Section 2.7.10.13). The backfill material contained soil, cinders, coal ash, brick, and other materials. Two radioactive isotopes—Uranium-238 and Thorium-232—were detected (Wester 2017a). The isotopes and levels detected indicate that they are naturally occurring radioactive material (NORM), consistent with what would be expected in bricks or coal ash (Wester 2017b).

2.7.10 Summary of Analytical Results

The following sections briefly describe historical activities and summarize analytical results from parcels at which the 2015 EOI Phase I ESA identified environmental concerns.

2.7.10.1 City Block 1078

The Phase I ESA identified environmental concerns at Parcel ID 1 in City Block 1078 resulting from historical activities there. The property address is 2701 25th Street. It has been occupied by various industrial operations, including machine shops, a varnish factory, iron works, and a foundry. During the Phase I ESA, the 68,000-square-foot commercial building was vacant, having been condemned in 2009. Details of the building's construction are provided in the Phase I ESA. Evidence of contamination, such as

odors, sheens, discolored or stressed vegetation, was not found during the site assessment; however, a filling station was present on an adjoining property immediately to the north (EOI 2015).

Although additional sampling was not conducted during the Phase II ESA, START collected soil and groundwater samples from two direct-push technology (DPT) borings as part of the Phase II Targeted Brownfields Assessment (Figure 3). In both surface and subsurface soil samples, START detected arsenic at concentrations above the MRBCA DTL and residential RBTL of 3.89 milligrams per kilogram (mg/kg) for sandy soils, but below the non-residential RBTL of 15.9 mg/kg. Lead concentrations exceeded the MRBCA DTL of 3.74 mg/kg, but were below the MRBCA residential RBTL of 260 mg/kg. All other detected metals, VOCs, TPHs, and PAHs in soil were at concentrations below MRBCA DTLs (Tetra Tech 2016). None of the constituents detected in groundwater samples collected from this block exceeded the MRBCA DTLs.

2.7.10.2 City Block 1079

City Block 1079 was occupied by plating, automotive painting, and machine shop operations on Parcel 2 (2500-2506 Montgomery) for over 50 years. Possibility of uncontrolled releases of hazardous materials from metals processing and painting operations was investigated (EOI 2015).

During the Phase II ESA, SCI collected soil samples from three DPT borings (SCI-1, SCI-2 and SCI-3) (Figure 4). Surface soil sample SCI-1A (0 to 3 ft bgs) contained lead at 329 mg/kg, which exceeded the MRBCA residential RBTL of 260 mg/kg and the maximum background concentration for St. Louis, County of 118.8 mg/kg (USGS 2017). Subsurface soil sample SCI-3B (12-16 ft bgs) contained arsenic at 18.8 mg/kg—above the DTL but below the residential RBTL; this sample also contained lead at 684 mg/kg, above the non-residential RBTL. Three PAHs (benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene) were detected in surface soil at SCI-2 at concentrations exceeding residential RBTLs. Benzo(a)pyrene concentration also exceeded the non-residential RBTL. One groundwater grab sample was collected from the DPT boring at SCI-2 and analyzed for VOCs and SVOCs. All groundwater results were below laboratory detection limits (SCI 2016).

SCI investigated fill material by digging a trench (Trench 7 [T-7]) along the southern half of City Block 1079 (Figure 5). SCI found various building materials, such as shingles, slate, tile, flooring, drywall, and plaster. SCI identified ACM in tile with paper backing at 395 feet along T-7.

START collected a geotechnical soil sample within 1 to 3 feet bgs near the southeast corner of City Block 1079 (Northwest corner of Warren and 25th Street). Sample GT-1 was classified as brown silty clay with 90.5 percent (%) clay and silt, and 9.5% sand (Tetra Tech 2016).

Seagull investigated suspected ACM at Structures 29, 36, and 38, which correspond with Parcels 9, 19, and 20, respectively. Chrysotile ACM was found in floor tile, mastic, thermal system insulation (TSI) Aircell pipe insulation and associated piping TSI joint compound, and flashing at Structure 29, ranging from 3% to 70%. At Structure 38, chrysotile ACM was found in drywall joint compound and floor tile at up to 4%. Samples could not be safely collected from Structure 36 because it had collapsed (Seagull 2016).

2.7.10.3 City Block 1080

City Block 1080 has been occupied by machine shops, and boiler and sheet metal works; a pulverizing and crusher operation previously occupied Parcel 32 for at least 70 years. Parcel IDs 41, 42, 43, and 44 previously hosted auto repair and junkyard operations. Many of these historical operations were conducted for brief periods of time, but were still considered a moderate risk for future development (EOI 2015).

SCI collected soil samples from three DPT borings (SCI-10, SCI-11 and SCI-12). All data were either non-detect or below DTLs or background concentrations reported for St. Louis City for metals. Two groundwater samples were collected from a shallow and deep boring at SCI-10. The deep groundwater sample contained total petroleum hydrocarbons (TPH) – oil range organics (ORO) at 435.5 milligrams per liter (mg/L), above the DTL of 31.8 mg/L.

SCI also performed trenching at the following locations: T-11, T-12, T-13, and T-19 (Figure 5). The following materials were found: shingles, drywall, plaster, roofing, binding, and sheet flooring. ACM was not detected in material retrieved from the trenches (SCI 2016).

In surface soil, START detected arsenic at a concentration of 19 mg/kg, above the DTL and residential RBTL (both 3.89 mg/kg) and non-residential RBTL (15.9 mg/kg). In subsurface soil, arsenic was detected at a concentration of 13 mg/kg below the non-residential RBTL, but above the residential RBTL (3.89 mg/kg). START detected lead at 500 mg/kg in surface soil at Parcel 32—above the residential RBTL of 260 mg/kg but below the non-residential RBTL of 660 mg/kg. Benzo(a)pyrene was detected at 0.82 mg/kg in surface soil at P32-1 (0-3), above the residential RBTL for surface soil of 0.62 mg/kg. All other concentrations of metals, VOCs, and TPHs were non-detect or below DTLs. Groundwater at P32-1

was found to contain concentrations of metals VOCs, TPHs and PAHs below DTLs, when detected (Tetra Tech 2016).

Seagull investigated ACM at Structures 7, 8, 9, 10, 34, 35, and 37, which correspond with Parcels 51, 48, 47, 46, 39, 40, and 43, respectively. Samples could not be safely collected from Structures 8, 34, and 35 because they had collapsed. Chrysotile ACM was found in Structures 7, 9, 10, and 37 in the following materials: drywall joint compound, sheet vinyl flooring, and floor tile. Concentrations ranged from 2% to 30% (Seagull 2016).

2.7.10.4 City Block 1081

This City Block included a mix of undeveloped land covered by weeds, trees, and grass; and residential housing structures (EOI 2015). During the Phase II ESA, SCI investigated the area by digging trenches (T-22, T-23, T-24, T-28, T-29, and T-30) (Figure 5), thus unearthing tiles of various colors and roofing material. ACM was not detected (SCI 2016). No other samples were collected.

START did not investigate City Block 1081.

Seagull investigated ACM at Structures 24, 25, and 26, which correspond with Parcels 81, 77, and 76, respectively. Samples could not be safely collected from Structure 26 because it had collapsed. Chrysotile ACM was found in Structures 24 and 25 in the following materials: caulk, insulation, sheet vinyl flooring, seam tape insulation, mastic, and floor tile; concentrations ranged from 2% to 70% (Seagull 2016).

2.7.10.5 City Block 1082

City Block 1082 hosted undeveloped land at the time of the Phase I ESA. Properties in this city block were covered by weeds, grass, and trees (EOI 2015).

SCI collected soil samples from three DPT borings: SCI-23, SCI-24, and SCI-25 (Figure 4). Lead was detected in surface soil at concentrations ranging from 341 mg/kg to 427 mg/kg exceeding the DTL/background concentration and residential RBTL, but below the non-residential RBTL.

Concentrations of lead in subsurface soil samples were below the DTL/background concentration and RBTLs. Three PAHs (benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene) were detected in surface soil at SCI-24A at concentrations exceeding residential RBTLs. Benzo(a)pyrene and benzo(b)fluoranthene concentrations also exceeded the non-residential RBTL at SCI-23A and SCI-24A. Benzo(a)pyrene was also detected in surface soil at SCI-25A at a concentration exceeding the residential

RBTL. In groundwater at SCI-23, one VOC, naphthalene was detected above the DTL, but below the residential RBTL. Other VOCs analyzed were below laboratory reporting limits. SVOCs and TPH were not analyzed in the sample from SCI-23. Trenches excavated at T-25 and T-31 yielded roofing material, wire wrap, sheet flooring, various colors of tile, and plaster. One sample of yellow spotted tile at T31-38-132 contained 20% chrysotile ACM (SCI 2016).

START did not investigate City Block 1082.

USACE installed one temporary monitoring well (MW-2) on the east side, near the midpoint of City Block 1082, adjacent to North 23rd Street (Figure 6). Concentrations of VOCs, SVOCs, PAHs, and PCBs were all below Missouri Tier 1, residential RBTLs for indoor inhalation, and below EPA MCLs. One metal—arsenic—was detected at 11 µg/L, exceeding the EPA MCL of 10 µg/L; but this detection likely occurred because the sample was highly turbid (and thus arsenic was deemed not a contaminant of concern) (USACE 2017).

2.7.10.6 City Block 1083

Properties at 2318 to 2320 Warren (City Block 1083) hosted a hauling operation. Trucking and hauling operations included vehicle maintenance at the property. Historical information indicates that the southern and western portions of City Block 1083 were occupied by iron works, dry cleaners, furniture refinishing operations, and auto repair facilities. Based on these historical occupants and the possibility of improper use or disposal of hazardous substances, City Block 1083 was investigated further during Phase II ESAs (EOI 2015).

SCI collected samples at eight soil boring locations: SCI-13 through SCI-17 and SCI-20 through SCI-22 (Figure 4). From one or more soil samples, the following results were obtained: lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene concentrations exceeded DTLs and residential RBTLs; lead, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene concentrations exceeded non-residential RBTLs; and lead concentration exceeded the construction worker RBTL. Highest concentrations of arsenic and lead were 25.3 and 759 mg/kg, respectively, at SCI-15B. Highest concentrations of benzo(a)anthracene (26.4 mg/kg), benzo(a)pyrene (20.7 mg/kg), and benzo(b)fluoranthene (29.2 mg/kg) occurred at SCI-16A. In groundwater at SCI-13 and SCI-15, TPH, VOCs, and SVOCs were not detected above laboratory reporting limits. In groundwater at SCI-20 through SCI-22, VOCs were not detected above laboratory reporting limits with the exception of naphthalene in SCI-22 detected at a concentration above the DTL, but below the residential RBTL. Groundwater samples

SCI-20 through SCI-22 were not analyzed for SVOCs or TPH. Trenches T-14 and T-20 revealed roofing material, shingles, wire wrap, plaster, sheet flooring, and tile. ACM was detected in roofing material at T-14 (SCI 2016).

START collected samples at Parcels 208, 209, 215, and 216 in City Block 1083 (Figure 3). Analytical results from soil samples indicated arsenic concentrations above the DTL and residential RBTL; arsenic concentration also exceeded the non-residential RBTL at P208-1 (0-3), P208-1 (14-16) and P209-1 (9-11). Lead concentrations in soil exceeded the DTL/background concentration and residential RBTL at P208-1 (0-3) and P209-1 (9-11); the two highest concentrations of lead—1,000 mg/kg at P208-1 (14-16) and 2,600 mg/kg at P215-1 (0-3)—also exceeded the non-residential RBTL. Concentrations of methylene chloride found in surface soil samples from several locations exceeded the DTL but were below the residential RBTL. PAHs were found at concentrations exceeding the DTL at all parcels investigated in City Block 1083. In general, the highest concentrations occurred in surface soil. Benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd) pyrene concentrations exceeded residential RBTL levels in surface soil at one or more locations. PAH concentrations did not exceed non-residential RBTLs in this City Block. Lead was detected in groundwater at P209-1 at 0.022 mg/L, exceeding the DTL and residential RBTL of 0.015 mg/L. In groundwater at P215-1, analyte concentrations were found either below detection limits or below screening levels (Tetra Tech 2016).

Seagull investigated ACM at Structures 33 and 39, which correspond with Parcels 205 and 201, respectively. Chrysotile ACM was found in transite siding, TSI mud joint, and Aircell pipe insulation in both structures. Concentrations ranged from 30% to 60% (Seagull 2016).

2.7.10.7 City Block 1084

According to EOI, the properties in City Block 1084 at 2345 to 2349 Warren Street hosted historical auto repair facilities from 1960 to 1970 (EOI 2015).

SCI investigated City Block 1084 by drilling and sampling soil at three DPT locations (SCI-7 through SCI-9) (Figure 4); SCI also excavated trenches T-3 and T-8 (Figure 5) to check for buried materials. In summary, lead and arsenic were detected at concentrations exceeding one or more screening levels. One elevated concentration of arsenic (103 mg/kg) occurred in surface soil at SCI-9A; two elevated concentrations of lead (875 and 483 mg/kg) occurred in surface soil at SCI-7A and SCI-8A, respectively. In surface soil samples collected at SCI-7A and SCI-7B, concentrations of PAHs—benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene—exceeded DTLs, residential RBTLs,

and in several cases, non-residential RBTLs. In groundwater at SCI-8, VOCs and SVOCs concentrations were found below detection limits. Trenching at T-3 and T-8 revealed tile, roofing, sheet flooring, shingles, and plaster, but ACM was not encountered (SCI 2016).

START did not investigate City Block 1084.

Seagull investigated ACM at Structure 33 in City Block 1084, which corresponds with Parcel 199. Notably, Structure 33 is labeled twice—once in City Block 1083 and once in City Block 1084. Chrysotile ACM was found in transite siding at Structure 33 at approximately 30% (Seagull 2016).

USACE installed one temporary monitoring well (MW-1) near the northwest corner of City Block 1084 (Figure 6). Concentrations of VOCs, SVOCs, PAHs, metals, and PCBs were all below Missouri Tier 1 residential RBTLs for indoor inhalation and EPA MCLs (USACE 2017).

2.7.10.8 City Block 1085

Parcel ID 159 at 2342 Montgomery Street (City Block 1085) hosted a foundry, battery manufacturing facility, and an iron works for over 50 years. These historical operations could have resulted in hazardous waste emissions; therefore, the area was considered for follow-up sampling in a Phase II ESA (EOI 2015).

SCI investigated City Block 1085 by excavating a trench (T-1) across most of the vacant property (Figure 5). The following material was observed: tile, roofing, and sheet flooring. ACM was detected in tile at T1-79-30 (SCI 2016).

START investigated Parcels 159 and 160 in City Block 1085 (Figure 3). Arsenic concentrations in surface soil exceeded DTL/background concentration and residential RBTLs. Lead concentrations exceeded DTL/background concentration in all surface soil samples; however, none of the lead concentrations exceeded the residential RBTL. At Parcel 159, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene concentrations in surface soil exceeded non-residential RBTLs; benzo(a)anthracene and indeno(1,2,3-cd)pyrene concentrations exceeded residential RBTLs; and naphthalene concentration exceeded the DTL. At Parcel 160, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene concentrations exceeded the residential RBTL; the naphthalene concentration exceeded the DTL. All other VOCs and SVOCs concentrations were found below screening levels. In groundwater at Parcel 159, analyte concentrations were found either non-detect or below screening levels (Tetra Tech 2016).

2.7.10.9 City Block 1092

The 0.07-acre parcel at 2342 Montgomery Street in City Block 1092 was developed with a two-story residential structure. Exterior finishes included masonry, wood, and unfinished or painted metal surfaces. During the Phase I ESA, the interior of this structure was not inspected due to access restrictions. During the inspection of this parcel, no unusual discolorations, odors, sheens, stains, or stressed vegetation were noted that may have indicated releases of hazardous materials or petroleum products at this parcel. No evidence (e.g., access ways, dispenser island, disturbed concrete, fill pipes, vent pipes, etc.) was noted that may have indicated presence of aboveground storage tanks (AST) or underground storage tanks (UST) at this parcel (EOI 2015).

SCI investigated City Block 1092 by excavating a trench (T-2) across most of the vacant property (Figure 5). The following materials were observed: shingles and light blue transite. ACM was detected in the transite at T2-77-84 (SCI 2016).

START did not investigate City Block 1092.

USACE installed one temporary monitoring well (MW-3) on the south-central side of City Block 1092, adjacent to Montgomery Street (Figure 6). Concentrations of VOCs, SVOCs, PAHs, metals, and PCBs were all found below Missouri Tier 1, residential RBTLs for indoor inhalation, and below EPA MCLs.

2.7.10.10 City Block 1093

City Block 1093 included a property at 2617-2619 North 22nd Street, which had hosted a small machine shop for approximately 40 years from the late 1800s into the early 1900s. Based on the small size and era of the operation, EOI considered its historical use to pose a moderate environmental risk (EOI 2015).

SCI investigated this city block by advancing three DPT borings (SCI-4, SCI-5, and SCI-6) and digging five trenches (T-5, T-6, T-9, T-10, and T-29) (Figures 4 and 5). Lead was detected in one surface soil sample (SCI-5A) at concentration above the DTL/background concentration, but below the residential RBTL. Benzo(a)pyrene was detected at concentration above the DTL, residential RBTL and non-residential RBTL at the same surface soil location (SCI-5A). TPH-diesel range organics (DRO) was detected at SCI-5B within 4 to 8 feet bgs at 10,700 mg/kg—above the DTL and residential RBTL for soil deeper than 3 feet bgs. In groundwater at SCI-5D, concentrations of TPH-DRO and TPH-ORO were found to exceed DTLs; however, TPH-DRO concentration was found below the residential RBTL

(no residential RBTL has been established for TPH-ORO). Trenching activities revealed various colored tiles, shingles, binding compound, and tiles with backing. T6-69-36 contained ACM (SCI 2016).

START did not investigate City Block 1092.

2.7.10.11 City Block 1094

The southwestern corner of City Block 1094 was occupied by tire and battery shops, a filling station, iron works, and machine shops. These operations involved uses of hazardous materials and petroleum products (EOI 2015); therefore, soil samples were collected during the Phase II ESA.

SCI performed trenching at three locations: T-16, T-17, and T-21 (Figure 5). Materials such as sheet flooring, roofing, and tile were encountered, but ACM was not detected in any sample. A DPT investigation was not conducted (SCI 2016).

START investigated Parcels 403, 405, and 407 in City Block 1094 (Figure 3). Five DPT borings were drilled, and soil samples were collected within shallow (0 to 3 feet) and deep intervals (17 to 20 feet). Arsenic concentrations exceeded DTLs at all locations. At Parcel 403, arsenic and lead concentrations exceeded residential RBTLs, and arsenic concentration exceeded non-residential RBTLs in two samples. At Parcel 405, arsenic concentrations exceeded the non-residential RBTL in one sample and the residential RBTL in the other sample. Lead concentrations were above the DTL, but below the residential RBTL. At Parcel 407, arsenic concentrations exceeded the residential RBTL, lead concentrations were above the DTL, and in one case—at P407-1 (0-3)—lead concentration was above the residential RBTL. Methylene chloride concentrations exceeded the DTL in two samples: P403-2 (8-10) and P407-2 (18-20). Concentrations of the following PAHs exceeded residential RBTLs at Parcel 403 (P403-1 [0-3]): benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Benzo(a)pyrene was detected at 6.6 mg/kg, which also exceeded the non-residential RBTL. Furthermore, benzo(a)pyrene concentrations were detected above the residential RBTL at Parcel 407. No other VOC or SVOC concentration was found above a screening level. Groundwater samples could not be collected because the temporary wells did not yield sufficient quantities of water. START conducted a GPR survey of Parcels 403, 404, and 405. The survey suggested presence of a UST near the center of Parcel 403 at approximately 2 feet bgs (Tetra Tech 2016).

Seagull investigated suspected ACM at Structures 2, 4, and 6, which correspond with Parcels 414, 410, and 408, respectively. Chrysotile ACM was found in floor tiles, mastic, Aircell pipe insulation and

associated TSI joint compound at concentrations ranging from 3% to 75%. Approximately 1% Actinolite/Tremolite was found in vermiculite insulation at Structure 4 (Seagull 2016).

2.7.10.12 City Block 1095

The parcels at 2212-2218 Benton Street (City Block 1095) were occupied by an iron works and a printer and roller company for over 20 years. The parcels at 2244-2250 Benton Street hosted a dry cleaner for over 20 years. The properties at 2407-2411 North 22nd Street hosted a filling station for over 40 years. The properties at 2241-2249 North Market Street were occupied by a filling station with several USTs in the 1920s and 1930s (EOI 2015).

SCI investigated City Block 1095 via two GPR surveys, three trenches, and eight DPT borings (Figure 4). One GPR survey at the corner of North Market and North 23rd Streets detected no potential objects. The GPR survey at the corner North Market and North 22nd Streets identified five objects, and during trenching, four USTs were identified. The USTs appeared to have been closed in place.

DPT borings SCI-26 through SCI-34 indicated presence of lead at concentrations above DTL/background concentration, residential RBTL, and non-residential RBTL. Highest concentrations occurred at SCI-29B (787 mg/kg), SCI-33A (324 mg/kg), and SCI-34A (667 mg/kg). Several PAHs were detected in DPT borings. Of note, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene concentrations exceeded DTLs, and residential and non-residential RBTLs. PAH exceedances were also detected at SCI-29A, SCI-30A, SCI-34A, and SCI-36A—all in surface soil. Groundwater grab samples collected at SCI-26, SCI-27, SCI-28, SCI-31, and SCI-33 either were non-detect or not analyzed. In addition to unearthing four USTs at T-32, trenching activities at T-26, T-27, and T-32 yielded various colors of tile, but ACM was not detected (SCI 2016).

START investigated Parcels 423 and 424 in City Block 1095 by advancing two DPT borings and collecting shallow (0 to 3 feet) and deep (18 to 20 feet) soil samples (Figure 3). Soil sample results for metals indicated presence of arsenic and lead at concentrations above DTLs; arsenic concentrations also exceeded the residential RBTL. Concentrations of all VOCs and TPHs were found below DTLs. Concentration of one PAH—benzo(a)pyrene in surface soil at P424 (0-3)—exceeded the residential RBTL (Tetra Tech 2016). Groundwater samples were not collected.

Seagull investigated suspected ACM at Structures 1, 3, and 5, which corresponds with Parcels 420, 426, and 427, respectively. Chrysotile ACM was found in floor tiles, mastic, sheet vinyl flooring, and drywall joint compound at concentrations ranging from 2% to 25% (Seagull 2016).

2.7.10.13 City Block 2314

The southwestern corner of City Block 2314 has been occupied by chemical companies, laundries, and a battery company that possibly used hazardous materials. Parcels at 2200-2202 Mullanphy Street, 1505-1507 North 22nd Street, and 2201-2203 Cass Avenue hosted historical service station operations for over 60 years (EOI 2015).

City Block 2314 was not investigated during the Phase II ESA.

START investigated City Block 2314 (Parcels 545, 548, 549, and 550) by drilling a total of 11 borings (Figure 3). Soil sample results for metals indicated presence of arsenic at concentrations above the residential RBTL. Lead concentrations exceeded the DTL/background concentration in all soil samples. One sample from P550-1 (3-5) was found to contain lead at 3,800 mg/kg, exceeding the non-residential RBTL. Soil samples collected at Parcel 548 also contained concentrations of benzene and methylene chloride above the DTL; one sample (P548-1(15-17)) contained a benzene concentration of 4.3 mg/kg, also exceeding the non-residential RBTL. PAHs detected at concentrations above their respective DTLs included: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and naphthalene at Parcel 550; naphthalene at Parcel 548; and benzo(a)pyrene at Parcel 545, where benzo(a)pyrene concentration also exceeded the residential RBTL. A groundwater sample collected from P548-1 contained arsenic (0.013 mg/L) above the DTL and residential RBTL (0.010 mg/L); this same sample yielded concentrations of benzene (6.4 mg/L) and naphthalene (0.1 mg/L) exceeding the non-residential RBTLs of 1.06 and 0.075 mg/L, respectively. In addition, that sample contained methyl tertiary butyl ether (MTBE), TPH-gasoline range organics (GRO), and 2-methyl-naphthalene concentrations exceeded residential RBTLs (Tetra Tech 2016).

START also concluded that vapor intrusion (VI) exposure potential may exist at Parcel 548 as a result of elevated VOC concentrations found in soil and groundwater samples. VI is a process by which chemicals in soil and groundwater, particularly VOCs, migrate to indoor air above a contaminated area. This report does not compare all analytical results to indoor inhalation MRBCA RBTLs established to evaluate VI exposure potential. Therefore, additional evaluation and assessment of media at Parcel 548 and/or mitigating actions to prevent exposure to VOC-impacted media may be desirable depending on future use of the site.

START conducted a GPR survey of Parcels 548, 549, and 550. The GPR survey suggested presence of a UST near the center of Parcel 548 (Tetra Tech 2016).

Seagull investigated suspected ACM at Structures 11 and 12, which correspond with Parcels 339 and 328, respectively. Chrysotile ACM was found in flashing at Structure 12 (up to 6%); however, ACM was not detected in Structure 11 (Seagull 2016).

Finally, Wester investigated backfill material at Parcel 545 for radiological levels. Wester detected NORM containing Uranium-238 and Thorium-232 isotopes. Specific activity of the brick sample was 2.3 picoCuries per gram (pCi/g) of U-238 and 3.1 pCi/g of Th-238. Average specific activities of the three soil-backfill samples were 19.7 pCi/g for U-238 and 9.9 pCi/g for Th-232 (Wester 2017a). Levels detected were consistent with what would be expected in bricks and coal ash (Wester 2017b).

2.7.10.14 City Block 2315

In City Block 2315, properties at 2409 to 2423 Cass Avenue have been occupied by auto repair operations and a plating company. Properties at 2301 to 2307 Cass Avenue hosted a dry cleaner and hatter for over 40 years (EOI 2015).

SCI investigated City Block 2315 by advancing two DPT borings (SCI-75 and SCI-77) and digging five trenches (T-74 to T-78) (Figures 4 and 5). Lead concentration exceeded the DTL/background concentration in surface soil at SCI-75A, but was below residential and non-residential RBTLs. Benzo(a)pyrene was detected in surface soil (SCI-77A) at 0.65 mg/kg, just above the DTL and residential RBTL of 0.62 mg/kg. Other reported VOCs and SVOCs concentrations in groundwater at SCI-75 were not found to exceed screening levels. Trenching revealed presence of roofing material, sheet flooring, and plaster in trenches T-74 through T-78. ACM was not detected in any material collected from the trenches (SCI 2016).

Historical operations in City Block 2315 could have resulted in releases of chemicals to soil and groundwater; therefore, the area was investigated during the Phase II Brownfields Assessment. START targeted its investigation at Parcels 325 and 327. START drilled four borings and collected soil samples. Results of metals analyses indicated arsenic and lead concentrations above their respective DTLs/background concentrations; arsenic concentrations also exceeded its residential RBTL, which is the same value as the DTL. All concentrations of VOCs and TPHs were either non-detect or below DTLs. All VOCs, TPH, and PAHs concentrations were below laboratory reporting limits or DTLs, except for benzo(a)pyrene concentration at P325-2 (3-5), which exceeded the DTL but was below RBTLs. Groundwater samples were not collected at City Block 2315 (Tetra Tech 2016).

USACE installed two temporary monitoring wells at City Block 2315—MW-8 at the southwest corner of Parcel 325 in City Block 2315 (corner of North 25th Street and Cass Avenue), and MW-9 on the north side of Parcels 338 and 339 (Figure 6). Detected concentrations of VOCs, SVOCs, PAHs, metals, and PCBs at both wells were found below Missouri Tier 1, Soil Type 1 residential RBTLs for indoor inhalation, and below EPA MCLs (USACE 2017).

2.7.10.15 City Block 2316

The entirety of City Block 2316 was occupied by dry cleaning, filling station, factory (i.e., glue, boxes, and batteries), and auto repair operations. Based on possibilities of improper storage, treatment, or disposal of hazardous waste and petroleum products to the environment, the Phase I ESA recommended additional investigation of this city block (EOI 2015).

SCI sampling planned at DPT borings SCI-72 through SCI-74 did not occur; however, START collected soil samples at 16 DPT boring locations covering Parcels 151, 152, 154, 155, and 158. One boring in Parcel 156 encountered refusal; therefore, sampling could not occur there (Figure 3).

Results of metals analyses of soil samples indicated arsenic and lead concentrations above DTLs in nearly every sample; arsenic concentrations also exceeded the residential RBTL. All concentrations of VOCs and TPHs were found below DTLs or laboratory reporting limits. At Parcel 151, benzo(a)pyrene concentrations in surface soil exceeded the non-residential RBTL, while benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene concentrations exceeded residential RBTLs. At Parcel 152, one sample collected in surface soil contained benzo(a)pyrene above the residential RBTL. All other concentrations of PAHs at Parcel 152 were below DTLs. At Parcel 154, benzo(a)pyrene concentrations in surface soil exceeded the non-residential RBTL, while benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene concentrations exceeded residential RBTLs. Concentrations of metals, VOCs, TPHs, and PAHs in groundwater samples collected at Parcels 151, 152, and 154 were either below detection limits or lower than DTLs. However, groundwater at Parcel 158 was found to contain concentrations of benzene, 2-methyl naphthalene, and naphthalene exceeding residential RBTLs (SCI 2016).

START conducted a GPR survey of Parcels 156, 157, and 158. The survey detected an unknown line running from an area of disturbance toward the southeast corner of Parcel 158. The disturbance was at a depth of 2 to 3 feet bgs, and could be related to USTs (Tetra Tech 2016).

2.7.10.16 City Block 2317

Parcels at 2500-2536 Howard Street (City Block 2317) were occupied by multiple manufacturing operations for over 80 years, including metal stamping, a rubber company, a cleaner and hatters, and a dyeing operation. The property at 1600 North Jefferson, southwestern corner of Parcel 150, hosts a dry cleaner (EOI 2015).

Shannon & Wilson (S&W) conducted a Phase I ESA at City Block 2317, Parcel 150 (also known as the Faultless Linen facility). In May 2011, near proposed utility locations, S&W collected surface soil samples found to contain concentrations of benzo(a)pyrene above the non-residential RBTL. S&W completed a Phase II investigation that confirmed exceedances of soil contaminants above DTLs and likely RBTLs; therefore, S&W recommended a Tier I Risk Assessment. The risk assessment concluded that the only chemical of concern was benzo(a)pyrene in surficial soils (S&W 2012).

SCI did not investigate City Block 2317; however, START investigated Parcels 149 and 150 (Figure 3). Results of metals analyses in soil indicated arsenic and lead concentrations above DTLs in nearly every sample; arsenic concentrations also exceeded the residential RBTL. Parcel 149 hosted concentrations of methylene chloride in soil above the DTL, but below the residential RBTL. Benzo(a)pyrene concentrations in soil exceeded the residential RBTL in surface soil at P149-2 (0-3) and the non-residential RBTL at P150-1 (0-3). Benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene concentrations exceeded respective DTLs in subsurface soil at P149-2 (14-16). Naphthalene was also detected in surface soil at concentration above the DTL at P150-1 (0-3). All concentrations of metals, VOCs, TPHs, and PAHs in groundwater were found below DTLs or detection limits (Tetra Tech 2016).

2.7.10.17 City Block 2318

City Block 2318 was occupied by several residential houses and undeveloped land that included grasses, trees, and shrubs. Parcel 299 had an asphalt-paved parking lot used by neighboring Faultless Linen facility (EOI 2015).

S&W conducted a Phase I ESA at City Block 2317, which also included part of City Block 2318 (Parcel 299)—a parking lot for the former Faultless Linen facility (refer to Section 2.7.6.16) (S&W 2012).

SCI investigated City Block 2318 by digging two trenches (T-73 and T-74) (Figure 5). SCI noted roofing material, but did not find evidence of ACM (SCI 2016).

START did not investigate City Block 2318.

USACE installed one temporary monitoring well (MW-7) near the northwest corner of Parcel 299 and the south side of Parcel 298 in City Block 2318 (Figure 6). This location is across North 25th Street from the former Faultless Laundry facility and adjacent to the northwest corner of the facility's parking lot. Concentrations of VOCs, SVOCs, PAHs, metals, and PCBs were all found below Missouri Tier 1, residential RBTLs for indoor inhalation, and below EPA MCLs (USACE 2017).

2.7.10.18 City Block 2319

In City Block 2319, historical trucking operations reportedly occurred on the parcels at 2222 to 2228 Howard Street, posing a REC to the Site; however, based on the small size and brief period of operations, EOI concluded that historical use posed a moderate environmental risk (EOI 2015).

At City Block 2319, SCI drilled one soil boring (SCI-71) and excavated one trench (T-71) (Figures 4 and 5). Lead concentration exceeded the DTL/background in surface soil at SCI-71A, but was below the residential RBTL. All concentrations of PAHs and VOCs in soil were found non-detect or below screening levels. All concentrations of VOCs and SVOCs found in groundwater were non-detect or below screening levels. Trench T-71—identified as T-72 on SCI figures, but with sampling results—revealed various colored tiles and shingles. Tile collected at T71-148-140 contained ACM (SCI 2016).

START investigated Parcel 531 at City Block 2319 via two DPT borings to collect soil samples and one boring to sample groundwater (Figure 3). Analytical results indicated arsenic and lead concentrations above DTLs and residential RBTLs in surface soil. In subsurface soil, arsenic concentrations exceeded the residential RBTL, and in one case at P531-1 (13-15), arsenic concentration of 16 mg/kg exceeded the non-residential RBTL of 15.9 mg/kg. In subsurface soil, lead concentration exceeded the DTL, but was below the residential RBTL. All concentrations of VOCs and TPHs in soil were found either below laboratory reporting limits or at concentrations below their respective DTLs. Concentration of only one PAH (benzo(a)pyrene) exceeded the residential RBTL in surface soil at P531-1 (0-2). In groundwater at Parcel 531, no exceedances of metals, VOCs, TPHs, or PAHs concentrations were detected. START also collected a geotechnical sample near the southeast corner of City Block 2319 (northwest corner of Mullanphy and 22nd Street). Sample GT-4 was classified as light reddish brown silty clay with 99.5% clay and silt, and 0.5% sand (Tetra Tech 2016).

Seagull investigated suspected ACM at Structures 13, 30, 31, and 32, which correspond with Parcels 533, 540, 541, and 543, respectively. Samples could not be safely collected from Structure 32 because it had

collapsed. Chrysotile ACM (up to 8%) was found in Structures 13, 30, and 31 in mastic and floor tile (Seagull 2016).

2.7.10.19 City Block 2324

According to available historical information, Parcel 510 at 2200 to 2202 Madison Street in City Block 2324 hosted historical auto body and dry cleaner operations. These historical operations involved uses of petroleum products and chlorinated solvents, which could have resulted in improper releases of chemicals into the environment (EOI 2015).

SCI investigated City Block 2324 via two borings and four trenches (Figures 4 and 5). Results from samples collected at borings SCI-66 and SCI-67 indicated lead exceedances of the DTL/background concentration at both shallow soil locations. Lead in shallow soil at SCI-67A was detected at 841 mg/kg, exceeding the non-residential RBTL. Benzo(a)pyrene concentrations also exceeded the DTL and residential RBTL in both surface soil samples, and in one sample from 10 to 15 feet; however, concentrations were below the non-residential RBTL. All concentrations of VOCs in soil were found either non-detect or below DTLs. In groundwater at SCI-66, concentrations of several PAHs were found above DTLs, but all were below residential RBTLs. Trenching at T-66, T-69, and T-70 yielded plaster, colored tile, roofing, and sheet flooring. ACM was not encountered in these three trenches (SCI 2016).

START did not investigate City Block 2324.

2.7.10.20 City Block 2325

Properties at 2301 to 2313 Howard Street (City Block 2325) hosted a dry cleaner and a variety of plastics and machinery manufacturing operations. Historical operations involved uses of chlorinated solvents and hazardous materials associated with plastics and machinery manufacturing; therefore, these properties were flagged in the Phase I for additional consideration (EOI 2015).

SCI investigated City Block 2325 by drilling three DPT borings (SCI-68, SCI-69, and SCI-70) and excavating four trenches (T-63, T-64, T-67, and T-68) (Figures 4 and 5). Lead concentration exceeded the DTL/background at one surface soil location—SCI-70A; benzo(a)pyrene concentration also exceeded the DTL and residential RBTL at this location. Concentrations of VOCs and SVOCs in groundwater samples collected at SCI-68 and SCI-68D were found either non-detect or below DTLs. Trenching revealed materials such as roofing, flooring, drywall, pipe coating, plaster, and shingles; however, ACM was not detected in any sample (SCI 2016).

START collected a geotechnical sample at the northwest corner of City Block 2325 (southeast corner of Madison and 25th Streets). Sample GT-3 was classified as reddish brown silty clay with 91.5% clay and silt, and 8.5% sand (Tetra Tech 2016) (Figure 3).

Seagull investigated ACM at Structures 14 and 40, which correspond with Parcels 272 and 265, respectively. Samples could not be safely collected from Structure 14 because it had collapsed. Chrysotile ACM (up to 8%) was found in Structure 40 in floor tiles, floor levelers, and mastic (Seagull 2016).

USACE installed one temporary monitoring well (MW-6) near the north side of Parcel 277 in City Block 1084, where a former dry cleaner had been located (Figure 6). Concentrations of SVOCs, PAHs, metals, and PCBs were all found below Missouri Tier 1, residential RBTLs for indoor inhalation, and below EPA MCLs. However, PCE was detected at 32 µg/L, above the MCL of 5 µg/L (USACE 2017).

2.7.10.21 City Block 2326

In City Block 2326, parcels at 2500 to 2530 Madison Street were occupied by shoe manufacturing operations for over 50 years. Properties at 2521 to 2525 Howard Street were occupied by trucking and hauling operations for over 40 years (EOI 2015). Based on historical vehicle maintenance activities, sampling of soil and groundwater occurred during the Phase II ESA and the Phase II Targeted Brownfields Assessment.

At City Block 2326, SCI collected soil samples at the following locations: SCI-58, SCI-59, SCI-61, SCI-63, SCI-64, and SCI-65 (Figure 4). Lead concentrations exceeded the DTL/background concentration at several locations in surface soil, but in all subsurface samples were below DTLs. The two highest concentrations of lead were 388 mg/kg (SCI-58A) and 679 mg/kg (SCI-63A)—both above the residential RBTL of 260 mg/kg. At SCI-63A, lead concentration was also detected above the non-residential RBTL of 660 mg/kg. Arsenic concentrations exceeded DTL/background concentration and RBTLs (residential and non-residential) at the two locations SCI-63A and SCI-65B. Highest concentration of arsenic was 27.9 mg/kg at SCI-65B. Concentrations of several PAHs exceeded DTLs, residential RBTLs, or non-residential RBTLs. Naphthalene concentration exceeded the DTL at SCI-64B (1.47 mg/kg), but was below the residential RBTL.

The following PAHs were detected at concentrations above DTLs, but below residential RBTLs in groundwater at SCI-58: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, pyrene, and naphthalene (analyzed as a VOC). At SCI-64, TPH-DRO, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and naphthalene concentrations exceeded DTLs, but were

below RBTLs. Trenching at T-62 revealed various colored and speckled tiles and sheet flooring. ACM was not detected in any building material sample (SCI 2016).

START investigated Parcel 146 by drilling two DPT borings (Figure 3). Analytical results indicated concentrations of arsenic exceeding DTLs and residential RBTLs. Lead concentrations exceeded DTLs in all samples; in one surface soil sample at P146-1 (0-3), lead was detected at 300 mg/kg—above the residential RBTL. Benzene was detected at 0.11 mg/kg at P146-2 (0-3)—above the DTL but below the residential RBTL. At Parcel 146, concentration of one PAH—benzo(a)pyrene—was detected in surface soil at 2.1 mg/kg, above the non-residential RBTL. Groundwater sampling could not occur at Parcel 146 due to dry conditions (Tetra Tech 2016).

2.7.10.22 City Block 2327

Properties in City Block 2327—specifically 2530 to 2536 Maiden Lane—were used as historical auto repair facilities in 1965. Properties at 1800 to 1812 hosted a wrecking operation from 1986 to 1991. According to the Phase I ESA, these historical uses pose RECs to the Site; however, considering the brief periods of operation at the Site, EOI concluded that these historical auto repair activities pose a moderate environmental risk to the Site (EOI 2015).

SCI investigated historical activities at City Block 2327 via six DPT borings (SCI-46 through SCI-51) and two trenches (T-46 and T-48) (Figures 4 and 5). One surface soil sample (at SCI-46A) was found to contain concentrations of lead exceeding the DTL, but below RBTLs. Benzo(a)pyrene concentration exceeded the DTL and residential RBTL at SCI-46A. Concentrations of VOCs and SVOCs in groundwater samples collected at SCI-47 and SCI-50 were found either non-detect or below DTLs. Trenching results (T-46 and T-48) were not shown (SCI 2016).

START did not investigate City Block 2327.

Seagull investigated suspected ACM at Structures 18, 19, and 20, which correspond with Parcels 126, 128, and 134, respectively. Samples could not be safely collected from Structure 20 because it had collapsed. Chrysotile ACM was found in Structures 18 and 19 in the following materials: floor tile, mastic, joint compound, and flashing. Concentrations of ACM ranged from 3% to 10% (Seagull 2016).

2.7.10.23 City Block 2328

The southeastern corner of City Block 2328 was occupied by machinery manufacturing and hat factory operations (EOI 2015).

SCI investigated City Block 2328 by sampling at three DPT locations (SCI-52, SCI-53, and SCI-54) and digging two trenches (T-49 and T-50) (Figures 4 and 5). One surface soil sample, from SCI-54A, contained concentrations of lead exceeding the DTL/background concentration but below RBTLs. Concentrations of PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene) were detected above DTLs and residential RBTLs in surface soil at SCI-52A; benzo(a)pyrene concentrations were also above non-residential RBTLs at SCI-52A and SCI-54A. All detections of VOCs in soil and groundwater were below detection limits or DTLs. Trenching at T-50 revealed sheet flooring, tile, roofing material, and a fireproof door with associated material. Two samples collected from the fireproof door were found to be ACM (SCI 2016).

START did not investigate City Block 2328.

Seagull investigated ACM at Structures 16 and 17, which correspond with Parcels 248 and 247, respectively. ACM was not found in Structure 17. Chrysotile ACM (up to 6%) was found in floor tile in Structure 16 (Seagull 2016).

2.7.10.24 City Block 2329

City Block 2329 includes Parcels 482 and 483, situated from 2201 to 2207 Madison Street. These parcels have been historically occupied by an auto repair facility and a dry cleaner. Historical operations involved uses of petroleum products and chlorinated solvents, and could have resulted in releases of hazardous chemicals or petroleum; therefore, the Phase I ESA listed these Parcels for additional consideration (EOI 2015).

SCI investigated historical activities at City Block 2329 via two soil borings, SCI-55 and SCI-57, and two trenches (Figures 4 and 5). One surface soil sample, at SCI-57A, was found to contain concentrations of lead exceeding the DTL/background concentration but below RBTLs; benzo(a)pyrene concentration also exceeded the DTL and residential RBTL at this location. Concentrations of VOCs and SVOCs in groundwater at SCI-55 were found either non-detect or below DTLs. Trenching at T-60 and T-61 revealed roofing material, but no ACM (SCI 2016).

START did not investigate City Block 2329.

Seagull investigated ACM at Structure 15, which corresponds with Parcel 488. Chrysotile ACM (up to 3%) was found in floor tile (Seagull 2016).

USACE installed one temporary monitoring well (MW-5) at the northeast corner of City Block 2329, at the corner of Maiden Lane and North 22nd Street (Figure 6). Concentrations of VOCs, SVOCs, PAHs, metals, and PCBs were all found below Missouri Tier 1, residential RBTLs for indoor inhalation, and below EPA MCLs (USACE 2017).

2.7.10.25 City Block 2345

City Block 2345 was occupied by residential housing and undeveloped land that included grasses, trees, and shrubs. Parcel 481 hosted a 12,000-square-foot, one-story building on a concrete slab. The building was used as office space, classrooms, and outdoor recreation space. Evidence of potential environmental degradation was not found during the Phase I ESA (EOI 2015).

SCI investigated City Block 2345 via trenches T-37, T-38, T-43, T-44, and T-45 (Figure 5). Material retrieved from the trenches included various colored tile, tar, roofing material, and sheet flooring. One sample collected at T45-111-22 contained 60% chrysotile ACM in beige fibrous material (SCI 2016).

START did not investigate City Block 2345.

2.7.10.26 City Block 2346

Properties at 2344 to 2348 North Market Street were used as auto repair facilities from 1950 to 1965, and the southwestern corner of City Block 2346 was used as a junk yard for approximately 15 years.

Considering the brief period and small sizes of the operations, EOI concluded that historical uses posed moderate environmental risks (EOI 2015).

City of St. Louis Building Permits show that two USTs were installed at Parcel 234 in 1926. Other available historical information indicates that this portion of the city block hosted a wire and iron works operation for over 30 years. Historical operations could have resulted in improper storage or handling of hazardous waste or petroleum products; therefore, the Phase I ESA noted this parcel as a REC (EOI 2015).

SCI investigated historical activities at City Block 2346 via nine DPT borings (SCI-37 through SCI-45), three trenches (T-35, T-36, and T-42), and a GPR survey (Figures 4 and 5). Six of nine surface soil

samples contained lead at concentrations above the DTL/background concentration; four of the six exceedances were also above residential and non-residential RBTLs. All metals concentrations in subsurface soil samples were below DTLs/background concentrations. Benzo(a)pyrene concentrations were above DTLs and the residential RBTL at five locations, and in two soil samples also exceeded the non-residential RBTL. Except for SCI-43B, all exceedances occurred in shallow soil. All concentrations of VOCs in soil were below DTLs. Groundwater grab samples were collected at SCI-37, SCI-41, SCI-41D, and SCI-45, and analyzed for VOCs and SVOCs. TPH-ORO concentrations exceeded the DTL at SCI-41 and SCI-45. Trenching revealed the following materials: sheet flooring, tile, and plaster. Pink checkered tile collected at T35-104-40 contained chrysotile in the backing (SCI 2016).

START collected a geotechnical soil sample within 13 to 15 feet bgs near the northeast corner of City Block 2346 (southwest corner of Market and 23rd Streets). Sample GT-2 was classified as light gray brown with 98.6% clay and silt, and 1.4% sand (Tetra Tech 2016) (Figure 3).

Seagull investigated suspected ACM at Structures 21 and 22, which correspond with Parcels 223 and 222, respectively. Chrysotile ACM was found in sheet vinyl flooring in Structure 21 (up to 20%) and in glaze from windows at Structure 22 (up to 4%) (Seagull 2016).

2.7.10.27 City Block 2347

In City Block 2347, the property at 2516 North Market, Parcel 89 hosted a dry cleaner. EOI concluded that historical operations involving uses of chlorinated solvents (i.e., PCE) pose a REC to the Site (EOI 2015).

SCI investigated City Block 2347 via soil borings SCI-35 and SCI-36, and trenches T-33, T-34, T-39, T-40, and T41 (Figures 4 and 5). All detected concentrations of metals, VOCs, TPH, and SVOCs were below DTLs; however, benzo(a)pyrene concentration exceeded DTLs and RBTLs in surface soil at SCI-36A. Groundwater was not collected from either SCI-35 or SCI-36. Trenching activities at City Block 2347 revealed sheet flooring and roofing material. ACM was not detected (SCI 2016).

START did not investigate City Block 2347.

Seagull investigated ACM at Structures 23, 26*, 26**, 27, and 28, which correspond with Parcels 85, 90, 91, 97, and 98, respectively. Structure 26 is shown three times on the map (Figure 7). In City Block 2347, Structure 26 corresponds with Parcels 90 and 91. In City Block 1081, Structure 26 corresponds with Parcel 76. In addition, Structure 26 is listed as collapsed, and thus no samples were collected there.

Asbestos sampling could not occur in Structure 23 because it had collapsed. Chrysotile ACM (up to 8%) was found in Structures 27 and 28 in caulk, glaze, and seam tape insulation; concentrations ranged from 3% to 60% (Seagull 2016).

USACE installed one temporary monitoring well (MW-4) near the center of City Block 2347 (Figure 6). Concentrations of VOCs, SVOCs, PAHs, metals, and PCBs were all found below Missouri Tier 1, Soil Type 1 residential RBTLs for indoor inhalation, and below EPA MCLs (USACE 2017).

2.8 WASTE CHARACTERISTICS

This section discusses waste characteristics of known contaminants at the Site or removed from the Site.

2.8.1 Asbestos-containing Material

Asbestos is a fibrous set of six naturally occurring silicate minerals, all having in common their eponymous asbestiform habit: long (roughly 1:20 aspect ratio), thin fibrous crystals, with each visible fiber composed of millions of microscopic "fibrils" that can be released by abrasion and other processes. Asbestos fibers are soft and flexible yet resistant to heat, electricity, and chemical corrosion. Pure asbestos is an effective insulator, and it can also be mixed into cloth, paper, cement, plastic, and other materials to make them stronger. These properties of asbestos supported its use for many years in a number of different commercial and industrial settings, as well as in a wide range of consumer products. Although its use has diminished in recent decades, many products still contain asbestos, especially in older homes, schools, and public buildings.

2.8.2 Chlorinated Volatile Organic Compounds

Chlorinated volatile organic compounds (CVOC) are organic compounds in which a chlorine atom has replaced a hydrogen atom. CVOCs are used in a variety of products, most notably as solvents, degreasers, and paint removers. CVOCs detected at concentrations exceeding DTLs or RBTLs are discussed below.

2.8.2.1 Methylene Chloride

Methylene chloride is a solvent used in a variety of industries and applications, such as adhesives, paint and coating products, pharmaceuticals, metal cleaning, chemical processing, and aerosols.

EPA's final risk assessment evaluated health risks to consumers and workers using methylene chloride in paint and coating removal products, as well as bystanders in the workplace and in residences where

methylene chloride paint and coating removers are used. Paint and coating removal poses some of the highest exposures among the various uses of methylene chloride (EPA 2016c). Because of its use as a cleaner, methylene chloride is a common analytical laboratory contaminant.

2.8.2.2 Tetrachloroethene

PCE is a nonflammable colorless liquid, and is typically used as a dry cleaning agent and metal degreasing solvent. It is also a starting material (building block) for making other chemicals, and is used in some consumer products (ATSDR 2017a). PCE is denser than water and tends to be found at greater depths with increasing distance from the source area.

PCE was introduced as a dry cleaning solvent in 1934, and by 1948 had replaced carbon tetrachloride (CCl₄) as the major chlorinated dry cleaning solvent used in the United States (petroleum solvents still dominated overall). By 1962, dry cleaning operations accounted for 90 percent of the PCE used in the United States. At one time, PCE had been mixed with grain protectants and certain liquid grain fumigants, but this was no longer approved by 1980 (Meister Publishing Company [Meister] 1980). PCE can degrade to daughter compounds with fewer chlorine atoms, such as to TCE, *cis*-1,2-dichloroethene (DCE), or vinyl chloride.

2.8.2.3 Trichloroethene

TCE is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste (ATSDR 2003). It is used mainly as a solvent to remove grease from metal parts, and is an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. TCE is denser than water and is typically found at greater depths with increased time or distance from a source area. TCE is reasonably anticipated to be a human carcinogen. Drinking small amounts of TCE for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women (ATSDR 2003). The *cis* and *trans* isomers of 1,2-DCE, as well as vinyl chloride, are common degradation products of TCE.

2.8.3 Metals

Environmental behaviors of metals (i.e., low-temperature geochemistry) have been widely studied, and characteristics of individual metals are generally better understood than those of individual organic compounds. On the other hand, it is sometimes difficult to distinguish between naturally occurring and introduced metals.

The most important factors controlling metals fate and transport are solubility, oxidation-reduction (redox) behavior, aqueous speciation, and sorption behavior, all of which are functions of the ambient geochemical environment. Biotransformation processes involving some metals (e.g., copper, arsenic, lead, thallium) can be important under certain environmental conditions. All metals are, to variable extents, subject to cation-exchange reactions with minerals present in the environment. The extent to which cation-exchange occurs depends on the mineral species present and on pH, as well as characteristics of individual metals.

Mobilities of metals within environmental matrices depend on numerous factors such as relative stabilities of individual valence states (element-specific), oxygen content, pH and redox potential (Eh) conditions, and presence of available complexing agents.

Typically, metals have a high adsorptive affinity for inorganic mineral surfaces and organic matter. Adsorption, for most metals, is highly pH-dependent, with desorption generally more favored at a low pH, and sorption mechanisms dominating at higher pH conditions. However, types of clays present and their surface charges, in relation to soil pH values, determine whether sorption or desorption will occur.

Metals detected at the Site at concentrations above screening levels are discussed in the following subsections.

2.8.3.1 Arsenic

Arsenic (As) occurs predominantly in the As^{+3} and As^{+5} valence states, and although certain conditions may promote formation of arsenous (H_3AsO_3) or arsenic (H_3AsO_4) acid, the oxidation state of arsenic is the factor that seems to control arsenic solubility. The inorganic state is dominant even though arsenic is involved in biological cycling that can form soluble organic complexes. A number of studies have shown that arsenic is both methylated and demethylated during biological cycling, and the processes seem to more or less cancel each other out.

Redox chemistry of arsenic is highly analogous to that of iron and manganese, and arsenic tends to be closely associated with these two elements in aqueous systems. Under aerobic conditions, As^{+5} is the predominant species. Pentavalent arsenic is highly insoluble and tends to be strongly adsorbed on ferromanganous precipitates (i.e., As^{+5} follows the oxidized species of iron [Fe^{+3}] and manganese [Mn^{+4}]). Thus, in oxidated water, arsenic is primarily associated with particulate phases. Under reducing or anoxic conditions, arsenic is reduced to As^{+3} , which is soluble in water. Notably, arsenic may also form complexes with anthropogenically introduced organic compounds, which may affect geochemical behavior of arsenic (Smith et al. 1996).

Arsenic is adsorbed principally onto clays, aluminum hydroxides, ferromanganese oxides, and organic compounds. In general, pentavalent arsenic has a greater adsorptive affinity than trivalent arsenic.

Arsenic occurs naturally in Mississippian and Pennsylvanian strata, which are rich in carbon. Natural levels of arsenic range from 1 to 40 mg/kg (EPA 2016b). Based on results from 1,140 samples collected throughout Missouri as part of a geochemical survey, the geometric mean (i.e., average) concentration was 8.7 mg/kg, with an observed range of 2.5 to 72 mg/kg (Tidball 1984). Arsenic in St. Louis County averages 10.56 mg/kg with a range of 4.09 to 17.43 mg/kg (USGS 2017).

2.8.3.2 Lead

Lead exists in three different oxidation states: 0, +2, and +4. The +2 oxidation state is the most common stable ionic aqueous species. Although metallic lead is insoluble in water, it can be solubilized by some acids. Industrial compounds containing lead are also soluble. Under aerobic conditions, PbSO_4 , and to a lesser extent PbCO_3 , control lead solubility; whereas, under anaerobic conditions, PbS concentrations mediate aqueous lead solubility. Lead may also exist in soluble organic complexes (i.e., humic and fulvic acids) in aqueous matrices. Lead-containing organo-metallic complexes may be other forms of dissolved lead in aqueous matrices on the Site. Lead adsorbs principally to clays, hydrous iron and manganese oxides, mineral surfaces, and organic compounds. Lead adsorption is very pH-dependent, with low pH conditions favoring desorption. Lead in soil is not easily taken up by plants; it is strongly complexed to organic materials in aquatic systems. (Clement 1985 and EPA 1979).

Lead occurs naturally in the environment. Minerals like Galena (lead sulfide) are abundant and widespread. Missouri has numerous lead mines and even recognized mining districts, such as the Central Mining District, Old lead belt, and Tri-State Lead/Zinc District. Natural levels of lead range from 50 to 400 parts per million (EPA 2017). Lead has been mined and used in plumbing, solders, paint, batteries, gasoline, ceramics, ammunition, cosmetics, and paint.

Based on results from 1,140 samples collected throughout Missouri as part of a geochemical survey, the geometric mean (i.e., average) concentration was 20 mg/kg, with an observed range of 10 to 7,000 mg/kg (Tidball 1984). Lead in St. Louis County averages 40.95 mg/kg with a range of 15.24 to 118.77 mg/kg (USGS 2017).

2.8.4 Polycyclic Aromatic Hydrocarbons

PAHs are a group of more than 100 different chemicals formed by incomplete burning of fossil fuels or other organic substances. Most PAHs enter the environment as emissions to the atmosphere from volcanoes, forest fires, wood burning, and motor vehicle exhaust. PAHs usually occur naturally as complex mixtures, rather than as a single compound. PAHs are used in some medicines, and in production of dyes, plastics, and pesticides. They are contained in asphalt, and can be found in crude oil, coal, coal tar pitch, creosote, and roofing tar. PAHs can be introduced to surface water via atmospheric deposition, industrial discharge, municipal waste water, and improper disposal of used motor oil.

Sorption of PAHs to soil and sediments generally increases with increasing particulate surface area and increasing organic carbon content. PAHs can be preferentially found in sediments, as they have low solubility and a strong affinity for organic carbon in particulate matter; therefore, PAH concentrations in sediments are generally much higher than those in surface water. In sediments, PAHs can biodegrade or accumulate in aquatic organisms. PAHs in soil degrade mostly by microbial metabolism; however, they can also volatilize, biodegrade, undergo abiotic degradation (photolysis and oxidation), or accumulate in plants (ATSDR 2017b).

The following PAHs were detected at the Site in soil at concentrations above DTLs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd) pyrene, and naphthalene.

2.8.5 Petroleum Hydrocarbons

2.8.5.1 Total Petroleum Hydrocarbons

TPH refers to a suite of organic hydrocarbons derived from crude oil. TPH analytical methods report concentration of purgeable hydrocarbons in the gasoline range (C6 to C10), extractable hydrocarbons in the diesel range (C10 to C21), and extractable hydrocarbons in the oil range (C21 to C35). TPH-GROs are generally lighter than water and often volatile; TPH-DROs and -OROs are also lighter than water, but heavier than TPH-GROs and less volatile in the environment.

Indigenous microbes have been shown to degrade organic compounds over most of the TPH-GRO, -DRO, and -ORO range, although those at the lower end of TPH-GRO range are preferentially removed via volatilization. Benzene, toluene, ethylbenzene and xylenes (BTEX) and other compounds in the gasoline range are preferentially volatilized, thus decreasing concentrations of these compounds in the liquid form.

Oxygen content, pH, moisture content, temperature, nutrient concentrations (particularly nitrogen), and microbiota affect the rate of biodegradation. Presence of oxygen is essential for biodegradation of petroleum hydrocarbons; anaerobic decomposition rates are extremely low.

As TPH concentration rises, the degradation rate decreases. When concentration reaches saturation conditions, biodegradation in the plume center is low, but occurs along the plume margins controlled by the oxygen supply. Presence of heavy metals can also inhibit biodegradation (ATSDR 2017c).

2.8.5.2 Benzene

High volatility of benzene is the controlling physical property in environmental transport and partitioning of this chemical. Benzene is readily degraded in water under aerobic conditions. Microbial degradation of benzene is influenced by many factors, including microbial population, dissolved oxygen (DO), nutrients, other sources of carbon, inhibitors, temperature, pH, and initial concentration of benzene. Laboratory studies of microbial degradation of benzene by mixed cultures of microorganisms in gasoline-contaminated groundwater revealed that both oxygen and nitrogen concentrations are major controlling factors in biodegradation of benzene.

Benzene biodegradation under anaerobic conditions does not readily occur. When DO is depleted, an alternative electron acceptor such as nitrate, carbonate, or iron (Fe^{+3}) must be available, and microbes capable of using the alternative electron acceptor to degrade the benzene must be present. Use of water as an oxygen source in anaerobic degradation of benzene has been demonstrated.

When mixtures of BTEX are present in an anaerobic environment, a sequential utilization of the substrate hydrocarbons occurs, with toluene usually the first to undergo degradation, followed by the isomers of xylene in varying order. Benzene and ethylbenzene tend to be degraded last, if degraded at all (Tetra Tech EM Inc. 2006).

3.0 HAZARD RANKING SYSTEM FACTORS

This section discusses sources of contamination and various contaminant migration pathways; however, a draft HRS score is not calculated in this PA report.

3.1 SOURCES OF CONTAMINATION

The Site, which encompasses approximately 97 acres and 27 city blocks, has undergone a variety of uses from residential housing to commercial industries. Sources of contamination include ACM, LBP, construction debris, and household hazardous waste from residential houses. Commercial industries included factories, foundries, filling stations, automotive repair facilities, junkyards, dry cleaners, manufacturers, trucking operations, and metal stamping facilities. These commercial industries produced or cleaned various hazardous chemicals and petroleum-based products, or sold these to the public or other industries. These industries could have improperly handled or disposed of various chemicals. In addition, nearby smelting, smoke stacks, and emissions from vehicles (leaded gasoline) could have contributed to shallow soil contamination.

Based on results of previous investigations described in Section 2.7.10, the primary chemicals of potential concern (COPC) found at the Site at concentrations exceeding screening criteria (DTLs, RBTLs, or MCLs) included ACM, arsenic, lead, PAHs, petroleum hydrocarbons, and CVOCs. ACM was found in construction materials. Arsenic, lead, PAHs, petroleum hydrocarbons, and CVOCs were found in surface and subsurface soils. Arsenic, petroleum hydrocarbons, and CVOCs were found in groundwater. Soil vapor samples have not been collected at areas where VOCs were detected in soil and groundwater.

3.2 SOIL EXPOSURE AND AIR PATHWAY

The Site has been partially covered by paved roads, residential and commercial structures, and grassy or treed lots. A minimum of 3 feet of surface soil was excavated under a Remedial Action Plan (RAP) with primary intent to remove urban fill, USTs, C&D materials, and contaminated soils. The area was backfilled with 3 feet of surface soil from Falling Springs Quarry in Dupo, Illinois—an MDNR-approved source. Elevated lead and PAHs in surface soil may have resulted, at least in part, from anthropogenic historical activities of the community, such as leaded gasoline emissions and burning of fossil fuels. Although arsenic concentrations exceeded screening levels, most detected concentrations were representative of natural levels in soil. Deeper excavation was necessary at some locations to remove foundations, underground utilities, USTs, and hot spots (i.e., soil contamination at concentrations

exceeding screening levels). Clean fill material is being brought on site and used to backfill and regrade in anticipation of the NGA facility's building footprint, parking lots, sidewalks, and landscaping.

Direct exposure to contaminated soil has been and remains possible during implementation of the RAP; however, following regrading and placement of clean fill, direct exposure (dermal or ingestion) to contaminated soil by workers, visitors, or trespassers will be eliminated. Although the Site will not be used for residential housing, removal or cleaning of soil is proceeding until concentrations of chemicals of concern therein would allow residential use.

CVOCs and some petroleum hydrocarbons (e.g., TPH-GRO, benzene, and naphthalene) could volatilize from soil or groundwater and migrate through the unsaturated zone to the surface, basements, or foundations. These chlorinated and petroleum-based VOCs pose potential risk to future workers in the NGA facility.

The Vapor Intrusion Screening Level Calculator (VISL) (EPA 2017) was used to screen selected VOCs in groundwater at the Site detected at concentrations exceeding MCLs or RBTLs (either vapor, dermal or domestic use), and which could migrate as soil vapors. Groundwater at Parcel 548 (P548-1) was found to contain benzene at 6.4 mg/L (exceeding the non-residential RBTL for vapor), naphthalene at 0.1 mg/L (exceeding the non-residential RBTL for domestic use), and methyl tert-butyl ether (MTBE) at 1.5 mg/L (exceeding the residential RBTL for domestic use). PCE was detected by USACE at MW-6 in City Block 2325 at 32 µg/L, which exceeds the MCL and RBTL for domestic use—5 µg/L, respectively. Benzene (0.034 mg/L), naphthalene (0.039 mg/L), and 2-methyl-naphthalene (0.37 mg/L) were detected at Parcel 158 (P158-3) at concentrations exceeding the residential RBTL for domestic use.

Assuming a commercial scenario of carcinogenic risk at 1E-6 and a hazard index of 1, concentrations of benzene and naphthalene at P548-1 and benzene at P158-3 were the only detected VOCs that exceeded the VISL benchmark for risk from soil vapors. Assuming a residential scenario, MTBE detected at P548-1 also exceeded the VISL benchmark, in addition to benzene and naphthalene. In both residential and commercial scenarios, PCE detected at MW-6 was below the VISL benchmark (Appendix C).

Subsurface soils at P548-1 and P158-3 were over excavated until sampling yielded results below subsurface screening levels (Section 4.0). Excavated soil that previously failed was removed and sent for disposal at the Roxana Landfill. Although VISL numbers are derived from groundwater concentrations, source-area removal of contaminated soils will likely result in diminishing groundwater and vapor concentrations due to natural attenuation processes.

3.2.1 Soil and Air Pathway Targets

Surface soil from 0 to 3 feet bgs has been removed and replaced with clean backfill material. All structures, foundations, utilities, and anomalous subsurface zones were investigated, and if construction or debris were found present, this was removed. Removals of lead, PAHs, and petroleum hydrocarbons at hot spots extended to depths of groundwater or bedrock, and extended laterally to achieve residential RBTLs (refer to the RAP; EOI 2016).

Vapor intrusion levels have been found below benchmark residential risk levels, except at P548-1 and P158-3. The area around these locations was excavated to remove all benzene and petroleum hydrocarbons in soil.

3.2.2 Soil and Air Pathway Conclusions

Historical operations at the Site and surrounding community resulted in elevated levels of lead, PAHs, and petroleum hydrocarbons. Most soil contamination occurred in the upper 3 feet of soil and fill material. Where present (Section 2.7.10 and Table 1), subsurface hot spots were remediated to residential RBTL levels. Removal of contaminants from source areas has addressed most risk from vapors containing VOCs (e.g., benzene); however, future installations of vapor mitigation systems (VMS) may be necessary if structures are located above previous hot spots (e.g., at Parcel 548 or 158).

3.3 GROUNDWATER PATHWAY

Section 3.3.1 discusses the hydrogeologic setting, groundwater targets, and conclusions drawn from analytical results from groundwater samples collected during the Phase II ESA, Phase II TBA, and USACE groundwater investigation.

3.3.1 Hydrogeological Setting

Sources of groundwater at the Site include shallow, unconfined groundwater that occurs in the overburden deposits, which range from 14 to 33 feet bgs. Below the overburden is the St. Louis Limestone, which also yields groundwater in fractures and solution zones. The City of St. Louis does not use shallow groundwater found in the overburden or limestone, but draws its water from two main surface water intakes. One intake is at the Chain of Rocks location, within the Mississippi River, approximately 8 miles north of the Site. The other intake is 18.5 miles west of the Site at the Howard Bend of the Missouri River.

Regional groundwater occurs in alluvium adjacent to the Missouri and Mississippi Rivers. The Mississippi River is approximately 1.5 miles to the east, and the Missouri River is roughly 12 miles north of the center of the Site. Therefore, the Mississippi River likely controls regional groundwater flow at the Site. According to USGS, pumping rates in the River alluvium range from 2,000 to 3,000 gallons per minute (gpm); in the St. Louis Limestone, pumping rates are between 3 and 50 gpm (USACE 2017).

Locally, USACE found that groundwater flow followed the bedrock surface toward the center of the Site, although USACE could not be certain because two wells had not fully recovered when static water level measurements were taken (USACE 2017). Groundwater appears to flow from north to south and south to north toward the center of the Site, then to the east or northeast toward the Mississippi River. Near the center of the Site, the hydraulic gradient from southwest (MW-4) to northeast (MW-3) is approximately 0.003 ft/ft (USACE 2017). Hydraulic conductivity data regarding the overburden clays found are not available; however, based on the lithology encountered (mainly clay with minor amounts of silt), hydraulic conductivity should range between roughly 1×10^{-7} and 1×10^{-4} centimeters per second (cm/sec) (0.0003 and 0.3 feet/day) (Heath 1987).

Hydraulic conductivity of the St. Louis Limestone was measured by Ozdemir and described as low, except for two tests that yielded 1.5×10^{-3} and 2.5×10^{-3} cm/sec (4.3 to 7.1 feet/day) (Ozdemir 2004).

3.3.2 Groundwater Targets

The 2016 census population of the City of St. Louis was 311,404. Saint Louis County has an average of 2.4 persons per household (U.S. Census Bureau 2017). The City of St. Louis draws and treats water from two main surface water intakes and does not use shallow groundwater from the clays or limestone. St. Louis also prohibits use of any groundwater within city limits, except for monitoring wells or non-potable uses (Ordinance 66777) (MDNR 2006b). A search of the USGS and state databases identified one state well between 0.5 and 1 mile north of the Site. The well, labeled as MOLOG1000018450, is at 38.65785 latitude and -90.20868 longitude. Total depth of the well is 1,430 feet in the St. Peters Sandstone Formation (EDR 2015).

Groundwater contamination encountered at the Site included mainly PCE and petroleum hydrocarbon compounds from historical activities. Parcel 548 (P548-1) hosted benzene at 6.4 mg/L (exceeding the MCL and non-residential RBTL), MTBE at 1.5 mg/L (exceeding the residential RBTL), GRO at 26 mg/L (exceeding the residential RBTL), 2-methyl-naphthalene at 0.055 mg/L (exceeding the residential RBTL), and naphthalene at 0.1 mg/L (exceeding the non-residential RBTL). Parcel 158 (P158-3) had the

following three petroleum hydrocarbons that exceeded residential RBTLs: benzene at 0.034 mg/L, 2-methyl-naphthalene at 0.37 mg/L, and naphthalene at 0.039 mg/L. PCE was detected by USACE at MW-6 in City Block 2325 at 32 µg/L, exceeding the MCL of 5 µg/L. USACE also detected arsenic concentration above the MCL at MW-2, but concluded that the elevated concentration was due to high turbidity and not representative of natural groundwater.

3.3.3 Groundwater Pathway Conclusions

Shallow groundwater at the site was vulnerable to site-related contaminants. Shallow groundwater occurs mainly in clay overburden and St. Louis Limestone. Shallow unconfined groundwater occurs at depths ranging from roughly 13 to 29 feet bgs. Shallow groundwater appears to be controlled by a bedrock surface channel (possibly a paleochannel), resulting in flow toward the center of the Site, and then toward the east or northeast.

Hydraulic conductivity was not measured, but assuming an effective porosity of 6% for clay overburden (McWhorter and Sunada 1977) and a hydraulic gradient of 0.003, average linear groundwater flow velocity in the shallow overburden ranges from 1×10^{-5} feet/day (0.005 feet/year) to 1×10^{-2} feet/day (5.5 feet/year). Hydraulic conductivity in limestone is even more variable, and where it is well-cemented, would be very low; however, assuming the two elevated hydraulic conductivity values reported by Ozdemir and an effective porosity of 8% for limestone (McWhorter and Sunada 1977), and a hydraulic gradient of 0.003, average linear groundwater flow velocity in the St. Louis Limestone could be as high as 0.27 feet/day (99 feet/year).

Based on the contaminants detected in groundwater, petroleum hydrocarbons (e.g., benzene) and CVOCs (e.g., PCE) pose greatest risk for contaminant migration through shallow groundwater. Benzene and PCE are naturally degraded via different microbial processes, and these compounds will attenuate and degrade with groundwater migration. These organic compounds will also be retarded or slowed by organic carbon that occurs in soil and bedrock; therefore, their solute velocities will typically be lower than the groundwater velocity.

Shallow groundwater is not used within the City of St. Louis (Ordinance 66777); therefore, the pathway for exposure is eliminated. Only one well was found within a mile radius from the Site; it is screened at 1,480 feet bgs and is cross-gradient of the Site (i.e., north, rather than east of the Site). If the well is active, water from it cannot be used for drinking, bathing, or residential purposes.

The most likely pathway for solutes emanating from the Site would be travel toward the Mississippi River, and between 80 and 1,000 years could elapse before arrival of these at the River. Based on this time frame, degradation and attenuation would likely lower concentrations of the contaminants below detection limits and consequently below risk benchmarks.

3.4 SURFACE WATER PATHWAY

There are no known surface water bodies on the Site. The closest perennial surface water body is the Mississippi River, 1.5 miles east of the Site. Average annual precipitation in Saint Louis, Missouri is 44 inches, and average snowfall is about 12 inches (U.S. Climate Data 2016). Any surface water at the Site would likely flow to storm sewers or overland as sheet flow.

3.4.1 Surface Water Targets

The closest surface water target is the Mississippi River, approximately 1.5 miles east of the center of the Site.

3.4.2 Surface Water Conclusions

No known surface water pathways at the Site, such as ponds, streams, ditches, etc., have transported or could transport site contaminants or create a risk to environmental receptors. The Site is within the City, and storm sewers dominate, rather than natural drainage ways.

4.0 REMOVAL ACTIONS

The following sections summarize removal actions at the NGA facility.

4.1 REMOVAL ACTION OVERVIEW

The National Contingency Plan (40 *Code of Federal Regulations* [CFR] 300.415(b) (2)) authorizes EPA to consider removal actions at those facilities that pose an imminent threat to human health or the environment. A removal action was conducted on behalf of the St. Louis LCRA Holdings under the Missouri BVCP with oversight and approval by MDNR. Residential and commercial structures have been removed. Removal and disposal of all ACM has occurred in compliance with National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations as adopted by EPA.

Excavation of surface soil (0 to 3 feet bgs) and targeted subsurface soil (deeper than 3 feet bgs) has been completed. Removal and proper disposal of subsurface tanks, utilities, construction materials, contaminated soil, and debris has been completed. Buried tanks were treated as USTs, in accordance with MRBCA tank guidance procedures (EOI 2016).

Remediation Target Concentrations (RTC) for surface soil (0 to 3 feet bgs) were based on MRBCA DTLs and/or site-specific background concentrations approved by MDNR. Background RTC concentrations for arsenic and lead in surface soil were 25.07 mg/kg and 45.12 mg/kg, respectively (MDNR 2017). Subsurface soil (below 3 feet bgs) RTCs were based on MRBCA Tier I RBTLs for Type 1 (sandy) soils (MDNR 2006a). For example, the RTC for lead in subsurface soil—based on the RBTL—was 260 mg/kg.

Contaminant concentrations in groundwater exceeding MCLs or RBTLs were addressed by removing soil overburden that may have caused the contamination. For example, Parcel 548 in City Block 2314 contained elevated levels of petroleum hydrocarbons in subsurface soil, which likely contributed to benzene, naphthalene, and TPH-GRO concentrations detected in groundwater. Removal of subsurface soils in this area—where USTs were present—proceeded until contaminant concentrations were lowered to residential levels according to the RAP (EOI 2016).

Furthermore, the City of St. Louis enacted Ordinance 66777 through a Memorandum of Understanding (MOU) with MDNR on August 1, 2005, which prohibits use or attempted use of groundwater as a potable water source. This ordinance eliminates the future groundwater domestic use pathway at any site within the limits of the City of St. Louis.

Shannon & Wilson (S&W) conducted a Phase I ESA, Phase II investigation, and Tier I risk assessment of City Block 2317, Parcel 150 (also known as the former Faultless Linen facility). The risk assessment concluded that the only chemical of concern was benzo(a)pyrene in surficial soils. MDNR also recognized benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene and lead as exceeding the State's leaching to groundwater standards. Therefore, based on the risk from benzo(a)pyrene, and potential leaching of PAHs and lead in surficial soil, an environmental covenant was established on May 9, 2013, dictating land use restrictions such as no residential housing or schools (S&W 2012). The covenant also restricted use of groundwater for any purpose other than collecting samples or performing remediation. The covenant established proper handling of soil through a Soil Management Plan (SMP) and screening levels for benzo(a)pyrene in site soils. Target levels included non-residential direct exposure (2.11 mg/kg), exposure to construction workers (119 mg/kg), highest remaining site concentration (138 mg/kg), and average concentration in contaminated area (10.26 mg/kg). Disturbance of soil must adhere to the SMP.

4.2 REMOVAL ACTIONS BY CITY BLOCK

The following subsections describe removal actions at each city block. Removal actions began at City Block 1084 on August 28, 2017, and ended at City Block 2317—formerly Faultless Linen— on September 27, 2018. EOI performed the removal activities on behalf of LCRA. Removal activities accorded with the Risk Management Plan (RMP) for Subgrade Site Conditions (March 22, 2016); an associated letter dated January 20, 2017; RMP Addendum (July 11, 2017); and RMP Memorandum dated August 28, 2017.

Activities proceeded by removal of surface debris, removal of buried construction and demolition (C&D) waste, removal of USTs, and removal of soils above site cleanup levels. Confirmation sampling accorded with the RMP and RMP addendum. For example, one sample was collected for every 10,000 square feet. At specific REC locations, one sample was collected per 2,500 square feet. Sidewall samples were collected at frequency of one per 50 or 100 linear feet at REC or general locations, respectively. Samples for lead or PAHs analysis were composited, but discrete samples were collected for VOCs analysis. An x-ray fluorescence (XRF) spectrometer was used to analyze samples for lead and arsenic, and 10 percent of the samples were sent to a laboratory, with analytical results referenced for correlation with field XRF data.

All waste was transported off site to the Roxana Landfill in Edwardsville, Illinois. Surface soil (0 to 3 feet bgs) in which analyte concentrations exceeded target concentrations but were below subsurface cleanup levels was excavated and placed below 3 feet bgs. Target concentrations for surface soil were MRBCA

DTLs or background concentrations approved by MDNR. Target concentrations for subsurface soil were MRBCA Tier 1 Residential Subsurface RBTLs.

A minimum of 3 feet (average of 4.5 feet) of surface soil was removed and replaced with clean soil backfill from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Specific removal activities—including confirmation sampling—are described in the following subsections.

4.2.1 City Block 1078

City Block 1078 occupies approximately 2 acres of land surrounded by Parnell Street, Montgomery Street, North 25th Street, and an alley to the north (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.1. This block was primarily residential, except for Parcel 1 where commercial activities included machine shops, a varnish factory, an iron works, and a foundry. In addition, a filling station operated immediately north of City Block 1078 (refer to sample grids 12, 13, and 14 [Figure 8]) (EOIa 2018).

Removal activities began on August 30, 2017, and continued through November 21, 2017. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, a UST, and soils above RTCs.

Remedial Action Completion Report – City Block 1079 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 4 of the EOI report list analytical results from on-site confirmation, perimeter, tank closure, and stockpile sampling (EOIa 2018).

EOI encountered a buried tank at sample grid 20. After acquisition of a permit, the 500-gallon UST was cut, cleaned, and recycled. Soil sample results collected below the tank are in Table 3 of the EOIa report.

Table 1 of the EOIa report lists confirmation samples collected from various grids within the city block. Data indicated lead and PAH concentrations exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. In several site perimeter samples, lead and PAHs concentrations exceeded RTCs (EOIa, Table 2). These exceedances would have required off-site excavation, but BVCP agreed that additional excavation into the sidewall could destabilize the street, and off-site remediation should not occur. Tank closure sampling results are listed in Table 3 of the EOIb report. In one sample (P1-F1-1.3), benzo(a)pyrene concentration exceeded the RTC, and additional excavation thus was necessary. Following excavation, VOCs, PAHs (including

benzo(a)pyrene), and lead concentrations were below RTCs. Analytical results from soil stockpile sampling at this city block indicated all analyte concentrations below RTCs.

City Block 1078 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIa report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 25, 2018, for remediation activities at City Block 1078 (MDNRa 2018).

4.2.2 City Block 1079

City Block 1079 occupies approximately 4 acres of land bounded by Montgomery, Parnell, Warren, and North 25th Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.2. This block was primarily residential, except for Parcel 2 where commercial activities included plating, automotive painting, and machine shop operations (refer to sample grids 07 through 10, shown on Figure 8).

Removal activities began on October 30, 2017, and continued through November 21, 2017. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals.

Remedial Action Completion Report – City Block 1080 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOI report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOIb 2018).

Table 1 of the EOIb report lists confirmation samples collected from various grids within the city block. Data indicated lead and PAH concentrations exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. In one site perimeter sample (1079-01-WW-S), lead, arsenic, and benzo(a)pyrene concentrations exceeded RTCs; in sample 1079-11-WW-S, lead concentration exceeded the RTC (EOIb, Table 2). Although these exceedances would have required off-site excavation, BVCP agreed that additional excavation into the sidewall could destabilize the street, and thus off-site remediation should not occur. In several stockpile

samples, lead and benzo(a)pyrene concentrations exceeded surface soil RTCs but were below subsurface soil RTCs (EOIb, Table 3). Soil from these stockpiles was relocated below subgrade.

City Block 1079 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIb report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 25, 2018, for remediation activities at City Block 1079 (MDNRb 2018).

4.2.3 City Block 1080

City Block 1080 occupies approximately 4 acres of land encompassed by Warren, Parnell, Benton, and North 25th Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.3. This block was primarily residential, except for the following:

- Parcels 41 through 44 (sample grids 01 through 06) hosted an auto repair and junkyard operation.
- Parcel 32 (sample grids 10 through 13) included a machine shop, sheet metal works, and crushing/pulverizing operation.

Removal activities began on October 10, 2017, and continued through March 7, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 1080 provides details of confirmation sampling, excavated locations, and depths. Tables 1 through 3 of the EOI report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOIc 2018).

Table 1 of the EOIc report lists confirmation samples collected from various grids within the city block. Data indicated lead, arsenic, and PAH concentrations exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. In several site perimeter samples, concentrations of lead and PAHs exceeded RTCs (EOIc, Table 2); however, BVCP agreed that additional excavation into the sidewall could destabilize the street, and off-site remediation should not occur. In all stockpile samples, concentrations of metals and PAHs were below surface soil RTCs (EOIc, Table 3).

City Block 1080 was graded and backfilled with soil from Falling Springs Quarry in Dupo, Illinois—an MDNR-approved source. Figure 3 of the EOIC report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 26, 2018, for remediation activities at City Block 1080 (MDNRc 2018).

4.2.4 City Block 1081

City Block 1081 occupies approximately 4 acres of land encompassed by Benton, Parnell, North Market, and North 25th Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.4. This block was exclusively residential, and no RECs were identified.

Removal activities began on October 15, 2017, and continued through March 1, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 1081 provides details of confirmation sampling, excavated locations and depths. Tables 1 through 3 of the EOId report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOId 2018).

Table 1 of the EOId report lists confirmation samples collected from various grids within the city block. Data indicated lead and PAH concentrations exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Several site perimeter samples exceeded RTCs for lead and PAHs (EOId, Table 2); however, BVCP agreed that additional excavation into the sidewall could destabilize the street and off-site remediation should not occur. One stockpile sample—1081-SP04—exceeded the surface soil RTC for lead, and soil from that stockpile was relocated below subgrade (EOId, Table 3).

City Block 1081 was graded and backfilled with soil from Falling Springs Quarry in Dupo, Illinois—an MDNR-approved source. Figure 3 of the EOId report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided

EOI with a Statement of Approval on July 30, 2018, for remediation activities at City Block 1081 (MDNRd 2018).

4.2.5 City Block 1082

City Block 1082 occupies approximately 4 acres of land surrounded by Benton, North 25th, North Market, and North 23rd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.5. This block was primarily residential, except for a dry cleaner that operated at Parcel 217 (sample grids 12 and 15)(Figure 8).

Removal activities began on October 29, 2017, and continued through March 8, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 1082 provides details of confirmation sampling, and excavated locations and depths. Tables 1 and 2 of the EOIE report list analytical results from on-site confirmation and stockpile sampling (EOIE 2018).

Table 1 of the EOIE report lists confirmation samples collected from various grids within the city block. Data indicated lead and benzo(a)pyrene concentrations exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. In all stockpile samples, concentrations of metals and PAHs were below RTCs (EOIE, Table 2).

City Block 1082 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIE report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 30, 2018, for remediation activities at City Block 1082 (MDNRe 2018).

4.2.6 City Block 1083

City Block 1083 occupies approximately 4 acres of land bounded by Warren, North 25th, Benton, and North 23rd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.6.

This block was primarily residential; however, identified RECs were associated with the following businesses, resulting in removal and sampling:

- An historic iron works and auto repair facility operated at Parcels 210 and 211 (sample grids 01 through 04).
- A hauling operation existed at Parcels 208 and 209 (sample grids 07 and 08).
- A dry-cleaning business operated at Parcels 212 through 214 (sample grids 14 through 16 and 19 through 21).
- A furniture refinisher conducted business at Parcels 215 and 216 (sample grids 17, 18, 22, and 23).

Removal activities began on October 20, 2017, and continued through April 9, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 1083 provides details of confirmation sampling, and excavated locations and depths. Tables 1 and 2 of the EOIf report list analytical results from on-site confirmation and stockpile sampling (EOIf 2018).

Table 1 of the EOI report lists confirmation samples collected from various grids within the city block. Data indicated lead concentrations exceeding the surface soil RTC, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. In seven stockpile samples, lead concentrations exceeded the RTC for surface soil, and in one stockpile sample, concentrations of lead and benzo(a)pyrene exceeded surface soil RTCs; however, all analyte concentrations in stockpile samples were below subsurface RTCs (EOIf, Table 2). Therefore, soil at these locations was relocated to the subgrade.

City Block 1083 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIf report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 26, 2018, for remediation activities at City Block 1083 (MDNRf 2018).

4.2.7 City Block 1084

City Block 1084 occupies approximately 4 acres of land surrounded by Montgomery, North 25th, Warren, and North 23rd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.7. This block was primarily residential except for Parcels 190 and 191 (sample grids 09 and 10), which hosted an automotive repair facility from 1960 to 1970.

Removal activities began on August 28, 2017, and continued through March 14, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 1084 provides details of confirmation sampling, and excavated locations and depths. Tables 1 and 2 of the EOIg list analytical results from on-site confirmation and stockpile sampling (EOIg 2018).

Table 1 of the EOIg report lists confirmation samples collected from various grids within the city block. Data indicated lead and benzo(a)pyrene concentrations exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. In three stockpile samples—1084-SP08, 1084-SP09, and 1084-SP10—either lead or benzo(a)pyrene concentration exceeded the associated surface soil RTC, but was below the associated subsurface soil RTC; therefore, soil at these locations was relocated to the subgrade.

City Block 1084 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOI report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 26, 2018, for remediation activities at City Block 1084 (MDNRg 2018).

4.2.8 City Block 1085

City Block 1085 occupies approximately 2 acres of land surrounded by North 25th Street, Montgomery Street, North 23rd Street, and an alley way to the north (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.8. This block was primarily residential except for Parcel 159, which

hosted a foundry, battery manufacturing facility, and an iron works. These manufacturing facilities occupied sample grids 01 through 06.

Removal activities began on August 30, 2017, and continued through November 21, 2017. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals.

Remedial Action Completion Report – City Block 1085 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOI report list analytical results from on-site confirmation, perimeter, and off-site sampling (EOIh 2018).

Table 1 of the EOIh report lists confirmation samples collected from various grids within the city block. Data indicated lead and benzo(a)pyrene concentrations exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs (lead and PAHs) was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Excavated soil exceeding RTCs was taken to the Roxana Landfill in Edwardsville, Illinois. In several site perimeter samples, lead, mercury, and benzo(a)pyrene concentrations exceeded RTCs (EOIh, Table 2); however, BVCP agreed that additional excavation into the sidewall could destabilize the alley, and thus off-site remediation should not occur. All analyte concentrations in stockpile soil sample were below RTCs.

City Block 1085 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIh report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 25, 2018, for remediation activities at City Block 1085 (MDNRh 2018).

4.2.9 City Block 1092

City Block 1092 occupies approximately 2 acres of land surrounded by an alley on the north and the following streets: North 23rd, Montgomery, and North 22nd (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.9. This block was primarily residential, and no RECs were identified.

Removal activities began on August 30, 2017, and continued through November 21, 2017. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals.

Remedial Action Completion Report – City Block 1092 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOI report list analytical results from on-site confirmation, site perimeter, and stockpile sampling (EOIi 2018).

Table 1 of the EOIi report lists confirmation samples collected from various grids within the city block. Data indicated lead and arsenic concentrations exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs (lead and PAHs) was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Excavated soil exceeding RTCs was taken to the Roxana Landfill in Edwardsville, Illinois. In several site perimeter samples, lead concentrations exceeded the RTC (EOIi, Table 2); however, BVCP agreed that additional excavation into the sidewall could destabilize the street or alley, and thus off-site remediation should not occur. All analyte concentrations in stockpile soil samples were below surface and subsurface RTCs.

City Block 1092 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIi report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 25, 2018, for remediation activities at City Block 1092 (MDNRi 2018).

4.2.10 City Block 1093

City Block 1093 occupies approximately 4 acres of land bounded by Warren, North 23rd, Benton, and North 22nd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.10. This block was primarily residential; however, a small machine shop operated at Parcels 356 and 357 in the late 1800s through the early 1900s.

Removal activities began on August 29, 2017, and continued through February 27, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals.

Remedial Action Completion Report – City Block 1093 provides details of confirmation sampling, and

excavated locations and depths. Tables 1 through 4 of the EOIj report lists analytical results from on-site confirmation, perimeter, Parcel 356 excavation, and stockpile sampling (EOIj 2018).

Table 1 of the EOIj report lists confirmation samples collected from various grids within the city block. Data indicated lead concentrations and one benzo(a)pyrene concentration exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. In one perimeter sample (1093-09-EW-S), lead concentration exceeded the subsurface soil RTC. However, this location was not remediated because it is next to the North 22nd Street property line (EOIj, Table 2). Because BVCP recognizes that elevated concentrations of lead, arsenic, and PAHs are from urban fill and anthropogenic activities throughout St. Louis, off-site remediation should not occur. Subsurface soil sampling at Parcel 356 excavation revealed one location (P356-WW) where TPH-DRO concentration exceeded the RTC. Soil from this location was over excavated and sent for disposal at the Roxana Landfill in Edwardsville, Illinois (EOIj, Table 3). All analyte concentrations in stockpile samples were below RTCs (EOIj, Table 4).

City Block 1093 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIj report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 26, 2018, for remediation activities at City Block 1093 (MDNRj 2018).

4.2.11 City Block 1094

City Block 1094 occupies approximately 4 acres of land encompassed by Warren, North 23rd, Benton, and North 222nd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.11. This block was primarily residential; however, RECs were identified at several locations due to a mechanic's facility at Parcel 396 (sample grid 03) and various commercial shops (tire and battery, filling station, iron works, and machine) at Parcels 403 through 407 (sample grids 07 through 14) (Figure 8).

Removal activities began on October 3, 2017, and continued through February 28, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Although

a filling station was identified as a REC, a GPR survey and test trenching could not identify any USTs. Remedial Action Completion Report – City Block 1094 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOI report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOIk 2018).

Table 1 of the EOI report lists confirmation samples collected from various grids within the city block. Data indicated concentrations of lead and PAHs exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. All concentrations of metals, PAHs and VOCs in sidewall samples were below RTCs (EOIk, Table 2). In three stockpile samples, lead concentrations exceeded the surface soil RTC, and the sample from one of these locations also contained benzo(a)pyrene concentration exceeding the surface soil RTC (EOIk, Table 3); soils at these locations were relocated to the subgrade.

City Block 1094 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIk report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 20, 2018, for remediation activities at City Block 1094 (MDNRk 2018).

4.2.12 City Block 1095

City Block 1095 occupies approximately 4 acres of land surrounded by Benton, North 23rd, North Market, and North 22nd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.12. This block was primarily residential; however, the following commercial operations were associated with identified RECs within this city block:

- A dry-cleaning business operated for 20 years at Parcel 436 and 437 (sample grids 01 through 04).
- An iron works facility and a printer and roller company operated for 20 years at Parcels 423 through 425 (sample grids 08 through 11).

- A filling station operated in the 1920s and 1930s at Parcels 438 and 439 (sample grids 14 through 17).
- A filling station and auto repair facility operated for 40 years at Parcels 451 through 454 (sample grids 14 through 17). The filling station included five USTs.

Removal activities began on September 16, 2017, and continued through March 15, 2018. EOII removed and disposed of miscellaneous surface debris, buried C&D waste, USTs, and soils above cleanup goals. Remedial Action Completion Report – City Block 1095 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 5 of the EOII report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOII 2018).

EOI removed five USTs—two 500-, one 800-, and two 1,000-gallon tanks—from City Block 1095 (Parcel 454). All USTs were cut, cleaned, and properly disposed of. Confirmation sampling is discussed below (EOII 2018).

Table 1 of the EOII report lists confirmation samples collected from various grids within the city block. Data indicated concentrations of lead and PAHs exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. In one sidewall composite sample collected along North 22nd Street (1095-25-EW-S), benzo(a)pyrene concentration exceeded the surface soil RTC, and lead concentration exceeded the subsurface soil RTC (EOII, Table 2). However, soil past the property boundary will be left in place. According to EOI, urban fill and anthropogenic activities throughout St. Louis have resulted in elevated levels of lead, arsenic, and PAHs, and BVCP agreed that off-site remediation should not occur. Table 3 of the EOII report lists tank closure sampling results. In soil samples collected at Tanks 1, 3, and 4, PAHs or VOCs concentrations exceeded RTCs, and additional excavation was required; that excavated soil was sent for disposal at the Roxana Landfill in Edwardsville, Illinois. In one stockpile sample, lead concentration exceeded the surface soil RTC (EOII, Table 4); soil from that stockpile was relocated to the subgrade.

City Block 1095 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOII report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided

EOI with a Statement of Approval on July 26, 2018, for remediation activities at City Block 1095 (MDNRI 2018).

4.2.13 City Block 2314

City Block 2314 encompasses approximately 4 acres, bounded by Mullanphy Street, North 23rd Street, Cass Avenue, and North 22nd Street (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.13. This city block was residential and commercial. RECs were identified at the following parcels:

- Parcel 545 (sampling grids 11 through 20) hosted chemical companies, laundries, and a battery company.
- Parcel 548 (sampling grids 07 through 10) included a service station for more than 60 years.
- Parcels 549 and 550 (sampling grids 25 and 26) included an auto repair facility.

Removal activities began on September 6, 2017, and continued through March 21, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, USTs, and soils above cleanup goals. Remedial Action Completion Report – City Block 2314 provide(s) details of confirmation sampling, and excavated locations and depths. Tables 1 through 4 of the EOIm report lists analytical results from on-site confirmation, perimeter, tank closure, and stockpile sampling (EOIm 2018).

Based on previous GPR investigation, EOI performed trenching to find one or more possibly present USTs. EOI located and removed three USTs—one 500-gallon tank with oily water, one 700-gallon tank with oily water, and another 500-gallon tank that was empty. Former locations of the USTs are shown on Figure 3 of the EOIm report (EOIm 2018). Furthermore, because of elevated levels of VOCs detected at the eastern property boundary, EOI conducted off-site sampling along the North 22nd Street right of way. EOI advanced two soil borings to approximately 20 feet bgs. One soil sample was collected from each boring at approximately 10 feet bgs, near the unconfined groundwater surface, and a photoionization detector (PID) was used to screen for VOCs. One sample (2314-10-EW-B2) exhibited visual staining, but analytical results were below detection limits.

Data listed in Table 1 of the EOIm report indicated concentrations of lead and PAHs exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were

below RTCs. Excavated soil exceeding subsurface RTCs was sent for disposal to the Roxana Landfill in Edwardsville, Illinois. Table 2 of the EOIm report indicated concentrations of lead and/or PAHs in several sidewall composite soil samples that exceeded RTCs. However, these locations were not remediated because they are next to the property line along Cass Avenue. BVCP indicated that additional excavation into the sidewall could destabilize the streets, and thus off-site remediation should not occur. According to EOI, elevated concentrations of lead, arsenic, and PAHs at the site are from urban fill and anthropogenic activities throughout St. Louis. Table 3 of the EOIm report lists UST closure samples collected from the tank floor following excavation and disposal. In two UST closure samples (P548T1-F1-7 and P548T2-F1-6), concentrations of lead, benzene, naphthalene, TPH-GRO, or xylenes exceeded either surface or subsurface soil RTCs; this location was over excavated until remaining soil was found to contain no analyte concentration exceeding an RTC. Excavated soil was sent to the Roxana Landfill for disposal. Table 5 of the EOIm report lists stockpile soil samples in which concentrations of lead, arsenic, or PAHs exceeded surface soil RTCs. Soil from these stockpiles was relocated below subgrade if all analyte concentrations were below subsurface soil RTCs or was sent for disposal at the Roxana Landfill if one or more analyte concentrations exceeded subsurface RTCs. Table 6 (EOIm) lists off-site confirmation sampling results for VOCs detected in sidewall samples; all VOC concentrations were below RTCs.

City Block 2314 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIm report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on August 29, 2018, for remediation activities at City Block 2314 (MDNRm 2018).

4.2.14 City Block 2315

City Block 2315 encompasses approximately 4 acres, surrounded by Mullanphy Street, North 25th Street, Cass Avenue, and North 23rd Street (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.14. This city block was primarily residential; however, Parcels 325 through 328 (sample grids 08 through 15) hosted auto repair and plating companies. Parcels 338-339 (sample grids 20 through 23) included a dry cleaner and hatter operation. Both RECs were associated with USTs that had been removed.

Removal activities began on August 30, 2017, and continued through April 12, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, USTs, and soils above cleanup goals.

Remedial Action Completion Report – City Block 2315 provide(s) details of confirmation sampling, and excavated locations and depths. Tables 1 through 4 of the EOIn list analytical results from on-site confirmation, perimeter, tank closure, and stockpile sampling (EOIn 2018).

EOI removed four USTs from City Block 2315. Two 500-gallon tanks with oily water were removed from sample grid 22. One 400-gallon tank with soil and fill material was removed from sample grid 08. One 500-gallon, empty tank was removed from sample grid 17 (EOIn 2018).

Data listed in Table 1 of the EOIn report indicated concentrations of lead, hexavalent chromium, and PAHs exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Excavated soil exceeding RTCs was sent for disposal to the Roxana Landfill in Edwardsville, Illinois. Table 2 lists several sidewall composite soil samples in which lead, arsenic, or benzo(a)pyrene concentrations exceeded RTCs. However, these locations were not remediated because they are next to the Cass Avenue property line. BVCP indicated that additional excavation into the sidewall could destabilize the streets, and thus off-site remediation should not occur. According to EOI, elevated concentrations of lead, arsenic, and PAHs are from urban fill and anthropogenic activities throughout St. Louis. Table 3 of the EOIn report lists UST closure samples collected at the tank floor following excavation and disposal. One UST closure sample (P338T1-F-5) contained lead concentration exceeding surface and subsurface soil RTCs for lead; this location was over excavated until sampling indicated lead concentration below the subsurface soil RTC. Excavated soil was sent for disposal at the Roxana Landfill. Table 4 of the EOIn report lists one stockpile soil sample in which lead concentration exceeded the surface soil RTC. Soil from this stockpile was relocated below subgrade.

City Block 2315 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIn report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on September 19, 2018, for remediation activities at City Block 2315 (MDNRn 2018).

4.2.15 City Block 2316

City Block 2316 encompasses approximately 4 acres, surrounded by Mullanphy Street, North Jefferson Avenue, Cass Avenue, and North 25th Street (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.15. This block was residential and commercial. RECs requiring removal of soil were identified within the following Parcels:

- A former machine and iron works company at Parcel 151 (sample grids 05 through 09 and 14 through 18).
- A metal stamping and shoe manufacturing facility at Parcel 152 (sample grids 01 through 04, 10 through 13, and 35).
- A glue factory and adjacent dry-cleaning facility at Parcels 153-155 (sample grids 19 through 22, 27 through 30, and 36).
- An autobody shop at Parcel 156 (sample grids 23 and 31).
- A filling station with USTs at Parcels 157 and 158 (sample grids 24 through 26 and 32 through 34).

Removal activities began on August 25, 2017, and continued through August 23, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, USTs, and soils above cleanup goals.

Remedial Action Completion Report – City Block 2316 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 4 of the EOIo report list analytical results from on-site confirmation, perimeter, tank closure, and stockpile sampling (EOIo 2018).

EOI removed two USTs from Parcel 158 (sample grid 34)—2,500- and 300-gallon tanks. EOI also removed a 400-gallon tank from Parcel 158 (sample grid 35) (EOIo 2018).

Data listed in Table 1 of the EOIo report indicated concentrations of lead and PAHs exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Excavated soil exceeding RTCs was sent for disposal to the Roxana Landfill in Edwardsville, Illinois. Table 2 lists seven sidewall composite soil samples in which lead or both lead and PAH concentrations exceeded RTCs. However, these locations were not remediated because they are next to the property lines of Cass and Jefferson Avenues. BVCP indicated that additional excavation into the sidewall could destabilize the streets, and thus off-site remediation should not occur. According to EOI, elevated concentrations of lead, arsenic, and PAHs are from urban fill and anthropogenic activities

throughout St. Louis. Table 3 of the EOIo report lists UST closure samples collected at the tank floor following excavation and disposal; all analyte concentration in those samples were below RTCs. Table 4 of the EOIo report lists two stockpile soil samples in which lead concentrations exceeded the surface soil RTC. Soil from these stockpiles was relocated below subgrade.

City Block 2316 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIo report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on September 19, 2018, for remediation activities at City Block 2316 (MDNRo 2018).

4.2.16 City Block 2317

City Block 2317 encompasses approximately 4 acres, bounded by Howard Street, North 25th Street, Mullanphy Street, and North Jefferson Avenue (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.16. This block was occupied by Faultless Healthcare Linen—a laundry service provider. Parcel 149 included a metal stamping, rubber company, cleaner, hatter, and dyeing operation (see sampling grids 01 through 04). Parcel 150 hosted a dry-cleaning business (refer to sample grid 16) (EOIp 2018).

Removal activities began on June 8, 2017, and continued through February 27, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 2317 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOIp report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOIp 2018).

Table 1 of the EOIp report lists confirmation samples collected in various grids within the city block. Data indicated concentrations of lead and PAHs exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Table 2 lists two sidewall soil samples (2317-16-WW-S and 2317-16-WW-SS) in which lead and benzo(a)pyrene concentrations exceeded surface soil RTCs; sample 2317-16-WW-SS also contained lead concentration

exceeding the subsurface soil RTC (EOIp, Table 2). However, these locations were not remediated because they are next to the North Jefferson Avenue property line. Because BVCP recognizes that elevated concentrations of lead, arsenic, and PAHs are from urban fill and anthropogenic activities throughout St. Louis, off-site remediation should not occur. In all stockpile samples, analyte concentrations were below subsurface soil RTCs; some stockpile samples contained lead or benzo(a)pyrene concentrations exceeding surface soil RTCs, and soil from those stockpiles was relocated to the subgrade (EOIp, Table 3).

City Block 2317 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIp report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on October 5, 2018, for remediation activities at City Block 2317 (MDNRp 2018).

4.2.17 City Block 2318

City Block 2318 encompasses approximately 4 acres, bounded by Howard, North 25th, Mullanphy, and North 23rd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.17. This block was primarily residential. A parking lot at Parcel 299 was associated with Faultless Cleaners, Although EOI indicated that no RECs had been identified within this city block, EOI found two USTs.

Removal activities began on December 6, 2017, and continued through February 27, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals.

Remedial Action Completion Report – City Block 2318 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOIQ report list analytical results from on-site confirmation, tank closure, and stockpile sampling (EOIQ 2018).

Two USTs were removed from City Block 2318. One 12,000-gallon tank at sample grid 12 contained oily water, resulting in generation of 24 drums (approximately 1,320 gallons) of tank liquids and cleaning clays. The second UST was a 2,000-gallon tank at sample grid 09. This tank also contained oily water (1,690 gallons), which was removed by a vacuum truck (EOIQ 2018).

Table 1 of the EOIQ report lists subsurface soil samples that contained lead concentrations exceeding the subsurface soil RTC; subsurface soil was excavated, and resampling and excavation of remaining soil continued until lead concentration was below the RTC. Two tank closure subsurface samples exceeded

one or more RTCs. Tank closure sample 2318-12-T-SW-SS contained TPH-GRO, TPH-DRO, benzene, naphthalene, and xylenes concentrations exceeding RTCs. Sample 2318-09-T1-SW-SS contained TPH-DRO concentration exceeding the RTC. These sample locations were excavated again, following which all analytical results were either non-detect or below RTCs. Excavated soil was sent for disposal to the Roxana Landfill. In several stockpile samples, lead, arsenic, or PAHs concentrations exceeded surface soil RTCs; however, in those samples, all analyte concentrations were below subsurface RTCs, and soils in those stockpiles were relocated below subgrade.

City Block 2318 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIQ report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on September 25, 2018, for remediation activities at City Block 2318 (MDNRq 2018).

4.2.18 City Block 2319

City Block 2319 encompasses approximately 4 acres, surrounded by Howard, North 23rd, Mullanphy, and North 22nd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.18. This block was primarily residential, except for Parcels 528-531 (sample grids 04 through 09, Figure 8), which hosted a trucking operation.

Removal activities began on December 7, 2017, and continued through March 21, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 2319 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOIR list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOIR 2018).

Table 1 of the EOIR report lists confirmation samples collected in various grids within the city block. Data indicated concentrations of lead and PAHs exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding subsurface soil RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Excavated soil exceeding RTCs was sent for disposal to the Roxana Landfill in Edwardsville, Illinois. Table 2 of the

EOIr report lists two sidewall composite soil samples in which analyte concentrations exceeded RTCs, but those locations cannot be remediated because they are next to North 22nd Street. BVCP indicated that additional excavation into the sidewall could destabilize the street, and thus off-site remediation should not occur. According to EOI, elevated concentrations of lead, arsenic, and PAHs are from urban fill and anthropogenic activities throughout St. Louis. Table 3 of the EOIr report lists one stockpile sample in which lead concentration exceeded the surface soil RTC. Soil from this stockpile was relocated below subgrade.

City Block 2319 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIr report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on August 6, 2018, for remediation activities at City Block 2319 (MDNRr 2018).

4.2.19 City Block 2324

City Block 2324 encompasses approximately 4 acres, surrounded by Madison, North 23rd, Howard, and North 22nd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.19. This block was primarily residential, except for Parcels 510, which hosted an auto body facility and dry cleaner (refer to sample grids 08 and 09, Figure 8).

Removal activities began on October 12, 2017, and continued through March 21, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 2324 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOIs report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOIs 2018).

Table 1 of the EOIs report lists some concentrations of lead and PAHs in surface soil exceeding the surface soil RTCs; that surface soil was removed and placed in the subgrade to eliminate the surface soil exposure pathway, and because all analyte concentrations were below subsurface soil RTCs. Table 2 lists three soil samples (surface and subsurface) in which analyte concentrations exceeded RTCs, but those sample locations cannot be remediated because they are next to North 22nd Street. BVCP indicated that additional excavation into the sidewall could destabilize the street, and thus off-site remediation should not occur. According to EOI, elevated concentrations of lead, arsenic, and PAHs are from urban fill and

anthropogenic activities throughout St. Louis. Table 3 of the EOIs report lists stockpile samples in which analyte concentrations exceeded surface soil RTCs but were below subsurface RTCs. Therefore, those stockpiles were relocated below subgrade.

City Block 2324 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIs report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on August 14, 2018, for remediation activities at City Block 2324 (MDNRs 2018).

4.2.20 City Block 2325

City Block 2325 encompasses approximately 4 acres, surrounded by Madison, North 25th, Howard, and North 23rd Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.20. This block was primarily residential, except for Parcels 277-280, which hosted a dry cleaner and manufacturing facility (refer to sample grids 13 through 18, Figure 8).

Removal activities began on December 6, 2017, and continued through February 27, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 2325 provides details of confirmation sampling, and excavated locations and depths. Tables 1 and 2 of the EOIt report list analytical results from on-site confirmation and stockpile sampling (EOIt 2018).

Table 1 of the EOIt report lists some surface soil concentrations of lead exceeding the surface soil RTC; these soils were removed and placed in the subgrade to eliminate the surface soil exposure pathway, and because all analyte concentrations were below subsurface soil RTCs. Some subsurface soil samples contained concentrations of lead exceeding the subsurface soil RTC; those soils were excavated, following which resampling and excavation continued until lead concentration was below the subsurface soil RTC. No other PAH or VOC concentration exceeded an RTC. All analyte concentrations in stockpile samples were below subsurface soil RTCs.

City Block 2325 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOI report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided

EOI with a Statement of Approval on July 26, 2018, for remediation activities at City Block 2325 (MDNRt 2018).

4.2.21 City Block 2326

City Block 2326 occupies approximately 4 acres of land surrounded by Madison, North 25th, North Jefferson Avenue, and Howard Streets (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.21. This block was primarily residential; however, a shoe manufacturing facility operated at Parcels 143-144, near sample grids 01 through 23. Parcels 145 and 146 (sample grids 27, 28, 29, 31, 32, 33, 35, 36, 37, and 38) (Figure 8) also included a trucking and hauling facility (EOIu 2018).

Removal activities began on November 13, 2017, and continued through September 14, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, USTs, and soils above cleanup goals. Two cisterns were also removed at City Block 2327. Remedial Action Completion Report – City Block 2327 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 4 of the EOIu report list analytical results from on-site confirmation, perimeter, tank closure, and stockpile sampling (EOIu 2018).

EOI found and removed two USTs—one 150-gallon tank and one 1,500-gallon tank. The 150-gallon tank (sample grid 17) contained heating oil, resulting in generation and disposal of three drums of liquids and cleaning clays. The 1,500-gallon tank (sample grid 22) contained 1,350 gallons of residual heating oil, which was removed by a vacuum truck and properly disposed (EOIu 2018).

Table 1 of the EOIu report lists confirmation samples collected in various grids within the city block. Data indicated concentrations of lead and PAHs exceeding surface soil RTCs, which resulted in removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Excavated soil exceeding subsurface RTCs was sent for disposal to the Roxana Landfill in Edwardsville, Illinois. Two perimeter sidewall samples (2326-24-WW-M and 2326-40-WW-S) contained lead concentrations exceeding the surface soil RTC. Soil at these locations met the subsurface RTC for lead; therefore, this soil was relocated to the subgrade (Table 2, EOIu). One tank confirmation sample (2326-22-T1-F-SS) contained TPH-DRO, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and naphthalene concentrations exceeding subsurface RTCs, and additional excavation was necessary until all PAH and VOC concentrations were

below RTCs (Table 3, EOIU). Three stockpile samples contained lead concentrations exceeding the surface soil RTC but below the subsurface soil RTC; soil at these locations was removed and placed in the subgrade (Table 4, EOIU).

City Block 2326 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIU report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on October 3, 2018, for remediation activities at City Block 2326 (MDNRu 2018).

4.2.22 City Block 2327

City Block 2327 occupies approximately 2 acres of land bounded by Maiden Lane, North Jefferson Avenue, Madison Street, and North 25th Street (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.22. This block was primarily residential; however, an auto repair facility operated at Parcels 129-131, near sample grids 8 and 9 (Figure 8). Parcels 139-142 (sample grids 01 through 04) also included a wrecking operation from 1986 to 1991 (EOIv 2018).

Removal activities began on November 13, 2017, and continued through March 23, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Two cisterns were also removed at City Block 2327. Remedial Action Completion Report – City Block 2327 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOIv report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOIv 2018).

Table 1 of the EOIv report lists confirmation samples collected from various grids within the city block. Data indicated concentrations of lead exceeding the surface soil RTC at 2327-08-S, 2327-08-S, 2327-09-S, 2327-09-S, and 2327-12C-S; and concentrations of PAHs exceeding the surface soil RTC at 2327-07B-S and 2327-08-S. These results induced removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade. At 2327-08B-S, EOI detected PCE at 0.376 mg/kg—exceeding the surface and subsurface RTCs. Soils at that location were excavated and sent for disposal. Subsurface soil found to contain analyte concentrations exceeding RTCs (lead, PAHs, and VOCs) was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Excavated soil exceeding RTCs was sent for disposal to the Roxana

Landfill in Edwardsville, Illinois. All analyte concentrations in perimeter sidewall and stockpile samples were below RTCs.

City Block 2327 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOI report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on July 26, 2018, for remediation activities at City Block 2327 (MDNRv 2018).

4.2.23 City Block 2328

City Block 2328 occupies approximately 2 acres of land surrounded by Maiden Lane, North 25th Street, Madison Street, and North 23rd Street (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.23. This block was primarily residential; however, Parcel 250 included a machinery manufacturing and hat factory. Parcel 250 is on the eastern side of City Block 2328 in sample grids 04 through 15.

Removal activities began on November 20, 2017, and continued through January 22, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 2328 provides details of confirmation sampling, and excavated locations and depths. Table 1 of the EOIw report lists analytical results from on-site confirmation sampling (EOIw 2018).

Table 1 of the EOIw report lists confirmation samples collected from various grids within the city block. Data indicated all surface and subsurface concentrations of metals, PAHs, and VOCs below RTCs.

City Block 2328 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOI report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on August 6, 2018, for remediation activities at City Block 2328 (MDNRw 2018).

4.2.24 City Block 2329

City Block 2329 occupies approximately 2 acres of land surrounded by Maiden Lane, Madison Street, North 23rd Street, and North 22nd Street (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.24. This block was primarily residential, but also included an auto repair facility and a dry cleaner on the east side of the block (Parcels 482-483; sample grids 06 through 09)(Figure 8).

Removal activities began on November 30, 2017, and continued through March 6, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals.

Remedial Action Completion Report – City Block 2329 provides details of confirmation sampling, and excavated locations and depths. Tables 1 and 2 of the EOIX report list analytical results from on-site confirmation and perimeter sampling (EOIX 2018).

Table 1 of the EOIX report lists confirmation samples collected from various grids within the city block. Data indicated concentrations of lead exceeding the surface soil RTC at several locations. These results induced removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs.

Subsurface soil found to contain analyte concentrations exceeding RTCs (lead and PAHs) was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Excavated soil exceeding RTCs was sent for disposal to the Roxana Landfill in Edwardsville, Illinois.

At the following composite soil sample locations, either lead or PAH concentrations exceeded RTC levels, required discrete sampling: 2329-06-S, 2329-06-NW-S, 2329-06-NW-SS, 2329-07-M, 2329-07-NW-S, 2329-07-NW-SS, 2329-08-S, and 2329-08-SW-S. One perimeter soil sample, collected at 2329-07-EW-S along North 22nd Street, contained lead concentration exceeding the RTC; however, BVCP agreed that additional excavation into the sidewall could destabilize the street, and that off-site remediation should not occur.

City Block 2329 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOI report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval on August 6, 2018, for remediation activities at City Block 2329 (MDNRx 2018).

4.2.25 City Block 2345

City Block 2345 occupies approximately 4 acres of land surrounded by the following Streets: North Market, North 23rd, Maiden Lane, and North 22nd (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.25. This block was residential, and no known RECs were identified.

Removal activities began on December 29, 2017, and continued through March 9, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals.

Remedial Action Completion Report – City Block 2345 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOiy report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOiy 2018).

Table 1 of the EOiy report lists confirmation samples collected from various grids within the city block. Data indicated concentrations of lead and benzo(a)pyrene exceeding surface soil RTCs. These results induced removal of those surface soils to eliminate the surface soil exposure pathway, and placement of those soils in the subgrade because all analyte concentrations were below subsurface soil RTCs.

Subsurface soil found to contain analyte concentrations exceeding RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below subsurface soil RTCs. Excavated soil exceeding RTCs was sent for disposal to the Roxana Landfill in Edwardsville, Illinois.

Two sidewall samples collected along the North 22nd Street property line (2345-07-EW-M and 2345-14-EW-M) contained lead concentrations exceeding the surface soil RTC. Sample 2345-14-EW-M also contained benzo(a)pyrene at concentration exceeding the surface soil RTC (EOiy, Table 2).

According to EOI, urban fill and anthropogenic activities throughout St. Louis have resulted in elevated levels of lead, arsenic, and PAHs, and BVCP agreed that off-site remediation should not occur. Several stockpile samples contained lead at concentrations exceeding the surface soil RTC, and three samples contained one or more PAHs exceeding surface soil RTCs; however, stockpile soils from which samples were collected that contained analyte concentrations below subsurface RTCs were re-placed 3 feet below grade. The following stockpile samples contained analyte concentrations exceeding subsurface soil RTCs: 2345-SP10, 2345-SP10D#, 2345-SP14, 2345-SP16, 2345-SP16D#, 2345-SP16D, 2345-SP17, 2345-SP18, and 2345-SP20. Soil stockpiles from which those samples were collected were removed and sent for disposal at the Roxana Landfill in Edwardsville, Illinois.

City Block 2345 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOiy report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of

clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval for remediation activities at City Block 2345 on August 2, 2018, (MDNRy 2018).

4.2.26 City Block 2346

City Block 2346 encompasses approximately 4 acres, demarked by North Market Street, North 25th Street, Maiden Lane, and North 23rd Street (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.26. This block was primarily residential, except for the following:

- An auto repair facility operated at Parcel 220 (sample grids 01 and 02) from 1950 to 1965.
- A junk yard operated at Parcel 242 (sample grids 11 through 16) for roughly 15 years.
- In 1926, two USTs were permitted by the City of St. Louis at 2301 Maiden Lane (Parcel 234 or sample grids 20 through 25).

Removal activities began on November 6, 2017, and continued through March 12, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals.

Remedial Action Completion Report – City Block 2346 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOIZ report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOIZ 2018).

Table 1 of the EOIZ report lists some lead and benzo(a)pyrene concentrations in surface soil samples that exceeded RTCs. Surface soil at those sample locations was removed and placed in the subgrade to eliminate the surface soil exposure pathway and because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. One sample (2346-13A-SS) contained concentrations of all VOC analytes, including TPH-GRO, that exceeded RTCs. This location was excavated two more times until VOCs and TPH-GRO concentrations in remaining soil were below RTCs. One stockpile sample contained benzo(a)pyrene and dibenzo(a,h)anthracene concentrations exceeding surface soil RTCs, but well below subsurface soil RTCs; therefore, soil from this stockpile was re-placed below 3 feet bgs.

City Block 2346 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOIZ report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided

EOI with a Statement of Approval for remediation activities at City Block 2346 on July 31, 2018, (MDNRz 2018).

4.2.27 City Block 2347

City Block 2347 is a 4-acre parcel defined by North Market Street, North 25th Street, Maiden Lane, and Parnell Street (Figure 2). Historical activities and analytical results are presented in Section 2.7.10.27. This block was primarily residential, except for a dry cleaner at Parcels 07 and 08.

Removal activities began on October 31, 2017, and continued through March 15, 2018. EOI removed and disposed of miscellaneous surface debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – City Block 2347 provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 3 of the EOIaa report list analytical results from on-site confirmation, perimeter, and stockpile sampling (EOIaa 2018).

Table 1 of the EOIaa report lists some surface soil concentrations of lead, benzo(a)pyrene, and dibenzo(a,h)anthracene exceeding surface soil RTCs. According to EOI, those surface soils were removed and placed in the subgrade to eliminate the surface soil exposure pathway, and because all analyte concentrations were below subsurface soil RTCs. One subsurface sample (2347-07D-SS) contained lead concentration exceeding both surface and subsurface soil RTCs; however, following additional excavation, the location was resampled, and lead concentration was below the subsurface soil RTC. Two sidewall samples collected along the Parnell Street property line (2347--12-WW-M and 2347-20-WW-S) contained lead and PAH concentrations exceeding surface soil RTCs (EOIaa, Table 2). Additional removal would have occurred off site, possibly inducing structural instability on Parnell Street. According to EOI, urban fill and anthropogenic activities throughout St. Louis have resulted in elevated levels of lead, arsenic, and PAHs, and BVCP agreed that off site remediation should not occur.

City Block 2347 was graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figure 3 of the EOI report shows the current topography; however, a grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval for remediation activities at City Block 2347 on August 14, 2018, (MDNRaa 2018).

4.2.28 Streets

Streets formerly present within the NGA facility and lying between city blocks were considered as one removal zone. A total of 10 streets were present, including North 25th and North 23rd Streets, which were oriented north to south, and the following Streets oriented east to west (Figure 2): Montgomery, Warren, Benton, North Market, Maiden Lane, Madison, Howard, and Mullanphy. These streets were composed of bricks, cobbles, concrete, asphaltic concrete, and other inert materials.

Removal activities began on December 15, 2017, and continued through September 19, 2018. EOI removed and disposed of construction debris consisting of street materials, underground utilities, miscellaneous debris, buried C&D waste, and soils above cleanup goals. Remedial Action Completion Report – Streets provides details of confirmation sampling, and excavated locations and depths. Tables 1 through 4 of the EOlab report list analytical results from on-site confirmation, perimeter, PCB wipe, and stockpile sampling (EOlab 2018).

Table 1 of the EOlab report lists lead and PAH concentrations, and one arsenic concentration in surface soil exceeding surface soil RTCs. According to EOI, surface soils containing these concentrations were removed and placed in the subgrade to eliminate the surface soil exposure pathway, and because all analyte concentrations were below subsurface soil RTCs. Subsurface soil found to contain analyte concentrations exceeding RTCs was excavated, and resampling and excavation of remaining soil continued until analyte concentrations were below RTCs. Excavated soil exceeding RTCs was sent for disposal to the Roxana Landfill in Edwardsville, Illinois. Sidewalk samples listed in Table 2 (EOlab 2018) that contained analyte concentrations exceeding surface or subsurface soil RTCs were left in place. According to EOI, urban fill and anthropogenic activities throughout St. Louis have resulted in elevated levels of lead, arsenic, and PAHs, and BVCP agreed that off-site remediation should not occur. PCB wipe samples were collected from cast iron natural gas lines. All wipe samples yielded concentrations allowing disposal at a municipal landfill according to 40 CFR 761.60(b)(5) (EOlab, Table 3). In two samples, PCB concentrations exceeded 10 micrograms per 100 square centimeters ($\mu\text{g}/100\text{ cm}^2$), but were below $100\ \mu\text{g}/100\text{ cm}^2$. Soil stockpiles from which samples were collected that contained analyte concentrations exceeding surface soil RTCs were placed below subgrade; soil stockpiles from which samples were collected that contained analyte concentrations exceeding subsurface RTCs were removed and sent for disposal at the Roxana Landfill in Edwardsville, Illinois (EOlab, Table 3).

All streets were graded and backfilled with soil from Falling Springs Quarry in Dupou, Illinois—an MDNR-approved source. Figures 1 through 5 of the EOlab report show the former locations and sample grids of

the streets. The current topography is shown on adjacent city block reports. A grading plan will be completed and approved by MDNR. The grading plan will document a minimum of 3 feet of clean surface soil as a cap. Based on the removal activities and confirmation sampling, MDNR provided EOI with a Statement of Approval for remediation activities at the Streets on October 5, 2018 (MDNRab 2018).

5.0 SUMMARY

The Site is in St. Louis, Missouri between Cass and Jefferson Avenues. The Site encompasses approximately 97 acres of residential and commercial properties to be used for next NGA facility. This PA has provided background information on historical uses of the Site and potential threats to human health and the environment. Various background documents were reviewed to understand the scope of environmental investigations and to identify data gaps.

HRS scoring was not conducted because the Site is enrolled in the Missouri BVCP. Remedial actions have been completed, and all residential and commercial structures have been removed. Underground tanks, utilities, and debris have been removed. Results of previous investigations at the Site are conveyed in Section 2.7.

Environmental investigations have included a Phase I ESA, Preliminary Environmental Assessment, Phase II ESA, Phase II Targeted Brownfields Assessment, Asbestos Inspection, Groundwater Investigation, and Radiological Sampling. The Phase I ESA report provided historical information on uses of each Parcel within 27 city blocks. The Phase I report identified parcels posing RECs to the Site (Table 1).

RECs and environmental concerns were further investigated for confirmation or elimination during a Phase II ESA, Phase II Targeted Brownfields Assessment, and asbestos surveys. These investigations focused on structures, fill material, surface soil, subsurface soil, and groundwater at the Site.

Some of the structures and buried construction materials contained chrysotile asbestos (in tile, transite, mastic, and fireproof doors); however, most construction materials were found not to be ACM. Construction materials have since been removed from the Site and transported for proper disposal.

Based on historical uses of various properties within the Site, surface and subsurface soils were investigated for presence of metals, VOCs, SVOCs (including PAHs), and petroleum hydrocarbons (TPH-GRO, -DRO, and -ORO). Surface soil is soil within 0 to 3 feet bgs. Subsurface soils extend from 3 feet bgs to bedrock (roughly 15 to 33 feet bgs).

Results of soil sampling indicated presence of arsenic and lead concentrations above Missouri DTLs, residential RBTLs, and non-residential RBTLs. Arsenic concentrations were mostly within natural background levels and are not thought to represent an ongoing risk beyond natural levels in soil. Lead concentrations are mostly within natural background levels; however, at some locations, elevated lead levels may have resulted from historical activities. These locations are described in Section 2.7.10.

Removals of lead concentrations exceeding residential RBTLs in surface soil (44 mg/kg) and subsurface soil (260 mg/kg) have been completed at all city blocks, according to the RAP.

VOCs and petroleum hydrocarbons detected in soil at concentrations above screening levels included benzene and methylene chloride. Of these, benzene detected in subsurface soil at Parcel 548 was of concern; however, this soil has been removed.

PAHs were detected at concentrations above screening levels throughout the Site, but mainly in surface soils. The following PAHs were detected at concentrations above screening levels: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene. PAHs are probably present because of historical burning, furnaces, automobiles, and other manmade activities. All surface soil has been removed to a minimum of 3 feet bgs and replaced with soil from a MDNR-approved source. At locations where subsurface soil PAH concentrations were found to exceed residential RBTLs, excavation and removal of those soils proceeded according the RAP.

Shallow groundwater was investigated during the soil investigation via collection of groundwater grab samples. In addition, USACE installed, developed, sampled, and abandoned nine monitoring wells across the Site. The following contaminants were detected at concentrations either exceeding residential RBTLs for groundwater or above federal MCLs: arsenic, lead, benzene, MTBE, TPH-GRO, 2-methylnaphthalene, naphthalene, and PCE. Detections of arsenic and lead in groundwater at those concentrations probably occurred because of high turbidity. USACE noted that a detection of arsenic at concentration exceeding the MCL was due to high turbidity. The remaining contaminants are either petroleum-fuel related or solvents from dry cleaning operations (i.e., PCE).

Parcel 548 exhibited elevated levels of benzene, naphthalene, MTBE, TPH-GRO and 2-methylnaphthalene. Parcel 158 also hosted elevated levels of benzene, 2-methyl naphthalene, and naphthalene. As discussed, all source area soils have been removed per the RAP. Concentrations of petroleum hydrocarbons remaining in groundwater will naturally degrade, and St. Louis's restriction on groundwater use should prevent exposure to human receptors via potable use.

PCE was detected at one location (MW-6) at 32 µg/L, which is above the MCL of 5 µg/L and the dermal contact residential RBTL of 5.06 µg/L. Again, St. Louis's restriction on groundwater use should prevent exposure to human receptors via potable use.

In late February 2016, revisions to the HRS were proposed to the *Federal Register*. These revisions included a new component to the soil exposure pathway that would consider subsurface intrusion (vapor

intrusion) to workplaces and residences. Subsurface intrusion has been identified as posing significant threats to human health and the environment that should be considered when evaluating sites for inclusion on the NPL. Subsurface intrusion occurs when contaminants are released, enter the subsurface environment, and move into occupied structures (e.g., residences, workplaces, and other buildings) as a gas, vapor, or liquid.

Benzene, MTBE, and naphthalene exceeded the target groundwater concentrations calculated using the VISL calculator (residential scenario) for vapor intrusion at Parcel 548; benzene and naphthalene failed the VISL benchmark under a residential scenario at Parcel 158. PCE was detected at 32 µg/L, an acceptable level in this regard. Based on the concentrations detected, either no structures should be placed immediately above Parcel 548 and 158, or a VMS should be installed.

In conclusion, surface soil has been removed and replaced with a 3-foot soil cap, eliminating current and future risk to workers, visitors, and potential residents. Subsurface soils containing contaminants at concentrations exceeding screening levels (e.g., subsurface RTCs) were removed and backfilled according to the RAP.

Groundwater contamination is limited to PCE and petroleum hydrocarbons, which could migrate off site. However, the groundwater risk pathway is incomplete because no wells are downgradient of the Site, and the City of St. Louis does not allow use of groundwater within city limits for drinking water or other potable purposes. The final pathway of concern is migration of vapors into buildings. Two parcels potentially impacted by subsurface vapors (P548 and P158) are at the extreme south and east boundaries of the NGA property and not within the footprint of proposed construction. If buildings are proposed for these parcels, engineering controls such as a VMS or vapor barrier may be warranted.

A surface cap and soils management plan for the entire NGA facility will replace the current plan covering the Faultless Linen Facility (EOIab 2018). This plan, along with the surface cap, provides engineering and administrative protections from potential exposure to contaminants of concern. The plan informs workers and personnel, provides for maintenance and repair of the cap, and documents inspections. In addition, the plan will be amended as necessary for construction, operation, maintenance, or design changes at the NGA facility. Furthermore, the existing environmental covenant will be superseded by a site-wide environmental covenant now under development.

Based on the information presented in this report, any potential threats to human health and the environment have been identified and mitigated, and no further assessment under Superfund appears warranted.

6.0 REFERENCES

- ASTM International (ASTM). 2011. *Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process*. E 1903-11.
- Agency for Toxic Substances and Disease Registry (ATSDR). 2003. Toxicological Profile for Trichloroethylene. July.
- ATSDR. 2017a. Toxicological Profile for Tetrachloroethene. Accessed December 14, 2017. <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=265&tid=48>
- ATSDR. 2017b. Toxicological Profile for Tetrachloroethene. Accessed December 14, 2017. <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=122&tid=25>
- ATSDR. 2017c. Toxicological Profile for Tetrachloroethene. Accessed December 14, 2017. <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=424&tid=75>
- CH2MHILL. 2015. Preliminary Environmental Assessment, St. Louis City Site, North St. Louis Missouri. May.
- Clement Associates, Inc. (Clement). 1985. *Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites*. September 27.
- Environmental Operations, Inc. (EOI). 2015. Phase I Environmental Site Assessment, North St. Louis Redevelopment Site. Project # 8024. October 23.
- EOI. 2016a. Asbestos Drywall Materials Inspection Report #1. North St. Louis Site. Prepared for LCRA Holdings Corporation. January 19.
- EOI. 2016b. Asbestos Drywall Materials Inspection Report #2. North St. Louis Site. Prepared for LCRA Holdings Corporation. January 23.
- EOI. 2016c. Risk Management Plan for Subgrade Site Conditions (3rd Revision). North St. Louis Site. Prepared for St. Louis LCRA Holdings Corporation. March 22.
- EOI. 2018a. Remedial Action Completion Report – City Block 1078. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 25.
- EOI. 2018b. Remedial Action Completion Report – City Block 1079. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 24.
- EOI. 2018c. Remedial Action Completion Report – City Block 1080. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 26.
- EOI. 2018d. Remedial Action Completion Report – City Block 1081. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 30.
- EOI. 2018e. Remedial Action Completion Report – City Block 1082. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 30.

- EOI. 2018f. Remedial Action Completion Report – City Block 1083. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 26.
- EOI. 2018g. Remedial Action Completion Report – City Block 1084. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 25.
- EOI. 2018h. Remedial Action Completion Report – City Block 1085. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 24.
- EOI. 2018i. Remedial Action Completion Report – City Block 1092. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 24.
- EOI. 2018j. Remedial Action Completion Report – City Block 1093. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 26.
- EOI. 2018k. Remedial Action Completion Report – City Block 1094. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 25.
- EOI. 2018l. Remedial Action Completion Report – City Block 1095. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 25.
- EOI. 2018m. Remedial Action Completion Report – City Block 2314. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. August 16.
- EOI. 2018n. Remedial Action Completion Report – City Block 2315. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. August 14.
- EOI. 2018o. Remedial Action Completion Report – City Block 2316. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. September 18.
- EOI. 2018p. Remedial Action Completion Report – City Block 2317. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. October 5.
- EOI. 2018q. Remedial Action Completion Report – City Block 2318. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. September 25.
- EOI. 2018r. Remedial Action Completion Report – City Block 2319. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. August 6.
- EOI. 2018s. Remedial Action Completion Report – City Block 2324. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. August 14.
- EOI. 2018t. Remedial Action Completion Report – City Block 2325. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 25.
- EOI. 2018u. Remedial Action Completion Report – City Block 2326. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. October 1.
- EOI. 2018v. Remedial Action Completion Report – City Block 2327. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 25.

- EOI. 2018w. Remedial Action Completion Report – City Block 2328. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. August 2.
- EOI. 2018x. Remedial Action Completion Report – City Block 2329. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. August 6.
- EOI. 2018y. Remedial Action Completion Report – City Block 2345. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. August 2.
- EOI. 2018z. Remedial Action Completion Report – City Block 2346. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. July 31.
- EOI. 2018aa. Remedial Action Completion Report – City Block 2347. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. August 7.
- EOI. 2018ab. Surface Cap Operations & Maintenance Plan and Soils Management Plan. Revision 10. Next NGA West. Next National Geo-Spatial Intelligence Agency West (N2W) Site, St. Louis. August 30.
- Environmental Data Resources, Inc. (EDR). 2015. EDR Radius Map with Geocheck. August 21.
- Heath. 1987. *Basic Ground-Water Hydrology*. U.S. Geological Survey Water-Supply Paper 2220.
- Land Clearance for Redevelopment Authority (LCRA) of the City of St. Louis. 2013. Environmental Covenant. May 9.
- March, Wes. 2017. Email regarding closure of Faultless Linen. To Todd Davis, EPA Region VII. October 11.
- McWhorter, D.B. and D.K. Sunada. 1977. *Ground-Water Hydrology and Hydraulics*. Water Resources Publications. Fort Collins, Colorado.
- Missouri Department of Natural Resources (MDNR). 2006a. Missouri Risk-Based Corrective Action Technical Guidance. June.
- MDNR. 2006b. Memorandum of Understanding between MDNR and the City of St. Louis regarding Use of Local Groundwater Ordinance as Environmental Institutional Control When Using Missouri's Risk-Based Corrective Action Process on Contaminated Sites. October.
- MDNR. 2017. Letter to Mr. Eric Page of Environmental Operations, Inc. dated August 31, 2017 from Mr. Wes March.
- MDNR. 2018a. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1078 Final Closure Report. July 25.
- MDNR. 2018b. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1079 Final Closure Report. July 25.
- MDNR. 2018c. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1080 Final Closure Report. July 26.

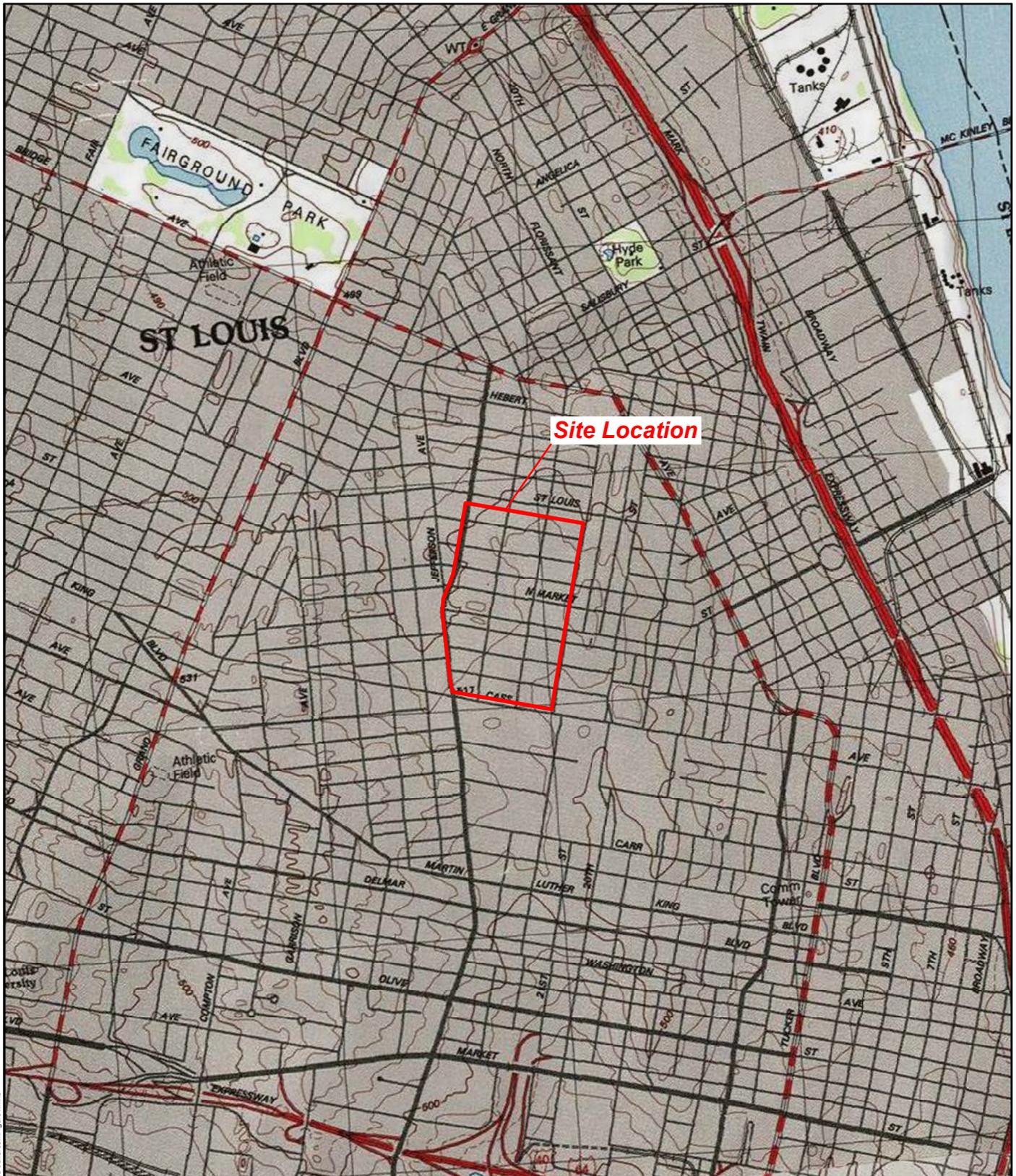
- MDNR. 2018d. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1081 Final Closure Report. July 30.
- MDNR. 2018e. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1082 Final Closure Report. July 30.
- MDNR. 2018f. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1083 Final Closure Report. July 26.
- MDNR. 2018g. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1084 Final Closure Report. July 26.
- MDNR. 2018h. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1085 Final Closure Report. July 25.
- MDNR. 2018i. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1092 Final Closure Report. July 25.
- MDNR. 2018j. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1093 Final Closure Report. July 26.
- MDNR. 2018k. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1094 Final Closure Report. July 20.
- MDNR. 2018l. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 1095 Final Closure Report. July 26.
- MDNR. 2018m. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2314 Final Closure Report. August 29.
- MDNR. 2018n. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2315 Final Closure Report. September 19.
- MDNR. 2018o. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2316 Final Closure Report. September 19.
- MDNR. 2018p. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2317 Final Closure Report. October 5.
- MDNR. 2018q. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2318 Final Closure Report. September 25.
- MDNR. 2018r. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2319 Final Closure Report. August 6.
- MDNR. 2018s. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2324 Final Closure Report. August 14.
- MDNR. 2018t. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2325 Final Closure Report. July 26.

- MDNR. 2018u. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2326 Final Closure Report. October 3.
- MDNR. 2018v. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2327 Final Closure Report. July 26.
- MDNR. 2018w. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2328 Final Closure Report. August 6.
- MDNR. 2018x. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2329 Final Closure Report. August 6.
- MDNR. 2018y. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2345 Final Closure Report. August 2.
- MDNR. 2018z. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2346 Final Closure Report. July 31.
- MDNR. 2018aa. Statement of Approval via Email from Wes March to Eryn Bassett regarding City Block 2347 Final Closure Report. August 14.
- MDNR. 2018ab. Statement of Approval via Email from Wes March to Eryn Bassett regarding Streets Final Closure Report. October 5.
- Meister. 1980. *Farm Chemicals Handbook*. Meister Publishing Company.
- Ozdemir, Levent. 2004. "North American Tunneling 2004." *Proceedings of the North American Tunneling Conference 2004*. April 17-22. 628 pages.
- SCI Engineering, Inc. (SCI). 2016. Phase Two Environmental Site Assessment. National Geospatial Intelligence Agency (Proposed), St. Louis, Missouri. March 3.
- Seagull Environmental Technologies, Inc. (Seagull). 2016. Phase II Environmental Site Assessment Asbestos-Containing Material Inspection Report. National Geospatial-Intelligence Agency Site, St. Louis, Missouri. February 26.
- Shannon & Wilson (S&W). 2012. Conceptual Site Model and Tier 1 Risk Assessment Faultless Linen. May 4.
- Smith, S.L., D.D. MacDonald, K.A. Keenleyside, C.G. Ingersoll, and J. Field. 1996. A Preliminary Evaluation of Sediment Quality Assessment Values for Freshwater Ecosystems. *Journal of Great Lakes Research*. 22(3):624-638. Tetra Tech EM Inc. 2006. River Valley Groundwater Contamination Site, North Platte, Nebraska, Remedial Investigation Report. September 8.
- Tetra Tech EM, Inc. 2006. River Valley Groundwater Contamination Site, North Platte, Nebraska, Remedial Investigation Report. September 8.
- Tetra Tech, Inc. (Tetra Tech). 2017. Phase II Targeted Brownfields Assessment Report Addendum, Proposed National Geospatial Intelligence Agency Site, St. Louis, Missouri. February 6.

- Tidball, Ronald. 1984. *Geography of Soil Geochemistry of Missouri Agricultural Soils*. Geological Survey Professional Paper 954-H.
- U.S. Army Corps of Engineers (USACE). 2017. Next National Geospatial-Intelligence Agency-West. Groundwater Investigation Report. May.
- U.S. Census Bureau. 2017. American FactFinder. Community Facts. Saint Louis, Missouri. Accessed December 11, 2017.
https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml?src=bkml
- U.S. Climate Data. 2016. Accessed November 22, 2016.
<http://www.usclimatedata.com/climate/atlantic/iowa/United-States/usia0048>
- U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). 2016. Web Soil Survey of St. Louis, Missouri. Accessed October 2016.
<http://websoilsurvey.nrcs.usda.gov/app/>
- U.S. Environmental Protection Agency (EPA). 1979. *Water-Related Environmental Fate of 129 Priority Pollutants*, Volume I: Introduction and Technical Background Metals and Inorganics Pesticides and PCBs. Office of Water Planning and Standards. EPA Contract No. 68-01-3852/3867.
- EPA. 1986. "Guidelines for the Health Risk Assessment of Chemical Mixtures."
- EPA. 2016a. Surf Your Watershed: Cahokia-Joachim Watershed – 07140101. Accessed October 2016.
http://cfpub.epa.gov/surf/huc.cfm?huc_code=07140101
- EPA. 2016b. Arsenic Environmental Occurrence.
https://clu.in.org/contaminantfocus/default.focus/sec/arsenic/cat/Environmental_Occurrence/
- EPA. 2016c. Fact Sheet: Methylene Chloride or Dichloromethane (DCM). Accessed on December 7, 2017. <https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-methylene-chloride-or-dichloromethane-dcm-0>
- EPA. 2017. Vapor Intrusion Screening Levels (VISLs). Accessed on December 14, 2017.
<https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-levels-visl>
- U.S. Geological Survey (USGS). 1993. Granite City, Missouri Quadrangle. USGS 7.5-Minute Topographic Series.
- USGS. 1997. *Groundwater Atlas of the United States: Kansas, Missouri, and Nebraska*. Accessed October 2016. <http://pubs.usgs.gov/ha/ha730/gwa.html>
- USGS. 2017. USGS Tidball mean background soil concentrations for the City of St. Louis, Missouri. Accessed January 2017.
- Wester, R.M. and Associates, Inc. (Wester). 2017a. 2233 Cass Avenue Sample Analysis Report. November 20.
- Wester. 2017b. 2233 Cass Avenue Sample Analysis Report, Letter from Joseph D. Kock, PhD, RPIH. December 11.

APPENDIX A

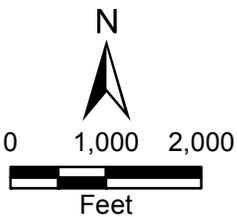
FIGURES



Site Location



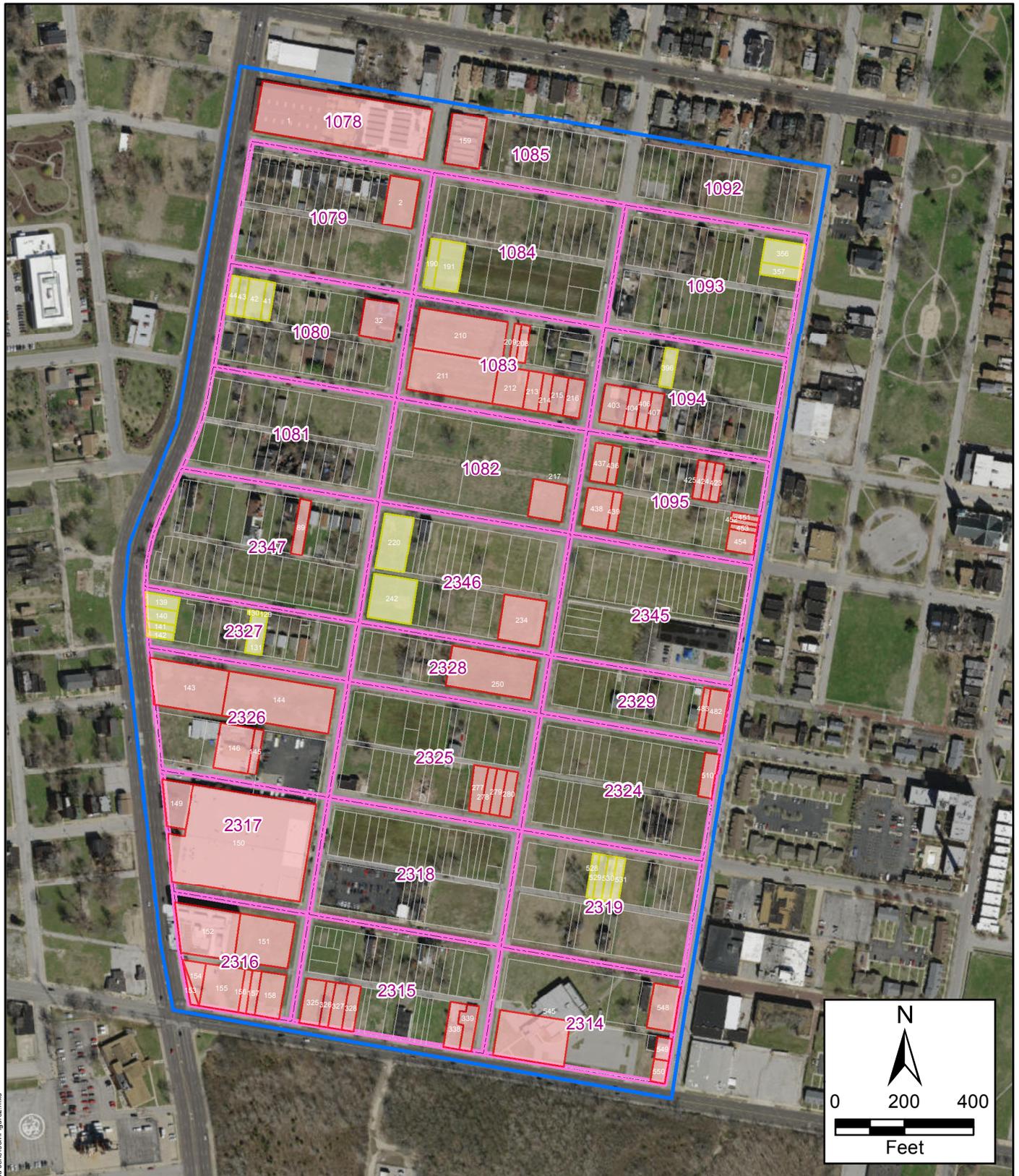
St. Louis City



Proposed National Geospatial
Intelligence Agency
St. Louis City, Missouri

Figure 1
Site Location Map





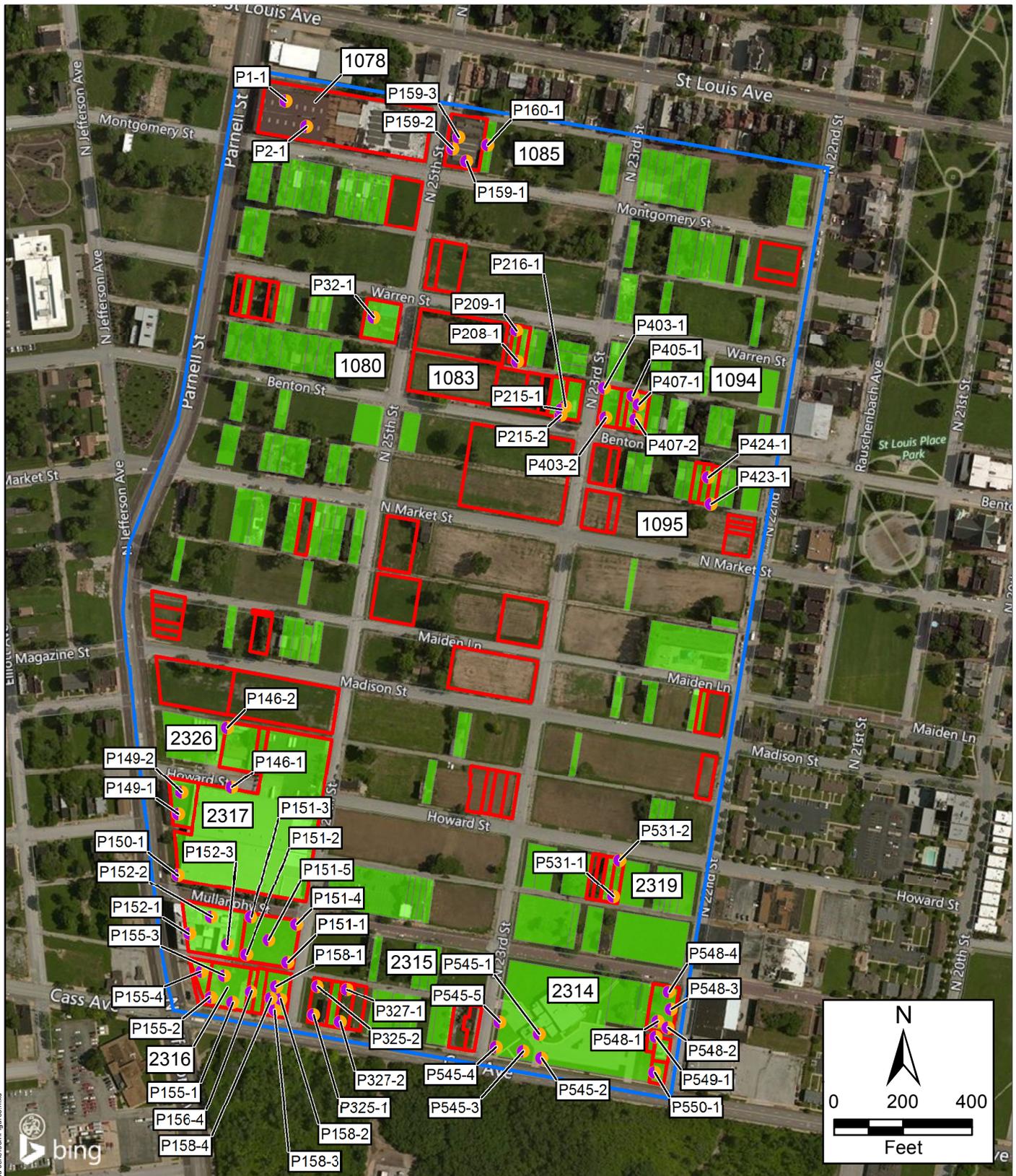
C:\START\WORK\Brownfields\St. Louis Assessments\Case and Jefferson\Figure2.mxd

- Legend**
- Site boundary
 - City Block
 - St. Louis Parcel
 - High Environmental Risk
 - Medium Environmental Risk
- 2314 City block ID

Proposed National Geospatial
Intelligence Agency
St. Louis City, Missouri

Figure 2
Site Layout Map and Parcels





C:\START\WORK\Brownfields\St. Louis Assessments\Casa and Jefferson\Figure3.mxd

Legend	
	Soil boring location
	Parcel for EPA Environmental Assessment
	Site boundary
	SLDC Phase 1 REC
	City block ID
	U.S. Environmental Protection Agency ID
	Recognized environmental condition
	St. Louis Development Corporation

Proposed National Geospatial Intelligence Agency
 St. Louis City, Missouri

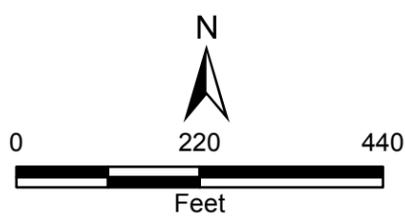
Figure 3
 Phase II Targeted Brownfields Assessment Report Location Map





Legend

- Proposed Soil Boring Location Not Conducted
- Conducted Soil Boring Location
- Proposed Trench Location Not Conducted
- Conducted Trench Location
- Areas Surveyed with GPR



Proposed National Geospatial Intelligence Agency
St. Louis City, Missouri

Figure 4
Phase II Environmental Site Assessment
Soil Boring and Trench Location Map

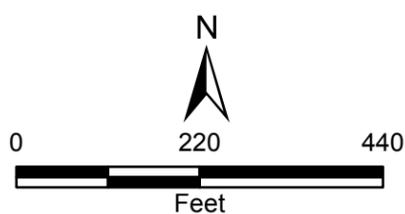




SCALE
1" = 200'
160
200

Legend

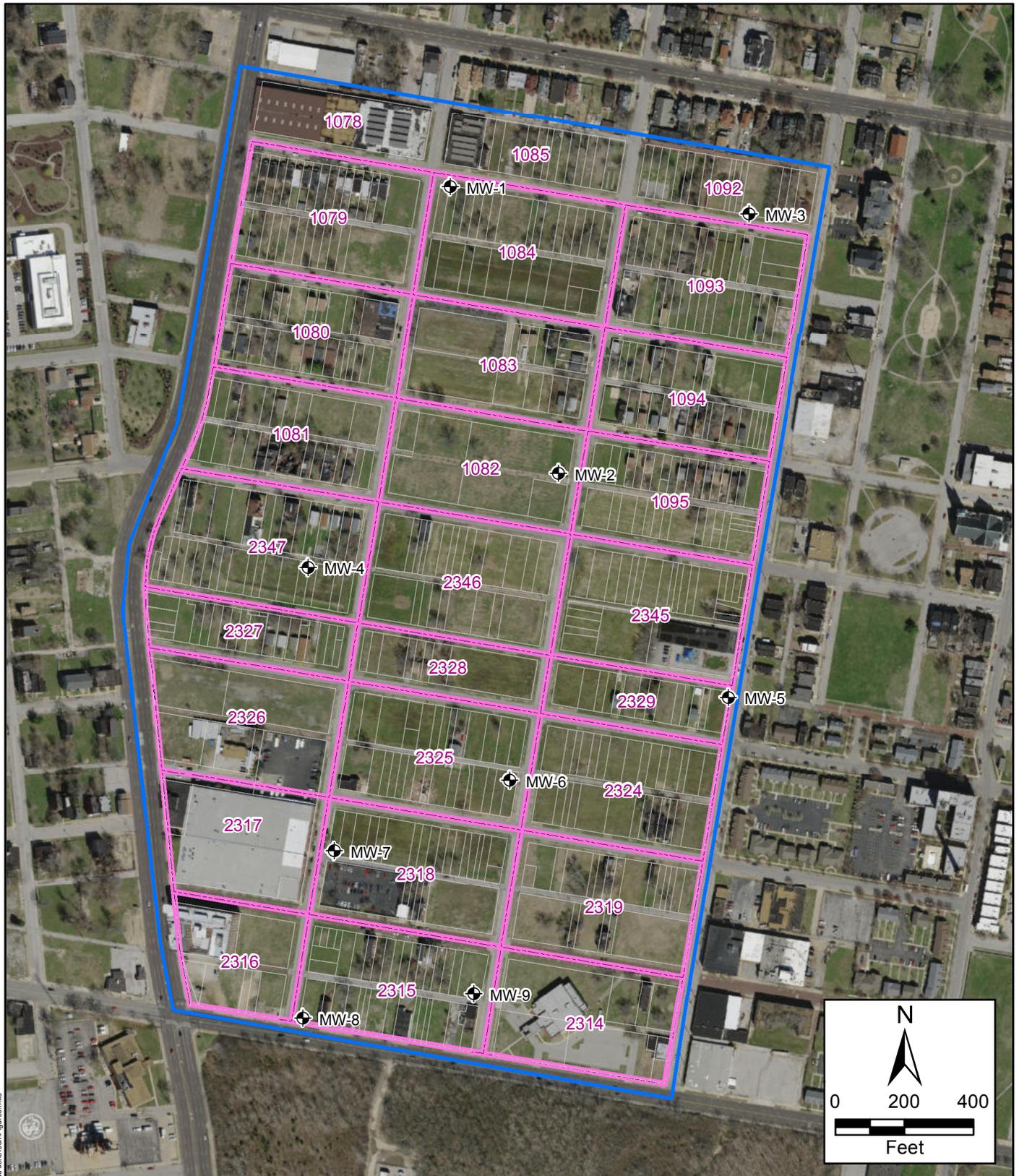
- ACM Sample Location
- Proposed Trench Location Not Conducted
- Conducted Trench Location
- ▣ Areas Surveyed with GPR



Proposed National Geospatial Intelligence Agency
St. Louis City, Missouri

Figure 5
Phase II Environmental Site Assessment
ACM Sample Location Map





C:\START\WORK\Brownfields\SI_Louis Assessments\Gass and Jefferson\Figure6.mxd

- Legend**
-  Shallow Bedrock Monitoring Well
 -  Site boundary
 -  City Block
 -  St. Louis Parcels
 - 2314 City block ID

Proposed National Geospatial
Intelligence Agency
St. Louis City, Missouri

Figure 6
Groundwater Investigation
Report Sample Location Map

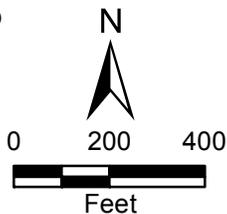




Structure Identifier*	Site Address	Approximate Building Size (ft ²)
1	2206 Benton Street	1,550
2	2209 Benton Street	1,800
3	2220 Benton Street	2,100
4	2221 Benton Street	4,000
5	2222 Benton Street	2,100
6	2231 Benton Street	2,100
7	2519 Benton Street	1,850
8	2535 Benton Street	Collapsed
9	2537 Benton Street	1,850
10	2541 Benton Street	1,850
11	2301-3 Cass Avenue	1,750
12	2409-11 Cass Avenue	750
13	2212 Howard Street	1,120
14	2325 Howard Street	Collapsed
15	2221-3 Madison Street	2,100
16	2331 Madison Street	1,800
17	2335 Madison Street	1,800
18	2513 Madison Street	1,200
19	2521 Madison Street	1,200
20	2531 Madison Street	Collapsed
21	2336 and 2336 1/2 North Market Street	4,125
22		
23	2504 North Market Street	2,100
24	2507 North Market Street	3,300
25	2517 North Market Street	4,400
26	2519-25 North Market Street	Collapsed
27	2548 North Market Street	3,600
28	2552 North Market Street	1,800
29	2524 Montgomery Street	2,000
30	2223 and 2225 Mullanphy Street	6,240
31		
32	2233 Mullanphy Street	Collapsed
33	2308-10 Warren Street	2,400
34	2530 Warren Street	Collapsed
35	2534 Warren Street	Collapsed
36	2543 Warren Street	Collapsed
37	2544 Warren Street	1,800
38	2545 Warren Street	1,800
39	2525 North 23rd Street	3,000
40	1700 25th Street	4,500

- Legend
- Site boundary
 - St. Louis Parcels Assessed
 - St. Louis Parcels Not Assessed
 - City Block

2314 City block ID



Proposed National Geospatial Intelligence Agency
St. Louis City, Missouri

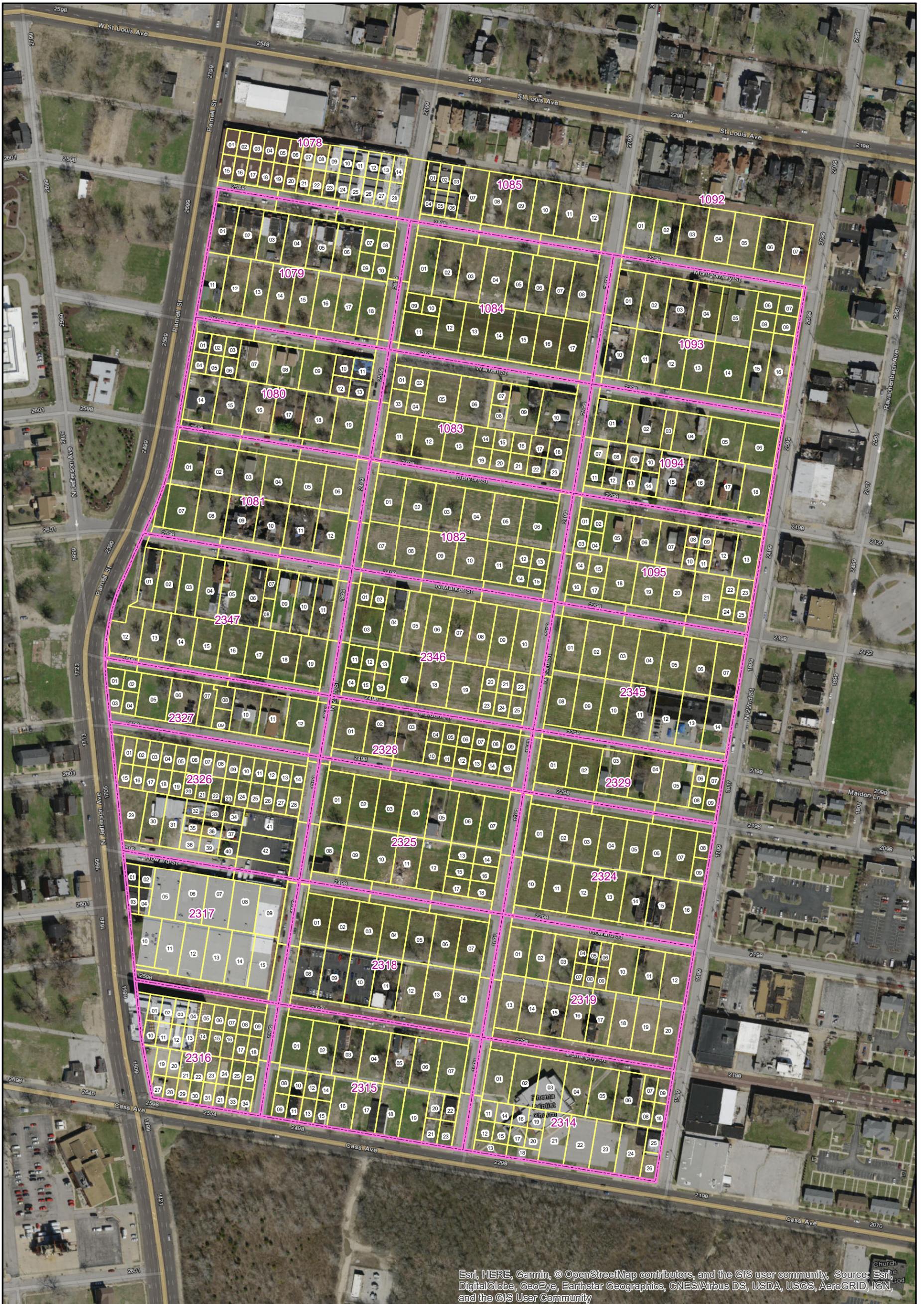
Figure 7
Phase II ACM Sample Location Map



C:\START\WORK\Brownfields\St. Louis Assessments\Casa and Jefferson\Figure7.mxd

Source: ESRI, ArcGIS Online Maps, Bing Hybrid, 2014, Seagull 2016

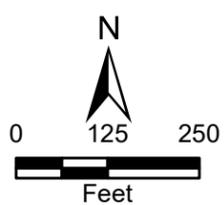
Date: 12/27/2017 Drawn By: michelle.handley Project No: X9025160104.000



Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend
 City block
 Excavation grid

2314 City block ID



Proposed National Geospatial Intelligence Agency
 St. Louis City, Missouri

Figure 8

Removal Action Sampling Grid Location Map



APPENDIX B

TABLE

TABLE 1
PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
1078	1	2701 25TH ST	1.67	Historic Varnish Factory, Iron Works, Foundry, Washing Machine Factory onsite, Filling station adjoining to north	Yes (Tt)	P1-1, -2	N/A	No	No Further Action (NFA)
1079	2	2500-6 MONTGOMERY ST	0.28	Plating, Auto repair/customization	Yes (SCI)	SCI-1,-2,-3	PAHs and Pb in surface soil > RBTLs; groundwater ND/<DTLs; ACM	PAHs and Pb in surface soil > RBTLs; ACM	NFA. Risk from ACM and surface soil mitigated by current removal action.
	3	2512 MONTGOMERY ST	0.08	No REC from the Phase I ESA (No REC)	No		N/A	N/A	NFA
	4	2514 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	5	2516 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	6	2518 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	7	2520 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	8	2522 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	9	2524 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	10	2526 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	11	2528 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	12	2530 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	13	2534 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	14	2536 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	15	2538 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	16	2540 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	17	2542 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	18	2544 MONTGOMERY ST	0.12	No REC	No		N/A	N/A	NFA
	19	2545 WARREN ST	0.12	No REC	No		N/A	N/A	NFA
	20	2543 WARREN ST	0.12	No REC	No		N/A	N/A	NFA
	21	2541 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	22	2539 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	23	2535 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	24	2533 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	25	2531 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	26	2529 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	27	2527 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	28	2523 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	29	2521 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	30	2519 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	31	2501 WARREN ST	0.56	No REC	No		N/A	N/A	NFA

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
1080	32	2500-8 WARREN ST	0.25	Historic machine shop operations, boiler and sheet metal works, Pulverizing and crusher operations	Yes (Tt)(SCI)	P32-1; SCI-10, -11 & -12	As (19 mg/kg) in SS; Pb (500 mg/kg); BaP (0.82 mg/kg) in surface soil; TPH-ORO 435.5 mg/L > DTL	As in soil > RBTL; Metals/PAHs in surface soil > RBTL; TPH-ORO in GW > DTL	NFA. Risk from surface soil mitigated by current removal action. Risk of exposure to groundwater mitigated by St. Louis Ordinance 66777, which prohibits using groundwater for drinking water or potable uses. As is likely naturally occurring.
	33	2510 WARREN ST	0.06	No REC	No		N/A	N/A	NFA
	34	2514 WARREN ST	0.06	No REC	No		N/A	N/A	NFA
	35	2516-8 WARREN ST	0.13	No REC	No		N/A	N/A	NFA
	36	2520 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	37	2522 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	38	2528 WARREN ST	0.13	No REC	No		N/A	N/A	NFA
	39	2530 WARREN ST	0.06	No REC	No		N/A	N/A	NFA
	40	2534 WARREN ST	0.06	No REC	No		N/A	N/A	NFA
	41	2536 WARREN ST	0.06	Historic Junkyard & auto repair	No		N/A	No	NFA
	42	2538 WARREN ST	0.13	Historic Junkyard & auto repair	No		N/A	No	NFA
	43	2544 WARREN ST	0.06	Historic Junkyard & auto repair	No		N/A	No	NFA
	44	2548 WARREN ST	0.06	Historic Junkyard & auto repair	No		N/A	No	NFA
	45	2547 BENTON ST	0.10	No REC	No		N/A	N/A	NFA
	46	2541 BENTON ST	0.10	No REC	No		N/A	N/A	NFA
	47	2537 BENTON ST	0.10	No REC	No		N/A	N/A	NFA
	48	2535 BENTON ST	0.10	No REC	No		N/A	N/A	NFA
	49	2525-9 BENTON ST	0.19	No REC	No		N/A	N/A	NFA
	50	2521 BENTON ST	0.08	No REC	No		N/A	N/A	NFA
	51	2519 BENTON ST	0.08	No REC	No		N/A	N/A	NFA
	52	2517 BENTON ST	0.09	No REC	No		N/A	N/A	NFA
	53	2515 BENTON ST	0.05	No REC	No		N/A	N/A	NFA
	54	2513 BENTON ST	0.04	No REC	No		N/A	N/A	NFA
	55	2511 BENTON ST	0.04	No REC	No		N/A	N/A	NFA
	56	2509 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	57	2505 BENTON ST	0.07	No REC	No		N/A	N/A	NFA
	58	2501 BENTON ST	0.13	No REC	No		N/A	N/A	NFA
	1081	59	2500-6 BENTON ST	0.20	No REC	No		N/A	N/A
60		2508-16 BENTON ST	0.33	No REC	No		N/A	N/A	NFA
61		2518-22 BENTON ST	0.10	No REC	No		N/A	N/A	NFA
62		2524-6 BENTON ST	0.09	No REC	No		N/A	N/A	NFA
63		2528 BENTON ST	0.09	No REC	No		N/A	N/A	NFA
64		2530 BENTON ST	0.08	No REC	No		N/A	N/A	NFA
65		2532-6 BENTON ST	0.17	No REC	No		N/A	N/A	NFA
66		2540 BENTON ST	0.09	No REC	No		N/A	N/A	NFA
67		2542-4 BENTON ST	0.09	No REC	No		N/A	N/A	NFA
68		2546-8 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
69		2551 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
70		2547-9 NORTH MARKET ST	0.10	No REC	No		N/A	N/A	NFA
71		2545 NORTH MARKET ST	0.13	No REC	No		N/A	N/A	NFA
72		2537-9 NORTH MARKET ST	0.09	No REC	No		N/A	N/A	NFA
73		2533-5 NORTH MARKET ST	0.10	No REC	No		N/A	N/A	NFA
74		2531 NORTH MARKET ST	0.07	No REC	No		N/A	N/A	NFA
75		2527-9 NORTH MARKET ST	0.09	No REC	No		N/A	N/A	NFA
76		2519-25 NORTH MARKET ST	0.19	No REC	No		N/A	N/A	NFA
77		2517 NORTH MARKET ST	0.07	No REC	Yes (SG)	Structure 25	ACM	Exposure to ACM	NFA. ACM has been removed.
78		2515 NORTH MARKET ST	0.08	No REC	No		N/A	N/A	NFA
79		2511-3 NORTH MARKET ST	0.10	No REC	No		N/A	N/A	NFA
80		2509 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
81		2507 NORTH MARKET ST	0.07	No REC	Yes (SG)	Structure 24	ACM	Exposure to ACM	NFA. ACM has been removed.
82		2503 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
83		2501 NORTH MARKET ST	0.08	No REC	No		N/A	N/A	NFA

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
1082	217	2301-29 NORTH MARKET ST	1.67	Historic dry cleaners (Southeast corner only)	Yes (SCI); (USACE)	SCI-23, -24, -25; MW-2	Pb in SS, PAHs in SS - BaP, BbF, BahA; GW not analyzed for PAHs, ND for VOCs; ACM	Pb/PAHs in surface soil > RBTLs; Naph in GW > DTL; As in GW > MCL	NFA. Risk from surface soil and ACM mitigated by removal action. As in groundwater due to turbidity. Risk of exposure to groundwater mitigated by St. Louis Ordinance 66777.
	218	2331-49 NORTH MARKET ST	0.97	No REC	No		N/A	N/A	NFA
	219	2346-50 BENTON ST	0.13	No REC	No		N/A	N/A	NFA
1083	201	2525 N 23RD ST	0.04	No REC	Yes (SG)	Structure 39	ACM	Exposure to ACM	NFA. ACM has been removed.
	202	2523 N 23RD ST	0.06	No REC	No		N/A	N/A	NFA
	203	2519 N 23RD ST	0.07	No REC	No		N/A	N/A	NFA
	204	2517 N 23RD ST	0.06	No REC	No		N/A	N/A	NFA
	205	2308-10 WARREN ST	0.09	No REC	Yes (SG)	Structure 33	ACM	Exposure to ACM	NFA. ACM has been removed.
	206	2312 WARREN ST	0.07	No REC	No		N/A	N/A	NFA
	207	2316 WARREN ST	0.07	No REC	No		N/A	N/A	NFA
	208	2318 WARREN ST	0.07	Historic Hauling company	Yes (Tt)	P208-1	As (22 and 31 mg/kg); Pb in SS (320 mg/kg); 1,000 mg/kg soil; PAHs in SS; As > RBTL	As/Pb in surface and subsurface soil > RBTLs; PAHs in surface soil > RBTLs; As in ss and soil > RBTLs	NFA. Risk from surface and subsurface soil mitigated by removal action. As is likely naturally occurring.
	209	2320 WARREN ST	0.05	Historic Hauling company	Yes (Tt)	P209-1	As in soil; BaP in SS; Pb (0.022 mg/L) in GW	As in soil > RBTLs; PAHs in surface soil > RBTL; Pb in GW > residential RBTLs	NFA. Risk from surface soil mitigated by removal action. Property not planned for residential use and City ordinance prohibits water wells. As is likely naturally occurring.
	210	2326-48 WARREN ST	0.71	Historic Iron works and auto repair	Yes (SCI)	SCI-13, -15, -17	Pb soil (759 mg/kg); ACM	Pb in subsurface soil > RBTLs; ACM	NFA. Risk from ACM, surface and subsurface soil mitigated by removal action.
	211	2327-37 BENTON ST	0.69	Historic Iron works and auto repair	Yes (SCI)	SCI-14, -16	PAHs in SS - BaP, BbF, BahA; GW not sampled	PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	212	2319-25 BENTON ST	0.23	Historic Dry cleaners (Old St. Louis Laundry)	Yes (SCI)	SCI-20	Pb in SS (390 mg/kg); BaP in SS; GW not analyzed for PAHs, ND for VOCs	Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	213	2311-5 BENTON ST	0.11	Historic Dry cleaners	Yes (SCI)	SCI-21	Pb in SS (227 mg/kg); GW not analyzed for PAHs, ND for VOCs	No	NFA. Risk from surface soil mitigated by current removal action.
214	2309 BENTON ST	0.07	Historic Dry cleaners	Yes (SCI)	SCI-22	Pb in SS (267 mg/kg), PAHs in SS - BaP, BbF, BahA; GW not analyzed for PAHs, Naph in GW > DTL	Pb/PAHs in subsurface soil > RBTLs	NFA. Risk from surface soil mitigated by removal action. Risk of exposure to groundwater mitigated by St. Louis Ordinance 66777.	
215	2307 BENTON ST	0.11	Historic furniture refinishing	Yes (Tt)	P215-1, -2	As in soil; Pb in SS (2,600 mg/kg), BaP in SS (1.4 mg/kg); GW sampled - ND	As in soil > RBTL; Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.	
216	2303 BENTON ST	0.12	Historic furniture refinishing	Yes (Tt)	P216-1, -2	As in soil; BaP in SS (2.0 mg/kg); GW not sampled (dry)	As in soil > RBTL; PAHs in surface soil > RBTL	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
1084	173	2300 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	174	2302 MONTGOMERY ST	0.10	No REC	No		N/A	N/A	NFA
	175	2304 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	176	2306 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	177	2308-10 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	178	2312 MONTGOMERY ST	0.07	No REC	No		N/A	N/A	NFA
	179	2316-8 MONTGOMERY ST	0.13	No REC	No		N/A	N/A	NFA
	180	2320 MONTGOMERY ST	0.07	No REC	No		N/A	N/A	NFA
	181	2322 MONTGOMERY ST	0.05	No REC	No		N/A	N/A	NFA
	182	2324-30 MONTGOMERY ST	0.29	No REC	No		N/A	N/A	NFA
	183	2332 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	184	2336 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	185	2338 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	186	2340 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	187	2342 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	188	2346 MONTGOMERY ST	0.08	No REC	Yes (USACE)	MW-1	GW sample below MCLs/RBTLs	No	NFA
	189	2348 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	190	2347-9 WARREN ST	0.09	Historic Auto Repair	Yes (SCI)	SCI-7, -9	As and Pb in SS (875 mg/kg); PAHs in SS, BaP (29.7 mg/kg)	As/Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	191	2345 WARREN ST	0.22	Historic Auto Repair	Yes (SCI)	SCI-8	Pb in SS (783 mg/kg); PAHs in SS, BaP (14.4 mg/kg); GS sample ND/<DTLs	Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	192	2337 WARREN ST	0.09	No REC	No		N/A	N/A	NFA
193	2331 WARREN ST	0.16	No REC	No		N/A	N/A	NFA	
194	2327 WARREN ST	0.21	No REC	No		N/A	N/A	NFA	
195	2321 WARREN ST	0.17	No REC	No		N/A	N/A	NFA	
196	2319 WARREN ST	0.17	No REC	No		N/A	N/A	NFA	
197	2311-5 WARREN ST	0.20	No REC	No		N/A	N/A	NFA	
198	2609-11 N 23RD ST	0.15	No REC	No		N/A	N/A	NFA	
199	2309 WARREN ST	0.07	No REC	Yes (SG)	Structure 33*	ACM	ACM	NFA. ACM has been removed.	
200	2301-3 WARREN ST	0.08	No REC	No		N/A	N/A	NFA	
1085	159	2343 MONTGOMERY ST	0.34	Historic foundry, battery manufacturing, iron works	Yes (Tt)	P159-1, -2, -3	PAHs in SS - BaA, BaP, BbF, Dibenzo(a,h)A, Indeno	PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	160	2339 MONTGOMERY ST	0.09	No REC, but sampled by START	Yes (Tt)	P160-1	Pb (330 mg/kg); PAHs in SS	Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	161	2337 MONTGOMERY ST	0.10	No REC	No		N/A	N/A	NFA
	162	2329-33 MONTGOMERY ST	0.23	No REC	Yes (SCI)	T1-79-30	ACM	ACM	Risk from ACM has been or will be mitigated by by removal action.
	163	2325 MONTGOMERY ST	0.11	No REC	No		N/A	N/A	NFA
	164	2323 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	165	2321 MONTGOMERY ST	0.06	No REC	No		N/A	N/A	NFA
	166	2319 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	167	2317 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	168	2313 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	169	2311 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	170	2309 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	171	2307 MONTGOMERY ST	0.12	No REC	No		N/A	N/A	NFA
172	2301-3 MONTGOMERY ST	0.16	No REC	No		N/A	N/A	NFA	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
1092	340	2249 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	341	2247 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	342	2245 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	343	2243 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	344	2239-41 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	345	2237 MONTGOMERY ST	0.07	No REC	No		N/A	N/A	NFA
	346	2235 MONTGOMERY ST	0.11	No REC	No		N/A	N/A	NFA
	347	2231 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
	348	2227-9 MONTGOMERY ST	0.17	No REC	No		N/A	N/A	NFA
	349	2225 MONTGOMERY ST	0.05	No REC	No		N/A	N/A	NFA
	350	2223 MONTGOMERY ST	0.06	No REC	Yes (SCI)	T2-77-84	ACM	ACM	Risk from ACM has been or will be mitigated by by removal action.
	351	2221 MONTGOMERY ST	0.06	No REC	No		N/A	N/A	NFA
	352	2211-9 MONTGOMERY ST	0.35	No REC	Yes (USACE)	MW-3	GW sample below MCLs/RBTLs	No	NFA
	353	2209 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	354	2207 MONTGOMERY ST	0.09	No REC	No		N/A	N/A	NFA
355	2201-5 MONTGOMERY ST	0.18	No REC	No		N/A	N/A	NFA	
1093	356	2619 N 22ND ST	0.20	Historic Machine shop	Yes (SCI)	SCI-4, -5	PAHs in SS - BaP (3.12 mg/kg); TPH-DRO in SS (10,700 mg/kg); TPH-DRO/ORO in GW	PAHs/TPH in surface soil > RBTLs; TPH in groundwater >DTLs	NFA. Risk from surface soil initiated by current removal action. Risk of exposure to groundwater mitigated by St. Louis Ordinance 66777.
	357	2617 N 22ND ST	0.08	Historic Machine shop	Yes (SCI)	SCI-6	Soil sample ND or below DTLs; NO GW sample collected	No	NFA
	358	2613-5 N 22ND ST	0.09	No REC	No		N/A	N/A	NFA
	359	2214 MONTGOMERY ST	0.11	No REC	Yes (SCI)	T6-69-36	ACM	ACM	Risk from ACM has been or will be mitigated by by removal action.
	360	2216 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	361	2218 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	362	2220 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	363	2222 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	364	2224 MONTGOMERY ST	0.10	No REC	No		N/A	N/A	NFA
	365	2228 MONTGOMERY ST	0.06	No REC	No		N/A	N/A	NFA
	366	2232 MONTGOMERY ST	0.16	No REC	No		N/A	N/A	NFA
	367	2236 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	368	2238 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	369	2240 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	370	2242 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	371	2244 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	372	2246 MONTGOMERY ST	0.08	No REC	No		N/A	N/A	NFA
	373	2247-51 WARREN ST	0.16	No REC	No		N/A	N/A	NFA
	374	2241-5 WARREN ST	0.16	No REC	No		N/A	N/A	NFA
	375	2239 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	376	2237 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	377	2233 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	378	2231 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	379	2229 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
380	2227 WARREN ST	0.08	No REC	No		N/A	N/A	NFA	
381	2225 WARREN ST	0.08	No REC	No		N/A	N/A	NFA	
382	2223 WARREN ST	0.16	No REC	No		N/A	N/A	NFA	
383	2217 WARREN ST	0.08	No REC	No		N/A	N/A	NFA	
384	2215 WARREN ST	0.08	No REC	No		N/A	N/A	NFA	
385	2211 WARREN ST	0.08	No REC	No		N/A	N/A	NFA	
386	2209 WARREN ST	0.08	No REC	No		N/A	N/A	NFA	
387	2207 WARREN ST	0.08	No REC	No		N/A	N/A	NFA	
388	2611 N 22ND ST	0.03	No REC	No		N/A	N/A	NFA	
389	2205 WARREN ST	0.13	No REC	No		N/A	N/A	NFA	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
1094	390	2200-2 WARREN ST	0.13	No REC	No		N/A	N/A	NFA
	391	2204-6 WARREN ST	0.09	No REC	No		N/A	N/A	NFA
	392	2208-18 WARREN ST	0.29	No REC	No		N/A	N/A	NFA
	393	2220 WARREN ST	0.05	No REC	No		N/A	N/A	NFA
	394	2222 WARREN ST	0.06	No REC	No		N/A	N/A	NFA
	395	2224-30 WARREN ST	0.18	No REC	No		N/A	N/A	NFA
	396	2232-4 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	397	2236 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	398	2238 WARREN ST	0.06	No REC	No		N/A	N/A	NFA
	399	2240 WARREN ST	0.06	No REC	No		N/A	N/A	NFA
	400	2242 WARREN ST	0.06	No REC	No		N/A	N/A	NFA
	401	2244 WARREN ST	0.05	No REC	No		N/A	N/A	NFA
	402	2246 WARREN ST	0.08	No REC	No		N/A	N/A	NFA
	403	2249 BENTON ST	0.14	Historic Tire & Battery Supply, Filling Station	Yes (Tt)	P403-1, -2	As/Pb in SS (440 mg/kg); PAHs in SS, BaP (6.6 mg/kg); No GW sample (dry)	As/Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	404	2243 BENTON ST	0.05	Historic Tire & Battery Supply, Filling Station	No	Covered by Parcel 403.			
	405	2241 BENTON ST	0.06	Historic Tire & Battery Supply, Filling Station	Yes (Tt)	P405-1	As in soil > RBTLs	As > RBTLs	NFA. As is likely naturally occurring. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	406	2237 BENTON ST	0.10	Historic Iron Works, machine shops	No	Covered by Parcel 405.			
	407	2233 BENTON ST	0.10	Historic Iron Works, machine shops	Yes (Tt)	P407-1, -2	As in soil; Pb in SS (440 mg/kg); PAHs in SS, BaP (1.9 mg/kg); No GW sample (dry)	As in soil; Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	408	2231 BENTON ST	0.06	No REC	Yes (SG)	Structure 6	ACM	ACM	NFA. ACM has been removed.
	409	2227 BENTON ST	0.13	No REC	No		N/A	N/A	NFA
410	2221 BENTON ST	0.13	No REC	Yes (SG)	Structure 4	ACM	ACM	NFA. ACM has been removed.	
411	2219 BENTON ST	0.04	No REC	No		N/A	N/A	NFA	
412	2217 BENTON ST	0.10	No REC	No		N/A	N/A	NFA	
413	2213 BENTON ST	0.10	No REC	No		N/A	N/A	NFA	
414	2209 BENTON ST	0.10	No REC	Yes (SG)	Structure 4	ACM	ACM	NFA. ACM has been removed.	
415	2207 BENTON ST	0.05	No REC	No		N/A	N/A	NFA	
416	2205 BENTON ST	0.04	No REC	No		N/A	N/A	NFA	
417	2203 BENTON ST	0.04	No REC	No		N/A	N/A	NFA	
418	2201 BENTON ST	0.05	No REC	No		N/A	N/A	NFA	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
1095	419	2200-4 BENTON ST	0.13	No REC	No		N/A	N/A	NFA
	420	2206 BENTON ST	0.06	No REC	Yes (SG)	Structure 1	ACM	ACM	ACM has been removed.
	421	2208 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	422	2210 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	423	2212-4 BENTON ST	0.06	Historic Iron Works, printers & roller company	Yes (Tt)	P423-1	As in soil > RBTL	As > RBTL	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	424	2216 BENTON ST	0.06	Historic Iron Works, printers & roller company	Yes (Tt)	P424-1	As in soil > RBTL; BaP in ss (0.75 mg/kg)	As > RBTL; PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	425	2218 BENTON ST	0.06	Historic Iron Works, printers & roller company	No	Covered by Parcels 423 and 424.			
	426	2220 BENTON ST	0.06	No REC	Yes (SG)	Structure 3	ACM	ACM	NFA. ACM has been removed.
	427	2222 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	428	2226 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	429	2230 BENTON ST	0.04	No REC	No		N/A	N/A	NFA
	430	2249 NORTH MARKET ST	0.02	No REC	No		N/A	N/A	NFA
	431	2232 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	432	2234 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	433	2236 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	434	2238 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	435	2240 BENTON ST	0.06	No REC	No		N/A	N/A	NFA
	436	2244 BENTON ST	0.06	Historic Dry Cleaners	Yes (SCI)	SCI-27, -28	Soil sample ND/< RBTLs; GW sample ND or below DTLs	No	NFA
	437	2246-50 BENTON ST	0.13	Historic Dry Cleaners	Yes (SCI)	SCI-26	Soil sample ND/< RBTLs; GW sample ND or below DTLs; GW not analyzed for VOCs	No	NFA
	438	2245 NORTH MARKET ST	0.19	Historic Filling Station	Yes (SCI)	SCI-29, -30	Pb in SS (787 mg/kg); PAHs in SS/soil, BaP (6.48/6.66 mg/kg); GW sample ND or below DTLs, GW not analyzed for VOCs	Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	439	2241 NORTH MARKET ST	0.06	Historic Filling Station	Yes (SCI)	SCI-31	Soil sample ND/< RBTLs; GW sample ND or below DTLs	No	NFA
	440	2239 NORTH MARKET ST	0.11	No REC	No		N/A	N/A	NFA
	441	2233-7 NORTH MARKET ST	0.08	No REC	No		N/A	N/A	NFA
	442	2231 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
	443	2229 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
	444	2225 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
	445	2219-23 NORTH MARKET ST	0.19	No REC	No		N/A	N/A	NFA
	446	2217 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
	447	2213 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
	448	2251 NORTH MARKET ST	0.03	No REC	No		N/A	N/A	NFA
449	2211 NORTH MARKET ST	0.03	No REC	No		N/A	N/A	NFA	
450	2209 NORTH MARKET ST	0.05	No REC	No		N/A	N/A	NFA	
451	2411 N 22ND ST	0.03	Historic Filling Station, auto repair	No	Covered by Parcel 454				
452	2409 N 22ND ST	0.03	Historic Filling Station, auto repair	No	Covered by Parcel 454				
453	2407 N 22ND ST	0.03	Historic Filling Station, auto repair	Yes (SCI)	SCI-33	Pb in SS (324 mg/kg); PAHs in SS, BaP (1.9 mg/kg); No GW sample (dry)	Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.	
454	2201 NORTH MARKET ST	0.11	Historic Filling Station, auto repair	Yes (SCI)	SCI-32, -34	Pb in SS (667 mg/kg); PAHs in SS - BaA, BaP, BbF; No GW sample collected	Pb/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
2314	545	2220-46 MULLANPHY ST	2.39	No REC	No		N/A	N/A	NFA
	545	2205R CASS AV	0.02	Historic Battery Company, Chemical company (SW 1/4 of block)	Yes (Tt)	P545-1, - 2, -3, -4, -5	As in soil > RBTL; PAHs in SS, BaP (1.6 mg/kg); GW sampled - ND or < DTLs	As > RBTL; PAHs in surface soil > RBTL	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	546	2212-8 MULLANPHY ST	0.26	No REC	No		N/A	N/A	NFA
	547	2208 MULLANPHY ST	0.10	No REC	No		N/A	N/A	NFA
	548	2200-2 MULLANPHY ST	0.23	Historic Service Station	Yes (Tt)	P548-1, -2, -3, -4	As in soil > RBTL; Benzene in SS and soil (4.3 and 0.4 mg/kg); GW sampled - Benzene (6.4 mg/L), MTBE (1.5 mg/L), TPH-GRO (26 mg/L), Naphthalene (0.1 mg/L); As in gw (0.013 mg/L)	As in soil > RBTL; VOCs in surface soil, soil, and groundwater > RBTLs; As in GW > RBTL; Benzene in GW > MCL	Remove/remediate surface and subsurface soil to groundwater and implement LUCs at this Parcel. Property not planned for residential use. Do not build immediately above this Parcel. Implement a VMS for nearby buildings. Risk of exposure to groundwater mitigated by St. Louis Ordinance 66777.
	549	1505-7 N 22ND ST	0.06	Historic Auto repair	Yes (Tt)	P549-1	As in soil > RBTL; Pb/PAHs in SS ND or <DTLs	As in soil > RBTL	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	550	2201-3 CASS AV	0.06	Historic Auto repair	Yes (Tt)	P550-1	As in soil > RBTL; Pb in soil (3,800 mg/kg); PAHs in soil -BaP (34 mg/kg); GW sampled - ND or < DTLs	As/Pb/PAHs in subsurface soil > RBTLs	NFA. Risk from surface subsurface soil mitigated by current removal action. As is likely naturally occurring.

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
2315	305	2300-6 MULLANPHY ST	0.20	No REC	Yes (USACE)	MW-9	GW sample below MCLs/RBTLs	No	NFA
	306	2308 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	307	2310 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	308	2312 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	309	2314 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	310	2318 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	311	2320 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	312	2322 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	313	2324 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	314	2326 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	315	2330 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	316	2332 MULLANPHY ST	0.07	No REC	No		N/A	N/A	NFA
	317	2334-6 MULLANPHY ST	0.11	No REC	No		N/A	N/A	NFA
	318	2342-8 MULLANPHY ST	0.11	No REC	No		N/A	N/A	NFA
	319	2350-2 MULLANPHY ST	0.03	No REC	No		N/A	N/A	NFA
	320	2354 MULLANPHY ST	0.03	No REC	No		N/A	N/A	NFA
	321	2358 MULLANPHY ST	0.03	No REC	No		N/A	N/A	NFA
	322	2364 MULLANPHY ST	0.02	No REC	No		N/A	N/A	NFA
	323	1518-20 25TH ST	0.07	No REC	No		N/A	N/A	NFA
	324	1514-6 25TH ST	0.06	No REC	No		N/A	N/A	NFA
	325	2419-23 CASS AV	0.17	Historic Plating, engine repair	Yes (Tt); (USACE)	P325-1, -2; MW-8	As in soil > RBTL; P325-1, -2; MW-8	As > RBTL; GW sample below MCLs/RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	326	2417 CASS AV	0.07	Historic Auto Repair	No			Covered by Parcel 325.	
	327	2413-5 CASS AV	0.12	Historic Auto Repair	Yes (Tt)	P327-1, -2	As in soil > RBTL; No GW sample collected	As > RBTL	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	328	2409-11 CASS AV	0.10	Historic Auto Repair	Yes (SG)	Structure 12	ACM	ACM	NFA. ACM has been removed.
	329	2407 CASS AV	0.05	No REC	No		N/A	N/A	NFA
	330	2405 CASS AV	0.04	No REC	No		N/A	N/A	NFA
	331	2401-3 CASS AV	0.15	No REC	No		N/A	N/A	NFA
	332	2323 CASS AV	0.09	No REC	No		N/A	N/A	NFA
	333	2319 CASS AV	0.15	No REC	No		N/A	N/A	NFA
	334	2317 CASS AV	0.05	No REC	No		N/A	N/A	NFA
	335	2315 1/2 CASS AV	0.05	No REC	No		N/A	N/A	NFA
	336	2315 CASS AV	0.05	No REC	No		N/A	N/A	NFA
	337	2309-13 CASS AV	0.15	No REC	No		N/A	N/A	NFA
338	2305-7 CASS AV	0.14	Historic Dry Cleaners, hatters	Yes (SCI)	SCI-75	Soil and GW samples ND or below DTLs, GW not analyzed for VOCs	No	NFA	
339	2301-3 CASS AV	0.10	Historic Dry Cleaners, hatters	Yes (SCI)	SCI-77	Soil samples ND or below DTLs except BaP in SS (0.65 mg/kg)	PAHs > DTLs but below Non-residential RBTLs	NFA. Risk from surface soil mitigated by removal action.	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
2316	151	2500-14 MULLANPHY ST	0.49	Historic Machine company, iron works	Yes (Tt)	P151-1, -2, -3, -4, -5	As in soil > RBTL; PAHs in SS - BaP, BbF, BahA, Indeno	PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	152	1516-30 N JEFFERSON AV	0.55	Historic Metal Stamping, shoe manufacturing	Yes (Tt)	P152-1, -2, -3	As in soil > RBTL; BaP in SS (0.76 mg/kg); PCE and TCE in GW < RBTLs	PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	153	2535 CASS AV	0.03	Historic glue factory, adjoining dry cleaning operations	No	Covered by Parcel 152.			
	154	2529 CASS AV	0.10	Historic glue factory, adjoining dry cleaning operations	Yes (Tt)	P155-4	As in soil > RBTL; PAHs in SS - BaP (9.7 mg/kg); GW = ND	PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	155	2513-27 CASS AV	0.33	Historic glue factory, adjoining dry cleaning operations	Yes (Tt)	P155-1, -2, -3	As in soil > RBTL; Soil ND/< RBTLs; GW not sampled	No	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	156	2507 CASS AV	0.06	Historic Auto Body shop	No.	Soil boring refusal			
	157	2505 CASS AV	0.08	Historic filling station	No	Covered by Parcel 158.			
	158	2501 CASS AV	0.21	Historic filling station	Yes (Tt)	P158-1, -2, -3, -4	As in soil > RBTL; Soil ND/< RBTLs; GW > RBTLs for Benzene, PAHs	As > RBTL; Benzene/PAHs in groundwater > residential RBTLs	Remove/remediate surface and subsurface soil to groundwater and implement LUCs at this Parcel. Property not planned for residential use. Do not build immediately above this Parcel. Implement a VMS for nearby buildings. Risk of exposure to groundwater mitigated by St. Louis Ordinance 66777.
2317	149	2536 HOWARD ST	0.22	Historic shoe manufacturing and machine shop operations, dry cleaning, Rubber company	Yes (Tt)	P149-1, -2	As in soil > RBTL; BaP in SS (1.5 mg/kg)	As > RBTL; PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	150	1600 N JEFFERSON AV	3.23	Historic Hatter and Dry cleaning operations, box manufacturer	Yes (Tt)	P150-1	As in soil > RBTL; BaP in SS (2.4 mg/kg)	As > RBTL; PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
2318	281	2300-2 HOWARD ST	0.08	No REC	No		N/A	N/A	NFA
	282	1617 N 23RD ST	0.04	No REC	No		N/A	N/A	NFA
	283	2304 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	284	2306 HOWARD ST	0.05	No REC	No		N/A	N/A	NFA
	285	2308 HOWARD ST	0.04	No REC	No		N/A	N/A	NFA
	286	2312 HOWARD ST	0.06	No REC	No		N/A	N/A	NFA
	287	2314 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	288	2316 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	289	2318 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	290	2320 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	291	2322 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	292	2324 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	293	2326-32 HOWARD ST	0.22	No REC	No		N/A	N/A	NFA
	294	2334 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	295	2336 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	296	2342 HOWARD ST	0.10	No REC	No		N/A	N/A	NFA
	297	2344 HOWARD ST	0.12	No REC	No		N/A	N/A	NFA
298	2346-8 HOWARD ST	0.09	No REC	Yes (USACE)	MW-7	GW sample below MCLs/RBTLs	No	NFA	
299	2329-49 MULLANPHY ST	0.70	No REC	No		N/A	N/A	NFA	
300	2327 MULLANPHY ST	0.05	No REC	No		N/A	N/A	NFA	
301	2325 MULLANPHY ST	0.06	No REC	No		N/A	N/A	NFA	
302	2323 MULLANPHY ST	0.05	No REC	No		N/A	N/A	NFA	
303	2321 MULLANPHY ST	0.06	No REC	No		N/A	N/A	NFA	
304	2305-17 MULLANPHY ST	0.58	No REC	No		N/A	N/A	NFA	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
2319	524	1618 N 23RD ST	0.05	No REC	No		N/A	N/A	NFA
	525	2242-8 HOWARD ST	0.20	No REC	No		N/A	N/A	NFA
	526	2238-40 HOWARD ST	0.09	No REC	Yes (SCI)	T-72	ACM	ACM	Risk from ACM has been or will be mitigated through removal action.
	527	2230 HOWARD ST	0.23	No REC	No		N/A	N/A	NFA
	528	2228 HOWARD ST	0.06	Historic Trucking company, coal sales	No		N/A	No	NFA
	529	2226 HOWARD ST	0.07	Historic Trucking company, coal sales	No		N/A	No	NFA
	530	2224 HOWARD ST	0.07	Historic Trucking company, coal sales	No		N/A	No	NFA
	531	2222 HOWARD ST	0.07	Historic Trucking company, coal sales	Yes (SCI), (Tt)	SCI-71, P531-1, -2	As in soil (16 mg/kg); Pb in SS (450 mg/kg); BaP in SS (25 mg/kg); GW sampled - ND or < DTLs	As in soil > RBTL; Pb/PAHs in surface soil > RBTL	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	532	2214 HOWARD ST	0.22	No REC	No		N/A	N/A	NFA
	533	2212 HOWARD ST	0.07	No REC	Yes (SG)	Structure 13	ACM	ACM	NFA. ACM has been removed.
	534	2210 HOWARD ST	0.06	No REC	No		N/A	N/A	NFA
	535	2208 HOWARD ST	0.05	No REC	No		N/A	N/A	NFA
	536	2206 HOWARD ST	0.05	No REC	No		N/A	N/A	NFA
	537	2204 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	538	2200-2 HOWARD ST	0.13	No REC	No		N/A	N/A	NFA
	539	2201-5 MULLANPHY ST	0.64	No REC	No		N/A	N/A	NFA
	540	2223 MULLANPHY ST	0.06	No REC	Yes (SG)	Structure 30	ACM	ACM	NFA. ACM has been removed.
	541	2225 MULLANPHY ST	0.06	No REC	Yes (SG)	Structure 31	ACM	ACM	NFA. ACM has been removed.
	542	2227-9 MULLANPHY ST	0.21	No REC	No		N/A	N/A	NFA
	543	2233 MULLANPHY ST	0.06	No REC	No		N/A	N/A	NFA
544	2235-7 MULLANPHY ST	0.48	No REC	No		N/A	N/A	NFA	
2324	496	2244-8 MADISON ST	0.18	No REC	No		N/A	N/A	NFA
	497	2242 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	498	2240 MADISON ST	0.06	No REC	No		N/A	N/A	NFA
	499	2236-8 MADISON ST	0.09	No REC	No		N/A	N/A	NFA
	500	2234 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	501	2232 MADISON ST	0.08	No REC	No		N/A	N/A	NFA
	502	2226-30 MADISON ST	0.15	No REC	No		N/A	N/A	NFA
	503	2222-4 MADISON ST	0.13	No REC	No		N/A	N/A	NFA
	504	2220 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	505	2218 MADISON ST	0.09	No REC	No		N/A	N/A	NFA
	506	2214 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	507	2210 MADISON ST	0.11	No REC	No		N/A	N/A	NFA
	508	2208 MADISON ST	0.06	No REC	No		N/A	N/A	NFA
	509	2206 MADISON ST	0.13	No REC	No		N/A	N/A	NFA
	510	2200-2 MADISON ST	0.13	Historic Dry Cleaners, auto body shop	Yes (SCI)	SCI-66, - 67	Pb in SS (238 mg/kg); PAHs in SS, BaP (2.91 mg/kg); GW sample ND or below RBTLs	PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	511	2201-5 HOWARD ST	0.20	No REC	No		N/A	N/A	NFA
	512	2207 HOWARD ST	0.09	No REC	No		N/A	N/A	NFA
	513	2209 HOWARD ST	0.06	No REC	No		N/A	N/A	NFA
	514	2211 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	515	2215 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
516	2217 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA	
517	2219 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA	
518	2221-9 HOWARD ST	0.22	No REC	No		N/A	N/A	NFA	
519	2231-3 HOWARD ST	0.26	No REC	No		N/A	N/A	NFA	
520	2235-7 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA	
521	2239 HOWARD ST	0.05	No REC	No		N/A	N/A	NFA	
522	2243 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA	
523	2245-9 HOWARD ST	0.18	No REC	No		N/A	N/A	NFA	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
2325	251	2300-2 MADISON ST	0.12	No REC	No		N/A	N/A	NFA
	252	2304 MADISON ST	0.11	No REC	No		N/A	N/A	NFA
	253	2310 MADISON ST	0.11	No REC	No		N/A	N/A	NFA
	254	2314 MADISON ST	0.15	No REC	No		N/A	N/A	NFA
	255	2318 MADISON ST	0.11	No REC	No		N/A	N/A	NFA
	256	2320 MADISON ST	0.06	No REC	No		N/A	N/A	NFA
	257	2322 MADISON ST	0.05	No REC	No		N/A	N/A	NFA
	258	2324 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	259	2326 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	260	1702 25TH ST	0.05	No REC	No		N/A	N/A	NFA
	261	2330-2 MADISON ST	0.12	No REC	No		N/A	N/A	NFA
	262	2334-40 MADISON ST	0.22	No REC	No		N/A	N/A	NFA
	263	2342-6 MADISON ST	0.15	No REC	No		N/A	N/A	NFA
	264	2348 MADISON ST	0.09	No REC	No		N/A	N/A	NFA
	265	1700 25TH ST	0.24	No REC	Yes (SG)	Structure 40	ACM	ACM	NFA. ACM has been removed.
	266	2339 HOWARD ST	0.10	No REC	No		N/A	N/A	NFA
	267	2337 HOWARD ST	0.05	No REC	No		N/A	N/A	NFA
	268	2335 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	269	2333 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	270	2331 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	271	2329 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	272	2325 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	273	2321-3 HOWARD ST	0.15	No REC	No		N/A	N/A	NFA
	274	2319 HOWARD ST	0.07	No REC	No		N/A	N/A	NFA
	275	2317 HOWARD ST	0.05	No REC	No		N/A	N/A	NFA
	276	2315 HOWARD ST	0.04	No REC	No		N/A	N/A	NFA
	277	2313 HOWARD ST	0.13	Historic Dry cleaners, machinery manufacturing, Semco Plastics	No	Covered by Parcels 278-280.		No	NFA.
	278	2307-9 HOWARD ST	0.07	Historic Dry cleaners, machinery manufacturing, Semco Plastics	Yes (SCI)	SCI-68	Metals, VOCs, and PAHs below DTLs in soil samples; GW sampled - PCE detected < RBTLs	No	NFA.
279	2305 HOWARD ST	0.10	Historic Dry cleaners, machinery manufacturing, Semco Plastics	Yes (SCI)	SCI-69	Metals, VOCs, and PAHs below DTLs in soil samples; GW not sampled	No	NFA.	
280	2301-3 HOWARD ST	0.10	Historic Dry cleaners, machinery manufacturing, Semco Plastics	Yes (SCI); (USACE)	SCI-70; MW-6	BaP (1.94 mg/kg) in SS; PCE in GW > MCL	PCE in groundwater >MCL	Remove/remediate surface and subsurface soil to groundwater and implement LUCs at this Parcel. Property not planned for residential use. Concentration of PCE is below risk; however, implementing a VMS for nearby buildings should be considered. Risk of exposure to groundwater mitigated by St. Louis Ordinance 66777.	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
2326	143	2530 MADISON ST	0.64	Historic shoe manufacturing and machine shop operations	Yes (SCI)	SCI-58, -59	Pb (388 mg/kg); PAHs in SS - BaP, BbF, BahA, Indeno; PAHs in GW below RBTLs	Metals/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	144	2500-24 MADISON ST	0.93	Historic shoe manufacturing and machine shop operations	Yes (SCI)	SCI-61, -63, -64, -65	As in soil > RBTL; Pb (679 mg/kg), PAHs in SS > RBTLs; GW below RBTLs	Metals/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action. As is likely naturally occurring.
	145	2521 HOWARD ST	0.07	Historic Trucking/motor freight operations	No		N/A	No	NFA. Risk from surface soil mitigated by current removal action.
	146	2525 HOWARD ST	0.30	Historic Trucking/motor freight operations	Yes (Tt)	P146-1, -2	Pb (300 mg/kg); BaP in SS (2.1 mg/kg); GW not sampled (dry)	Metals/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	147	2533-5 HOWARD ST	0.12	No REC	No		N/A	N/A	NFA
2327	148	2537 HOWARD ST	0.40	No REC	No		N/A	N/A	NFA
	119	2500 MAIDEN LA	0.02	No REC	No		N/A	N/A	NFA
	120	2501 MADISON ST	0.04	No REC	No		N/A	N/A	NFA
	121	2503 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	122	2505 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	123	2509 MADISON ST	0.08	No REC	No		N/A	N/A	NFA
	124	2512 MAIDEN LA	0.01	No REC	No		N/A	N/A	NFA
	125	2511 MADISON ST	0.06	No REC	No		N/A	N/A	NFA
	126	2513 MADISON ST	0.08	No REC	Yes (SG)	Structure 18	ACM	ACM	NFA. ACM has been removed.
	127	2517 MADISON ST	0.09	No REC	No		N/A	N/A	NFA
	128	2521 MADISON ST	0.09	No REC	Yes (SG)	Structure 19	ACM	ACM	NFA. ACM has been removed.
	129	2526 MAIDEN LA	0.01	Historic Auto Repair	No		N/A	No	NFA
	130	2530 MAIDEN LA	0.01	Historic Auto Repair	No		N/A	No	NFA
	131	2525 MADISON ST	0.12	Historic Auto Repair	Yes (SCI)	SCI-49, -50, -51	Soil and GW samples ND or below DTLs	No	NFA
	132	2527 MADISON ST	0.08	No REC	No		N/A	No	NFA
	133	2529 MADISON ST	0.07	No REC	No		N/A	No	NFA
	134	2531 MADISON ST	0.08	No REC	No		N/A	No	NFA
	135	2533 MADISON ST	0.08	No REC	No		N/A	No	NFA
	136	2535 MADISON ST	0.07	No REC	No		N/A	No	NFA
	137	2543 MADISON ST	0.08	No REC	No		N/A	No	NFA
138	2547-9 MADISON ST	0.13	No REC	No		N/A	No	NFA	
139	1810-2 N JEFFERSON AV	0.09	Historic Wrecking operations	Yes (SCI)	SCI-47	Soil and GW samples ND or below DTLs	No	NFA	
140	1804-6 N JEFFERSON AV	0.08	Historic Wrecking operations	Yes (SCI)	SCI-46	BaP in SS (0.708 mg/kg)	PAHs in surface soil >RBTLs	NFA. Risk from surface soil mitigated by current removal action.	
141	1802 N JEFFERSON AV	0.04	Historic Wrecking operations	Yes (SCI)	SCI-48	Soil ND or below DTLs; No GW samples collected	No	NFA	
142	1800 N JEFFERSON AV	0.04	Historic Wrecking operations	No		N/A	No	NFA	
2328	243	2351 MADISON ST	0.06	No REC	No		N/A	N/A	NFA
	244	2347-9 MADISON ST	0.08	No REC	No		N/A	N/A	NFA
	245	2339-45 MADISON ST	0.21	No REC	No		N/A	N/A	NFA
	246	2337 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	247	2335 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	248	2331 MADISON ST	0.07	No REC	Yes (SG)	Structure 16	ACM	ACM	NFA. ACM has been removed.
	249	2329 MADISON ST	0.14	No REC	No		N/A	N/A	NFA
	250	2301-23 MADISON ST	0.68	Unknown History	Yes (SCI)	SCI-52, -53, -54	BaP (11.4 mg/kg) in SS; GW sampled - ND or < DTLs	PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by removal action.

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
2329	482	2201-3 MADISON ST	0.15	Historic Auto Repair, dry cleaners	Yes (SCI); (USACE)	SCI-55, -57; MW-5	Soil sample ND/< RBTLs; GW sample ND or below DTLs; BaP > RBTL.	BaP in ss > RBTL	NFA. Risk from surface soil mitigated by removal action.
	483	2205-7 MADISON ST	0.06	Historic Auto Repair, dry cleaners	No		Covered by Parcel 482		
	484	2209 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	485	2211 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	486	2213 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	487	2215-9 MADISON ST	0.14	No REC	No		N/A	N/A	NFA
	488	2221-3 MADISON ST	0.09	No REC	Yes (SG)	Structure 15	ACM	ACM	NFA. ACM has been removed.
	489	2225 MADISON ST	0.06	No REC	No		N/A	N/A	NFA
	490	2227 MADISON ST	0.12	No REC	No		N/A	N/A	NFA
	491	2231 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	492	2233 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	493	2237 MADISON ST	0.07	No REC	No		N/A	N/A	NFA
	494	2239-41 MADISON ST	0.12	No REC	No		N/A	N/A	NFA
	495	1804-12 N 23RD ST	0.22	No REC	No		N/A	N/A	NFA
2345	455	2200 NORTH MARKET ST	0.04	No REC	No		N/A	N/A	NFA
	456	2202 NORTH MARKET ST	0.04	No REC	No		N/A	N/A	NFA
	457	2204-6 NORTH MARKET ST	0.03	No REC	No		N/A	N/A	NFA
	458	2208 NORTH MARKET ST	0.03	No REC	No		N/A	N/A	NFA
	459	1831 N 22ND ST	0.04	No REC					
	460	1829 N 22ND ST	0.03	No REC	Yes (SG)	Structure 15	ACM	ACM	NFA. ACM has been removed.
	461	1827 N 22ND ST	0.04	No REC	No		N/A	N/A	NFA
	462	2210-4 NORTH MARKET ST	0.26	No REC	No		N/A	N/A	NFA
	463	2216 NORTH MARKET ST	0.09	No REC	No		N/A	N/A	NFA
	464	2218 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
	465	2218 1/2 NORTH MARKET ST	0.05	No REC	No		N/A	N/A	NFA
	466	2220 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
	467	2222 NORTH MARKET ST	0.09	No REC	No		N/A	N/A	NFA
	468	2224-8 NORTH MARKET ST	0.17	No REC	No		N/A	N/A	NFA
	469	2230 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
	470	2232 NORTH MARKET ST	0.06	No REC	No		N/A	N/A	NFA
	471	2234-6 NORTH MARKET ST	0.12	No REC	No		N/A	N/A	NFA
	472	2238 NORTH MARKET ST	0.09	No REC	No		N/A	N/A	NFA
	473	2240-4 NORTH MARKET ST	0.17	No REC	No		N/A	N/A	NFA
	474	2248 NORTH MARKET ST	0.18	No REC	No		N/A	N/A	NFA
	475	1824 N 23RD ST	0.05	No REC	No		N/A	N/A	NFA
476	1822 N 23RD ST	0.05	No REC	No		N/A	N/A	NFA	
477	1820 N 23RD ST	0.05	No REC	No		N/A	N/A	NFA	
478	1818 N 23RD ST	0.05	No REC	No		N/A	N/A	NFA	
479	1814-6 N 23RD ST	0.10	No REC	No		N/A	N/A	NFA	
480	2231-3 MAIDEN LA	0.46	No REC	No		N/A	N/A	NFA	
481	2201-19 MAIDEN LA	0.77	No REC	No		N/A	N/A	NFA	

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation	
2346	220	2344-8 NORTH MARKET ST	0.32	Historic Auto Repair	Yes (SCI)	SCI-37, -39, -39; T35-104-40	Pb (682 mg/kg), PAHs (BaP 3.63 mg/kg) in SS > RBTLs; GW below RBTLs; ACM	Metals/PAHs in surface soil > RBTLs; ACM	NFA. Risk from surface soil and ACM mitigated by current removal action.	
	221	2338 NORTH MARKET ST	0.07	No REC	No		N/A	N/A	NFA	
	222	2336 1/2 NORTH MARKET ST	0.05	No REC	Yes (SG)	Structure 22	ACM	ACM	NFA. ACM has been removed.	
	223	2336 NORTH MARKET ST	0.05	No REC	Yes (SG)	Structure 21	ACM	ACM	NFA. ACM has been removed.	
	224	2332-4 NORTH MARKET ST	0.12	No REC	No		N/A	N/A	NFA	
	225	2330 NORTH MARKET ST	0.09	No REC	No		N/A	N/A	NFA	
	226	2328 NORTH MARKET ST	0.07	No REC	No		N/A	N/A	NFA	
	227	2326 NORTH MARKET ST	0.08	No REC	No		N/A	N/A	NFA	
	228	2324 NORTH MARKET ST	0.09	No REC	No		N/A	N/A	NFA	
	229	2320-2 NORTH MARKET ST	0.11	No REC	No		N/A	N/A	NFA	
	230	2318 NORTH MARKET ST	0.24	No REC	No		N/A	N/A	NFA	
	231	2310-2 NORTH MARKET ST	0.18	No REC	No		N/A	N/A	NFA	
	232	2306-8 NORTH MARKET ST	0.11	No REC	No		N/A	N/A	NFA	
	233	2300-4 NORTH MARKET ST	0.18	No REC	No		N/A	N/A	NFA	
	234	2301 MAIDEN LA	0.38	Historic Iron works, machinery manufacturing, 2 USTs installed for gas station	Yes (SCI)	SCI-43, -44, -45	Pb in SS (973 mg/kg); BaP (2.49 mg/kg) in SS; GW sampled - ND/<DTLs for PAHs/VOCs; TPH-ORO > DTL	Pb in surface soil > RBTL; PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by removal action.	
	235	2313 MAIDEN LA	0.08							
	236	2315-9 MAIDEN LA	0.15							
237	2323-7 MAIDEN LA	0.23								
238	2329 MAIDEN LA	0.08								
239	2331 MAIDEN LA	0.08								
240	2333 MAIDEN LA	0.08								
241	2337 MAIDEN LA	0.08								
242	2339 MAIDEN LA	0.38	Historic junkyard	Yes (SCI)	SCI-40, -41, -42	Pb (784 mg/kg), PAHs (BaP 1.87 mg/kg) in SS > RBTLs; GW below RBTLs; TPH-ORO in GW (44.3 mg/L)	Metals/PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.		

TABLE 1 (Continued)

PROPOSED NGIA SITE
ST. LOUIS, MISSOURI

City Block	Parcel ID	Site Address	Acres	Environmental Concern	Sampled	Locations	Notable Findings	Potential Risk	Recommendation
2347	84	2500 NORTH MARKET ST	0.12	No REC	No		N/A	N/A	NFA
	85	2504 NORTH MARKET ST	0.10	No REC	Yes (SG)	Structure 23	None	N/A	N/A
	86	2508 NORTH MARKET ST	0.11	No REC	No		N/A	N/A	NFA
	87	2510 NORTH MARKET ST	0.12	No REC	No		N/A	N/A	NFA
	88	2512 NORTH MARKET ST	0.13	No REC	No		N/A	N/A	NFA
	89	2516 NORTH MARKET ST	0.12	Historic Dry Cleaners	Yes (SCI); (USACE)	SCI-35, -36; MW-4	BaP (3.24 mg/kg) in surface soil; groundwater below RBTLs/MCLs	PAHs in surface soil > RBTLs	NFA. Risk from surface soil mitigated by current removal action.
	90	2518-20 NORTH MARKET ST	0.15	No REC	Yes (SG)	Structure 26*	None	N/A	NFA
	91	2524 NORTH MARKET ST	0.10	No REC	Yes (SG)	Structure 26*	None	N/A	NFA
	92	2526 NORTH MARKET ST	0.10	No REC	No		N/A	N/A	NFA
	93	2530 NORTH MARKET ST	0.17	No REC	No		N/A	N/A	NFA
	94	2534-6 NORTH MARKET ST	0.18	No REC	No		N/A	N/A	NFA
	95	2538-40 NORTH MARKET ST	0.17	No REC	No		N/A	N/A	NFA
	96	2544-6 NORTH MARKET ST	0.19	No REC	No		N/A	N/A	NFA
	97	2548 NORTH MARKET ST	0.08	No REC	Yes (SG)	Structure 27	ACM	ACM	NFA. ACM has been removed.
	98	2552 NORTH MARKET ST	0.07	No REC	Yes (SG)	Structure 28	ACM	ACM	NFA. ACM has been removed.
	99	2555 MAIDEN LA	0.03	No REC	No		N/A	N/A	NFA
	100	2553 MAIDEN LA	0.03	No REC	No		N/A	N/A	NFA
	101	2554 NORTH MARKET ST	0.03	No REC	No		N/A	N/A	NFA
102	2551 MAIDEN LA	0.07	No REC	No		N/A	N/A	NFA	
103	2549 MAIDEN LA	0.08	No REC	No		N/A	N/A	NFA	
104	2547 MAIDEN LA	0.08	No REC	No		N/A	N/A	NFA	
105	2543 MAIDEN LA	0.09	No REC	No		N/A	N/A	NFA	
106	2541 MAIDEN LA	0.07	No REC	No		N/A	N/A	NFA	
107	2539 MAIDEN LA	0.07	No REC	No		N/A	N/A	NFA	
108	2537 MAIDEN LA	0.08	No REC	No		N/A	N/A	NFA	
109	2533 MAIDEN LA	0.15	No REC	No		N/A	N/A	NFA	
110	2529 MAIDEN LA	0.07	No REC	No		N/A	N/A	NFA	
111	2527 MAIDEN LA	0.07	No REC	No		N/A	N/A	NFA	
112	2525 MAIDEN LA	0.14	No REC	No		N/A	N/A	NFA	
113	2517-9 MAIDEN LA	0.15	No REC	No		N/A	N/A	NFA	
114	2513 MAIDEN LA	0.08	No REC	No		N/A	N/A	NFA	
115	2511 MAIDEN LA	0.07	No REC	No		N/A	N/A	NFA	
116	2505-9 MAIDEN LA	0.15	No REC	No		N/A	N/A	NFA	
117	2503 MAIDEN LA	0.07	No REC	No		N/A	N/A	NFA	
118	2501 MAIDEN LA	0.08	No REC	No		N/A	N/A	NFA	

Notes:

- High environmental risk (as identified in Phase I ESA)
- Medium environmental risk (as identified in Phase I ESA)
- * Indicates location is labeled more than once in background report

ACM	Asbestos-containing material	ND	Sampled analytes not detected above laboratory reporting limits
As	Arsenic	NFA	No further action
BaA	Benzo(a)anthracene	PAH	Polycyclic aromatic hydrocarbons
BaP	Benzo(a)pyrene	Pb	Lead
BbF	Benzo(b)fluoranthene	RBTL	Risk-based target level
DahA	Dibenzo(a,h)anthracene	REC	Recognized environmental condition
DTL	Default target level	SCI	SCI Engineering Inc.
GW	Groundwater	SG	Seagull Environmental Technologies, Inc.
Indeno	Indeno(1,2,3-cd)pyrene	SS	Surface soil
LUC	Land use control	Tt	Tetra Tech, Inc.
MCL	Maximum contaminant level		

APPENDIX C

VAPOR INTRUSION SCREENING LEVEL RESULTS

OSWER VAPOR INTRUSION ASSESSMENT

Vapor Intrusion Screening Level (VISL) Calculator Version 3.5, June 2017 RSLs

The primary objective of risk-based screening is to identify sites or buildings unlikely to pose a health concern through the vapor intrusion pathway. Generally, at properties where subsurface concentrations of vapor-forming chemicals (e.g., groundwater or "near source" soil gas concentrations) fall below screening levels (i.e., VISLs), no further action or study is warranted, so long as the exposure assumptions match those taken into account by the calculations and the site fulfills the conditions and assumptions of the generic conceptual model underlying the screening levels. In a similar fashion, the results of risk-based screening can help the data review team identify areas, buildings, and/or chemicals that can be eliminated from further assessment. The generic conceptual model underlying these screening levels is described in OSWER Publication 9200.2-154 (OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air) (EPA 2015, Section 6.5)

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens
Average Groundwater Temperature (°C)	Tgw	11	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

Chemical	CAS#	Does the chemical meet the definition for volatility? (HLC>1E-5 or VP>1)	Does chemical have inhalation toxicity data? (IUR and/or RTC)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Soil Sources? Cvp > Cia.target?	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Sources? MIN(Cia.c,Cia.nc)	Target Indoor Air Conc. @ TCR = 1E-06 or THQ = 1	Toxicity Basis	Target Sub-Slab and Exterior Soil Gas Conc. @ TCR = 1E-06 or THQ = 1	Target Ground Water Conc. @ THQ = 1	Is Target Ground Water Conc. < MCL?	Pure Phase Vapor Conc. @ 25°C	Maximum Groundwater Vapor Conc.	Temperature for Max. Groundwater Vapor Conc. Tgw or 25	Lower Explosive Limit**	LEL Source	Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator	Target Indoor Air Conc. for Carcinogens @ TCR = 1E-06	Target Indoor Air Conc. for Non-Carcinogens @ THQ = 1	
																					Cia.c	Cia.nc	
71-43-2	Benzene	Yes	Yes	Yes	Yes	1.8E+00	C	5.2E+01	6.9E+00	No (5)	3.98E+08	4.06E+08	11	1.2	N	7.80E-06	I	3.00E-02	I	I	1.6E+00	1.3E+02	
1534-04-4	Methyl tert-Butyl Ether (MTBE)	Yes	Yes	Yes	Yes	4.7E+01	C	1.8E+03	3.8E+03	--	1.19E+09	6.68E+08	11	1.8	M	2.60E-07	CA	3.00E+00	I	I	4.7E+01	1.3E+04	
81-57-6	Methylnaphthalene, 2-	Yes	No	No	No Inhal. Tox. Info						4.21E+05	1.35E+05	11										
81-20-3	Naphthalene	Yes	Yes	Yes	Yes	3.6E-01	C	1.2E+01	5.9E+01	--	5.88E+05	1.91E+05	11	0.9	N	3.40E-05	CA	3.00E-03	I	I	3.8E-01	1.3E+01	
127-18-4	Tetrachloroethylene	Yes	Yes	Yes	Yes	4.7E+01	C	1.6E+03	1.4E+02	No (5)	1.65E+08	6.74E+07	11									4.7E+01	1.8E+02

Notes:

- (1) **Inhalation Pathway Exposure Parameters (RME):**
- | Exposure Scenario | Units | Residential | Commercial | Selected (based on scenario in cell G10) |
|------------------------------------|-----------|-------------|------------|--|
| Averaging time for carcinogens | (yrs) | ATC_R 70 | ATC_C 70 | ATC 70 |
| Averaging time for non-carcinogens | (yrs) | ATnc_R 26 | ATnc_C 25 | ATnc 25 |
| Exposure duration | (yrs) | ED_R 26 | ED_C 25 | ED 25 |
| Exposure frequency | (days/yr) | EF_R 350 | EF_C 250 | EF 250 |
| Exposure time | (hr/day) | ET_R 24 | ET_C 8 | ET 8 |
- (2) **Generic Attenuation Factors:**
- | Source Medium of Vapors | Units | Residential | Commercial | Selected (based on scenario in cell G10) |
|--------------------------------|-------|--------------|--------------|--|
| Groundwater | (-) | AFgw_R 0.001 | AFgw_C 0.001 | AFgw 0.001 |
| Sub-Slab and Exterior Soil Gas | (-) | AFss_R 0.03 | AFss_C 0.03 | AFss 0.03 |
- (3) **Formulas**
- Cia_target = MIN(Cia.c, Cia.nc)
 Cia.c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
 Cia.nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RTC x (1000 ug/mg) / (ED x EF x ET)
- (4) **Special Case Chemicals**
- | Chemical | Residential | Commercial | Selected (based on scenario in cell G10) |
|-------------------|---|---|--|
| Trichloroethylene | mIURTCR_R 1.00E-06
IURTCR_R 3.10E-06 | mIURTCR_C 0.00E+00
IURTCR_C 4.10E-06 | mIURTCR 0.00E+00
IURTCR 4.10E-06 |

Mutagenic Chemicals

The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration (years)	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 5 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMAO) adjustment factor = 25. This factor is used in the equations for mutagenic chemicals.

See the Navigation Guide equation for Cia.c for vinyl chloride.

Notation:

N/T = Not sufficiently volatile and/or toxic to pose inhalation risk in selected exposure scenario for the indicated medium

C = Carcinogenic

NC = Non-carcinogenic

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: <http://www.epa.gov/iris/subst/index.html>

P = PPRTV: EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: <http://hhprrtv.com.gov/pprtv.shtml>

A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: <http://www.atsdr.cdc.gov/mrls/index.html>

CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: <http://www.oehha.ca.gov/risk/ChemicalDB/index.asp>

H = HEAST: EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: <http://epa-heast.com.gov/heast.shtml>

S = See RSL User Guide, Section 5

X = PPRTV Appendix

E = The Engineering ToolBox. Available online at http://www.engineeringtoolbox.com/explosive-concentration-limits-d_423.html

N = Centers for Disease Control and Prevention (CDC) National Institute for Occupational Safety and Health (NIOSH). Pocket Guide to Chemical Hazards. Available online at: <http://www.cdc.gov/niosh/npg/default.html>

M = Chemical-specific MSDS

Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).

VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).

TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).

Yellow highlighting indicates site-specific parameters that may be edited by the user.

Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

**Lower explosive limit is the minimum concentration of the compound in air (by volume) that is needed for the gas to ignite and explode.

OSWER VAPOR INTRUSION ASSESSMENT

Vapor Intrusion Screening Level (VISL) Calculator Version 3.5, June 2017 RSLs

The primary objective of risk-based screening is to identify sites or buildings unlikely to pose a health concern through the vapor intrusion pathway. Generally, at properties where subsurface concentrations of vapor-forming chemicals (e.g., groundwater or "near source" soil gas concentrations) fall below screening levels (i.e., VISLs), no further action or study is warranted, so long as the exposure assumptions match those taken into account by the calculations and the site fulfills the conditions and assumptions of the generic conceptual model underlying the screening levels. In a similar fashion, the results of risk-based screening can help the data review team identify areas, buildings, and/or chemicals that can be eliminated from further assessment. The generic conceptual model underlying these screening levels is described in OSWER Publication 9200.2-154 (OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air) (EPA 2015, Section 6.5)

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens
Average Groundwater Temperature (°C)	Tgw	11	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

Chemical	CAS#	Does the chemical meet the definition for volatility? (HLC>1E-5 or VP>1)	Does chemical have inhalation toxicity data? (IUR and/or RTC)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Soil Source? Cvp > Cia.target?	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Source? MIN(Cia.c,Cia.nc)	Target Indoor Air Conc. @ TCR = 1E-06 or THQ = 1	Toxicity Basis	Target Sub-Slab and Exterior Soil Gas Conc. @ TCR = 1E-06 or THQ = 1	Target Ground Water Conc. @ THQ = 1	Is Target Ground Water Conc. < MCL?	Pure Phase Vapor Conc. @ 25°C	Maximum Groundwater Vapor Conc.	Temperature for Max. Groundwater Vapor Conc.	Lower Explosive Limit**	LEL Source	Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator	Target Indoor Air Conc. for Carcinogens @ TCR = 1E-06	Target Indoor Air Conc. for Non-Carcinogens @ THQ = 1	
																					Cia.c	Cia.nc	
71-43-2	Benzene	Yes	Yes	Yes	Yes	3.6E-01	C	1.2E+01	1.6E+00	Yes (5)	3.98E+08	4.06E+08	11	1.2	N	7.80E-06	I	3.00E-02	I	I	3.6E-01	3.1E+01	
1534-04-4	Methyl tert-Butyl Ether (MTBE)	Yes	Yes	Yes	Yes	1.1E+01	C	3.6E+02	6.2E+02	--	1.19E+09	6.68E+08	11	1.8	M	2.60E-07	CA	3.00E+00	I	I	1.1E+01	3.1E+03	
81-57-6	Methylsulfonamide, 2-	Yes	No	No Inhal. Tox. Info	No Inhal. Tox. Info						4.21E+05	1.35E+05	11										
81-20-3	Naphthalene	Yes	Yes	Yes	Yes	8.3E-02	C	2.8E+00	1.3E+01	--	5.88E+05	1.91E+05	11	0.9	N	3.40E-05	CA	3.00E-03	I	I	8.3E-02	3.1E+00	
127-18-4	Tetrachloroethylene	Yes	Yes	Yes	Yes	1.1E+01	C	3.6E+02	3.3E+01	No (5)	1.65E+08	6.74E+07	11								1.1E+01	4.2E+01	

Notes:

- (1) **Inhalation Pathway Exposure Parameters (RME):**
- | Exposure Scenario | Units | Residential | Commercial | Selected (based on scenario in cell G10) |
|------------------------------------|-----------|-------------|------------|--|
| Averaging time for carcinogens | (yrs) | ATC_R 70 | ATC_C 70 | ATC 70 |
| Averaging time for non-carcinogens | (yrs) | ATnc_R 26 | ATnc_C 25 | ATnc 26 |
| Exposure duration | (yrs) | ED_R 26 | ED_C 25 | ED 26 |
| Exposure frequency | (days/yr) | EF_R 350 | EF_C 250 | EF 350 |
| Exposure time | (hr/day) | ET_R 24 | ET_C 8 | ET 24 |
- (2) **Generic Attenuation Factors:**
- | Source Medium of Vapors | Units | Residential | Commercial | Selected (based on scenario in cell G10) |
|--------------------------------|-------|--------------|--------------|--|
| Groundwater | (-) | AFgw_R 0.001 | AFgw_C 0.001 | AFgw 0.001 |
| Sub-Slab and Exterior Soil Gas | (-) | AFss_R 0.03 | AFss_C 0.03 | AFss 0.03 |
- (3) **Formulas**
- Cia_target = MIN(Cia.c, Cia.nc)
 Cia.c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
 Cia.nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RTC x (1000 ug/mg) / (ED x EF x ET)
- (4) **Special Case Chemicals**
- | Chemical | Residential | Commercial | Selected (based on scenario in cell G10) |
|-------------------|---|---|--|
| Trichloroethylene | mIURTCR_R 1.00E-06
IURTCR_R 3.10E-06 | mIURTCR_C 0.00E+00
IURTCR_C 4.10E-06 | mIURTCR 1.00E-06
IURTCR 3.10E-06 |

Mutagenic Chemicals

The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration (years)	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 5 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72. This factor is used in the equations for mutagenic chemicals.

See the Navigation Guide equation for Cia.c for vinyl chloride.

Notation:

N/T = Not sufficiently volatile and/or toxic to pose inhalation risk in selected exposure scenario for the indicated medium

C = Carcinogenic

NC = Non-carcinogenic

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: <http://www.epa.gov/iris/subst/index.html>

P = PPRTV: EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: <http://hhsprtv.com/gov/pprtv.shtml>

A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: <http://www.atsdr.cdc.gov/mrls/index.html>

CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: <http://www.oehha.ca.gov/risk/ChemicalDB/index.asp>

H = HEAST: EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: <http://epa-heast.com/gov/heast.shtml>

S = See RSL User Guide, Section 5

X = PPRTV Appendix

E = The Engineering ToolBox. Available online at http://www.engineeringtoolbox.com/explosive-concentration-limits-d_423.html

N = Centers for Disease Control and Prevention (CDC) National Institute for Occupational Safety and Health (NIOSH). Pocket Guide to Chemical Hazards. Available online at: <http://www.cdc.gov/niosh/npg/default.html>

M = Chemical-specific MSDS

Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).

VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).

TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).

Yellow highlighting indicates site-specific parameters that may be edited by the user.

Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

**Lower explosive limit is the minimum concentration of the compound in air (by volume) that is needed for the gas to ignite and explode.