

ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES
U.S. EPA Brownfield
American Recovery and Reinvestment Act of 2009 (ARRA) Revolving Loan Fund
(RLF) Assistance Amendment (AA)# 2B-00E96801-1
and RLF AA# BL-00E48101-4
Indiana Brownfields Program
Former Columbus Wood Treating Plant Site
53 Lafayette Avenue (a.k.a. 705 2nd Street)
Columbus, Indiana
Revised November 2011

This Analysis of Brownfield Cleanup Alternatives (ABCA) was prepared in cooperation among the Indiana Brownfields Program (Program), the City of Columbus, and Bruce Carter Associates (BCA) as a requirement for borrowing United States Environmental Protection Agency (U.S. EPA) Revolving Loan Fund (RLF) monies to remediate a brownfield. The subject brownfield site is the Former Columbus Wood Treating Plant Site located at 53 Lafayette Avenue (a.k.a. 705 2nd Street) in Columbus, Indiana (Site). The Program and U.S. EPA deemed the Site eligible for the expenditure of \$1.2 million in combined Program ARRA RLF and Regular RLF funds by the City of Columbus (City) Redevelopment Commission as the borrower. Phase II Environmental Site Assessment (ESA) activities that were conducted determined soil and ground water contamination at the Site. Environmental remediation activities utilizing this RLF funding are anticipated to be implemented in 2012. Site reuse is planned as a parking lot for a future recreational facility.

The ABCA outlines the following seven (7) alternative cleanup and environmental management activities that are being considered for the Site:

1. Alternative 1 – Soil Vapor Extraction
2. Alternative 2 – SVE with Groundwater Depression
3. Alternative 3 – Bioremediation
4. Alternative 4 – Soil Excavation / Disposal
5. Alternative 5 – Soil Excavation / Disposal and Ex-situ Soil S/S
6. Alternative 6 – In-situ Soil S/S of All Contaminated Soils
7. Alternative 7 – Soil Excavation / Disposal and In-situ Soil S/S

Site History/Comprehensive Plan

The Site is located at the southeast corner of 1st Street and Lafayette Avenue in Columbus, Indiana (Figure 1 and Figure 2). According to previous environmental reports, it appears that coal and coke processing took place at the Site from 1885 to

1903. The wood treating plant began operations at the Site in the 1920's. The plant closed in 1970, and the buildings were destroyed in a fire in 1971. Operations on the Site included the use of creosote and pentachlorophenol (PCP) for the preservation of wood products.

The following environmental reports/studies have been conducted at the Site:

- Sieco, 1999a. Sieco, Inc., *Phase I Environmental Site Assessment, Former Columbus Wood Preserving Plant, 705 2nd Street, Columbus, Indiana* May 1999.
- Sieco, 1999b. Sieco, Inc., *Phase II Site Investigation, Former Columbus Wood Preserving Plant, 705 2nd Street, Columbus, Indiana* October 1999.
- AME 2002. August Mack Environmental, Inc., *Draft Report, Subsurface Investigation, Former Columbus Wood Preserving Plant, 705 2nd Street, Columbus, Indiana, 2002.*
- Haley and Aldrich 2008. Haley and Aldrich, Inc., *Investigation Report, Former Columbus Wood-Treating Facility, VRP Site #6060703, 705 2nd Street, Columbus, Indiana, 2008.*
- Haley and Aldrich 2009. Haley and Aldrich, Inc., *ASTM Phase I Environmental Site Assessment, Lots 2A and 2B Along 2nd Street, Columbus, Indiana, 2009.*
- BCA 2010, Bruce Carter Associates, L.L.C., *Phase II Environmental Site Assessment, Former Columbus Wood Preserving Plant, 705 2nd Street, Columbus, Indiana, 2010.*
- BCA 2011, Bruce Carter Associates, L.L.C., *Interim Remediation Work Plan, Former Columbus Wood Preserving Plant, 705 2nd Street, Columbus, Indiana, 2011.*
- BCA 2011, Bruce Carter Associates, L.L.C., *Delineation Sampling (Tables, Figures, and Appendices), Former Columbus Wood Preserving Plant, 53 Lafayette Street, Columbus, Indiana, 2011.*

The following is a summary of each report:

Sieco, Inc. 1999 Phase I and II Investigations

A Phase I ESA was conducted which included the Site in May 1999 for the City of Columbus by Sieco, Inc. (Sieco, 1999a). The Phase I identified the following:

- Historic activities on the Site are known to have resulted in adverse environmental impact to soil and groundwater on the Site. Polynuclear aromatic hydrocarbons (PAHs) and other organic contaminants were identified during limited soil and groundwater sampling completed by the U.S. EPA in 1987 (no documentation for this sampling event was found).
- There is potential for contamination as a result of gas station operations to the north and east migrating onto the Site. One Site, Bob's Car Wash located at 711 2nd Street was the location of a low priority leaking underground storage tank (LUST) Site. Petroleum contamination was identified on the Site as late as 1992.

A Phase II ESA was conducted in October 1999 for the City of Columbus by Sieco, Inc. (Sieco, 1999b), a portion of which included the Site. The Phase II was conducted to address the issues identified in the May 1999 Phase I ESA and to expand on the findings of the sampling completed by the U.S. EPA in 1987. A total of eleven (11) borings were completed during the investigation, and four (4) were placed on the Site (SB-6 and SB-9 through SB-11). Borings SB-7 and SB-8 were placed near the southern property line on the railroad right-of-way. The remaining borings were placed up-gradient to the north or cross-gradient to the east of the Site. Groundwater was collected from six (6) probes. Fifteen (15) soil samples were analyzed for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) including polynuclear aromatic hydrocarbons (PAHs). Based on the results of the investigation, the following conclusions were made regarding the Site:

- Significant organic compound contamination was identified through soil and groundwater sampling and analysis on the Site. A significant exceedance in soil for multiple analytes was detected in all six (6) borings SB-6 through SB-11 completed on the Site. Notable analytes exceeding the Indiana Department of Environmental Management (IDEM) Risk Integrated System of Closure (RISC) Industrial Default Closure Levels (IDCLs) include benzene, various PAHs and PCP. Exceedances were also detected in groundwater samples collected from borings SB-7

through SB-11. Notable exceedances include naphthalene in SB-8 (6,400 ug/L compared to the IDCL of 2,000 ug/L) and SB-10 (5,000 ug/L compared to the IDCL of 2,000 ug/L) and pentachlorophenol (PCP) in SB-10 (20,300 ug/L compared to an IDCL of 24 ug/L) and SB-11 (400 ug/L compared to the IDCL of 24 ug/L).

August Mack Environmental 2002 Phase II Investigation

A Phase II was conducted by August Mack Environmental, Inc. (AME) in April and May of 2002 (AME 2002). Eleven (11) borings were completed during the investigation, and nine (9) were placed on the Site (B-12 through B-17, B-19, B-20 and B-22). The remaining borings were placed up-gradient to the north or cross-gradient to the east of the Site. Soil samples were collected continuously from the surface to the bottom of each boring. Groundwater samples were collected from each of the nine (9) borings on the Site. Soil and groundwater samples were analyzed for total petroleum hydrocarbons (TPH) gasoline-range organics (GRO) and TPH diesel-range organics (DRO), VOCs, SVOCs, pH and metals. Based on the results of the investigation, the following conclusions were made regarding the Site:

- The majority of the Site is covered with black foundry sand to depths of 7 to 12 feet below ground surface (bgs). Underlying this unit is native soil consisting of sandy or silty clay. A sand and gravel aquifer was encountered at depths of 12 to 18 feet bgs.
- VOCs, SVOCs and arsenic were detected above the RISC IDCLs. Soil and groundwater contamination was found beneath the Site and areas immediately adjoining the Site.

Haley and Aldrich 2008 and 2009 Phase II and Phase I Investigation

A Phase II ESA was conducted for the Columbus Redevelopment Commission in 2008 by Haley & Aldrich, Inc. (Haley and Aldrich 2008). The investigation included the Site (Lot 3 or 53 Lafayette Ave) and adjoining sites. Based on the Phase II investigation, the following conclusions were made regarding the Site:

- Contaminated groundwater is present beneath the Site (Lot 3) and extends off-Site to the south and west.

- The soils at the Site consist mainly of foundry sand underlain by sand and gravel or a silty clay layer at some locations. Saturated sand with gravel is found above a continuous silty clay layer at 25-30 feet bgs. A second saturated sand layer was found below the clay at one location.
- The contaminated area extends throughout the Site (Lot 3) and chemicals of concern (COCs) include VOCs, SVOCs (primarily pentachlorophenol and naphthalene), some PAHs, TPH extended-range organics (ERO) and arsenic.
- The extent of unsaturated contaminated soil is largely limited to the southwest portion of the Site (Lot 3) and has been delineated.
- Twelve (12) groundwater monitoring wells were installed both on and near the Site, and a single round of groundwater samples was collected.
- Contaminated groundwater was also detected in monitoring wells to the west of the southwest corner (PAHs, TPH-ERO, and VOCs) and to the south of the Site (arsenic, PAHs, TPH-ERO, and VOCs).
- Contaminated groundwater was detected in the single monitoring well in the second aquifer at 45-50 feet bgs (PAH and VOC).
- Groundwater flow in the shallow aquifer is to the south toward Haw Creek and the East Fork of the White River.

A Phase I ESA was conducted on the adjoining properties to the north and east on May 12, 2009 (Haley and Aldrich 2009). These properties are designated as Lots 2A and 2B (the Site is designated as Lot 3). The parcel designated as Lot 2A is a combined property that was formerly comprised of two smaller lots with the addresses of 703 2nd Street and 711 2nd Street. Lot 2A is approximately 1 acre in size. A portion of Lot 2A is leased to Brett Crusier LLC and operated as a Rhino Linings sales and installation center. Another portion of Lot 2A is leased to Robert Cseszko and operated as Bob's Car Wash. Columbus Downtown, Inc. owns Lot 2A. The parcel designated as Lot 2B is approximately 4.5 acres in size (formerly part of 701 2nd Street), is vacant, and is owned by Columbus Downtown, Inc. Based on the 2009 Phase I ESA, recognized environmental conditions identified at the Site include:

- It appears that coal and coke processing took place at the Site from 1885 to 1903, and creosote treatment was conducted at the Site from the 1920s to 1971. Soil and groundwater were contaminated by VOCs, PAHs and TPH above the IDEMRISCIDCLs.
- Several feet of foundry sand were found throughout the Site as fill.
- Site operations at the Rhino Linings, since 1997, have included the storage and application of products including solvents and petroleum distillates.
- A LUST was reported at the 711 2nd Street lot in 1992. It was listed as a low priority, but not granted no further action (NFA) status.

BCA 2010 Phase II Investigation

The purpose of the investigation was to further evaluate the lateral and vertical extent of COCs. Specifically, BCA determined the lateral extent of COCs off-Site to the south and west in the shallow aquifer. BCA also investigated the lateral extent of COCs at the bottom of the aquifer at approximately 50 feet bgs. In addition, BCA determined whether COCs are present below the deepest currently contaminated monitoring well at a depth of 50 feet bgs. The activities included the following:

- Twelve (12) existing monitoring wells were sampled on January 11 through January 14, 2010 using the micro-purge sampling method;
- Water levels were measured in each of the wells. Groundwater samples were analyzed for SVOC/PAHs by method 8270SIM, for VOCs by method 8260, for TPH-ERO by method 8015, and arsenic by Method 6010;
- Groundwater sampling results from the existing 12 monitoring wells indicated MW-2 exceeded the IDCL for benzene (77.5 micrograms per Liter or µg/L compared to an IDCL of 52 µg/L), naphthalene (5,680 µg/L compared to an IDCL of 2,000 µg/L), 3&4-methylphenol (1,540 µg/L compared to an IDCL of 510 µg/L), pentachlorophenol (3,270 µg/L compared to an IDCL of 24 µg/L) and TPH-ERO (91,400 µg/L);
- Groundwater sampling results from MW-4 exceeded the IDCL for pentachlorophenol (813 µg/L compared to an IDCL of 24 µg/L), the PAH

compound benzo(a)pyrene (1.31 µg/L compared to an IDCL of 0.39 µg/L) and TPH-ERO (2,150 µg/L compared to an IDCL of 1,100 µg/L);

- Groundwater from MW-6 exceeded the IDCL for the PAH compound benzo(a)pyrene (2.05 µg/L compared to an IDCL of 0.39 µg/L) and TPH-ERO (4,090 µg/L compared to an IDCL of 1,100 µg/L);
- Groundwater sampling results from MW-9 exceeded the IDCL TPH-ERO (3,650 µg/L compared to an IDCL of 1,100 µg/L);
- Groundwater from MW-11 exceeded the IDCL TPH-ERO (7,050 µg/L compared to an IDCL of 1,100 µg/L);
- Seven (7) groundwater probes were driven off-Site to the south and west of the Site on January 12 through January 13, 2010. Five (5) of the probes (B-23 through B-27) were driven to first groundwater or a depth of about 25 feet bgs. B-21D and B-22D were driven to a depth of 51 and 52 feet bgs, respectively;
- Groundwater was encountered in B-23 through B-27 and was sampled and analyzed for SVOC/PAHs by method 8270SIM, for VOCs by method 8260, for TPH-ERO by method 8015, and for arsenic by Method 6010. One (1) sample from the seven (7) probes (B-21D) exceeded the IDCL TPH-ERO (2,320 µg/L compared to an IDCL of 1,100 µg/L);
- Three (3) permanent monitoring wells were installed on or near the Site on February 17 through February 19, 2010. One well (MW-7DD) was installed adjacent to the existing monitoring well MW-7D. MW-7DD was installed to bedrock (62 feet bgs). The well was blank drilled to 50 feet bgs, then sampled to the bottom. The two additional wells (MW-13 and MW-14) were installed south of the Site in the area of existing monitoring wells MW-11 and MW-12. Both wells were blank drilled to 50 feet bgs (since the locations had previously been sampled continuously to 51 (B-21D) and 52 (B-22D) feet bgs) and then continuously sampled to the bottom;
- On March 2, 2010, the three (3) new wells were developed, purged and sampled using IDEM Low Flow guidance. Groundwater samples from each location were analyzed for SVOC/PAHs by method 8270SIM, for VOCs by method 8260 and for TPH-ERO by method 8015;

- A groundwater sample collected from MW-7DD exceeded the IDCL for naphthalene (2,270 µg/L compared to an IDCL of 2,000 µg/L) benzo(a)pyrene (1.14 µg/L compared to an IDCL of 0.39 µg/L) and TPH-ERO (5,790 µg/L compared to an IDCL of 1,100 µg/L);
- Groundwater from MW-13 exceeded the IDCL for naphthalene (3,410 µg/L compared to an IDCL of 2,000 µg/L), benzo(a)pyrene (0.70 µg/L compared to an IDCL of 0.39 µg/L) and TPH-ERO (8,070 µg/L compared to an IDCL of 1,100 µg/L);
- Groundwater from MW-14 exceeded the IDCL for benzo(a)pyrene (0.70 µg/L compared to an IDCL of 0.39 µg/L) and TPH-ERO (1,940 µg/L compared to an IDCL of 1,100 µg/L).

BCA 2011 Interim Remediation Work Plan

The Interim Remediation Work Plan (RWP) was prepared for the IDEM State Cleanup Section in January 2011. The purpose of the Interim RWP was to describe the unsaturated soil remediation plan on the Site. The remediation strategy proposed was to excavate and transport contaminated soil for landfill disposal.

BCA 2011 Delineation Sampling / Tier I Treatability

The Interim RWP was conditionally approved with amendments on May 6, 2011, and the project was publically bid during the latter part of May. In June, IDEM determined that a significant portion of the contaminated soil, if removed from the Site, would have to be treated or disposed as a listed hazardous waste. The CRC requested that BCA conduct more detailed delineation of contaminated soil and evaluate treatability of the soil by solidification/stabilization (S/S).

The purpose of the delineation sampling was to better estimate the volume of contaminated soil (above and below thresholds for off-Site non-hazardous waste disposal) and clean overburden soils. The purpose of the Tier I treatability study was to determine if soil solidification / stabilization (S/S) is a feasible remediation technology for the Site.

The field work was conducted August 2 through August 5, 2011. The work scope consisted of a total of 26 soil probes (P-1 through P-26) and two (2) groundwater probes (SB-28 and SB-29). A total of 79 soil samples were analyzed for SVOCs by U.S. EPA Method 8270/8270SIM. Four (4) soil

samples were analyzed for baseline SVOC and SVOC synthetic precipitation leaching procedure (SPLP) and two (2) soil samples were analyzed for toxic characteristic leaching procedure (TCLP) (VOC, SVOC, and 14 Metals), ignitability, corrosivity, and reactivity. Field duplicates and matrix spike/matrix spike duplicate (MS/MSD) samples were also collected at a frequency of one (1) per 20 samples.

The groundwater samples were collected using the IDEM-approved low-flow or micro-purge sampling method and were analyzed for VOCs and SVOCs. The analytical methods used for analyses include U.S. EPA Methods 8260 and 8270, respectively.

Contaminated soil samples exhibiting elevated flame ionization detector (FID) readings were collected from the borings and transported to Western Michigan University for the Tier I treatability study.

- Each soil probe was extended from the surface to the first groundwater at approximately 18 to 20 feet bgs with exception of one (1) probe, P-7, which encountered refusal at 8 feet bgs;
- Nine (9) of the 26 soil borings had non-detectable samples analyzed for SVOCs. Eight (8) borings had samples above ICL-direct (>54 parts per million or ppm) for PCP. The remaining nine (9) soil borings had samples above the ICL-migration for SVOCs but below the ICL-direct (>54 ppm) for PCP;
- Based on the analytical results from the soil boring samples, the contaminated area was estimated to include 5,400 tons of soil containing PCP >ICL-direct (>54 ppm). The contaminated area was also estimated to include 6,000 tons of soil SVOC >ICL-migration and PCP <ICL-direct. The clean overburden soil was estimated at 4,300 tons;
- Four (4) samples, one (1) from each boring including P-6, P-10, P-15, and P-20, were analyzed for SVOC and SVOC SPLP. Two (2) of the highest SVOC SPLP sample results from all four (4) samples were naphthalene and PCP at 10,300 and 26,300 ug/l, respectively;
- Two (2) soil samples from P-6 and P-22 were analyzed for hazardous waste characteristics (TCLP, ignitability, corrosivity, and reactivity) and contained TCLP. SVOC PCP and metals (barium, copper, lead, and zinc) were reported above detection limits but far below hazardous waste characteristic levels.

- Groundwater samples collected from temporary points SB-28 and SB-29 were analyzed for VOCs and SVOCs. The sample collected from SB-28 was non-detect for all parameters. The sample collected from SB-29 had detectable levels of acenaphthene, anthracene, and fluorene but were below the Residential Default Closure Levels (RDCLs) for groundwater.
- The Tier I S/S treatability study work scope involved the analysis of SVOC SPLC, falling head permeability, and unconfined compressive strength on three (3) samples; an untreated or control sample, a low dose (5% Portland cement (PC) with 1% powdered activated carbon (PAC)) sample, and a high dose sample (20% PC and 5% PAC). The Tier I results indicated at a high dose concentration, the SVOC SPLP passed for every parameter except PCP (PCP had a SVOC SPLP at 315 parts per billion (ppb) above the IDCL in groundwater of 24 ppb). The falling head permeability and unconfined compressive strength results at a high dose concentration were beyond the U.S. EPA specifications for S/S at 2.72×10^{-7} cm/sec and 465.5 psi, respectively. A Tier II study is necessary to optimize the PC and PAC amendment percentages.
- The Tier II S/S treatability study was performed to optimize the percentages used in the final amendment mixture. The results of the study determined 16% PC and 3.5% PAC would be used in the in-situ S/S specifications.

A Revised RWP was submitted to IDEM on September 20, 2011. The Revised RWP was based on information provided by the 2011 BCA Delineation and Pilot Test, the Sieco, Inc. 1999 Phase II ESA report, August Mack Environmental, Inc. 2002 Phase II ESA report, and the Haley and Aldrich, Inc. 2008 Phase I and II ESA reports. IDEM approved the Revised RWP pending any public comments.

The planned use of the Site is a parking lot for a recreational facility. Soil closure levels will be industrial-direct contact (ICL-direct) and construction worker (ICL-construction) levels. Closure levels will be ICL-direct for the first 10 feet of soil and ICL-construction from 10 feet until the surface of the groundwater is met (about 20 feet). Soil exceeding the Closure Levels will be treated in-situ or removed from the site.

The four (4) main chemicals of concern are pentachlorophenol (PCP), naphthalene (Naph), benzo(a)pyrene (BaP), and benzo(a)anthracene (BaA). The ICL-direct for PCP is 54 ppm. Rather than selecting the construction limit for PCP (3,800 ppm) for soil >10 feet, the more restrictive industrial limit (<54 ppm) was selected in order to assure greater reduction of impact on groundwater.

Therefore, any soil containing PCP at or above this level will be treated using in-situ S/S. Soil containing Naph above the ICL-direct of 8,000 ppm in the first 10 feet of soil or above ICL-construction of 17,000 ppm from 10 feet to the water table will be treated by in-situ soil S/S. Soil containing BaP above the ICL-direct value of 1.5 ppm in the upper 10 feet and 79 ppm from 10 feet to the water table will be treated using in-situ soil S/S. Soil containing BaA above the ICL-direct value of 15 ppm in the upper 10 feet and above the ICL-construction value of 790 ppm from 10 feet until the groundwater is encountered will be treated using in-situ soil S/S.

These closure levels were chosen as being protective of site users due to site cover/cap preventing direct exposure and impacted soils being treated and buried beneath a cap. Closure levels also assure that the vast bulk of on-site impacted vadose soil is treated or removed to greatly reduce potential continuing migration/impact to groundwater.

Post-remediation groundwater contaminant concentrations will be evaluated by conducting groundwater monitoring after the source has been removed. Based on the vadose zone and uppermost saturated soil, contamination will be treated on-Site by soil S/S (i.e., the source area will be removed), a reduction in the dissolved-phase contaminants by natural attenuation should occur. Therefore, groundwater closure will be based on prevention of exposure, a relatively stable plume, declining concentrations, and an absence of free product.

Furthermore, an environmental restrictive covenant (ERC) shall be placed on the properties downgradient of the source area but within the plume area protecting the potential receptors (i.e., vapor and groundwater pathways). A City ordinance is currently in place which requires an entity (business, residence, etc.) be connected to the City-owned water utility.

The eventual goal will be the commercial/industrial groundwater closure level within eight (8) quarters downgradient of the Site for each contaminant due to the stabilization and remediation of the source area. If the goal does not seem reasonable within eight (8) quarters, a newly calculated Site-specific groundwater number will be established based on greatly limited exposure with the ERC.

Alternative 1 – Soil Vapor Extraction

Soil Vapor Extraction (SVE) is a very effective means of mass removal of VOCs from the vadose zone. However, nearly all of the COCs are SVOCs thus, SVE is less effective. Although ideal conditions are permeable coarse-grained soils, it is also reasonably effective in finer-grained soils such as the silt and sandy silt found in the vadose zone at the Site. The lower permeability means that higher vacuums must be used to achieve acceptable radii of influence. Higher vacuums result in groundwater elevation cones which reduce the effectiveness of the SVE system. This tendency can be countered by a higher density of SVE wells and the use of air recharge wells. The

air recharge wells will allow the use of a lower vacuum resulting in a lower radius of influence. This technology is costly compared to the other technologies.

1. **Effectiveness** – Low to medium
2. **Implementability** – The removal actions are relatively easy, however, the SVE requires a pilot study, and subsurface conditions are not ideal for SVE.
3. **Cost** – Initial cost includes capital outlays for equipment and materials; this type of system would operate for a long period of time (>10 years) increasing energy usage costs to operate.

Alternative 2 – SVE with Groundwater Depression

By installing a groundwater extraction pump in each SVE well the groundwater level can be suppressed and the effectiveness of the SVE system maximized. This allows higher vacuums, air flow rates and radii of influence and would remediate the soil more rapidly than SVE alone. This system would pump a larger volume of water needing to be treated and would be more complex and more costly to install and operate than SVE.

1. **Effectiveness** – Low to medium
2. **Implementability** – The removal actions are relatively easy, however, the SVE requires a pilot study and a drawdown test, and subsurface conditions are not ideal for SVE.
3. **Cost** – Initial cost includes capital outlays for equipment and materials; this type of system would operate for a long period of time (>10 years) increasing energy usage costs to operate.

Alternative 3 – Bioremediation

Bioremediation of contaminated unsaturated soils may be accomplished by excavating and spreading the soils on the Site. By creating “biocells” and adding nutrients to the contaminated soils, with time it may be possible to remediate the Site to less than closure levels. This remedial technology is labor-intensive, requires ample land space, and is seasonal at best. The soil constituents are non-ideal, since they are predominantly PAHs and pentachlorophenol (PCP), which are low volatility and resistant to biodegradation. The type of soil (i.e., silty to sandy clay) also increases the time to remediate. The problems inherent with this remedial method include on-going soil sampling, runoff and drainage issues, and inability to bio-remediate because of below-freezing temperatures. This option was not chosen due to these issues.

1. **Effectiveness** – Low to medium
2. **Implementability** – The removal actions are relatively easy, however, the biocells are labor-intensive and require remobilizing to the Site numerous times.
3. **Cost** – Initial cost is low for equipment and materials; this type of system would operate for a long period of time (>15 years).

Alternative 4 – Soil Excavation / Disposal

All contaminated soils above the clean-up goals could be excavated and transported for treatment and/or disposal at landfills. Since a large amount of the soil (roughly 5370 tons) contains PCP >54 ppm (the contained-in policy limit), the soil would have to be treated as hazardous waste if removed. Most of that soil exceeds treatment limits and would have to be incinerated. This option is cost-prohibitive.

1. **Effectiveness** – High
2. **Implementability** – The removal actions are relatively easy, however, the hazardous waste would have to be treated by incineration thus increasing transportation costs.
3. **Cost** – Very high

Alternative 5 – Soil Excavation / Disposal and Ex-situ Soil S/S

Another option for remediation of on-Site vadose soil is source removal / disposal of soil containing other SVOCs (i.e., naphthalene, benzo(a)pyrene, and benzo(a)anthracene) greater than ICL-direct and greater than ICL-construction coupled with ex-situ soil S/S of soil containing greater than ICL-direct of PCP at 54 ppm.

Removal of contaminated soils on-Site is limited by the property lines to the west and south and by the water table. Soil contamination removal is also limited by the depth of the excavation and side slope excavation. Some contaminated soil above the ICL-direct or construction values would be left above the water table, along the south and west property boundaries. It is assumed that the side slope excavation would extend to ten (10) feet from the property lines. Unstable soils (i.e., sandy fill) extending from ten (10) to twelve (12) feet near both the west and south property lines will inhibit setbacks equal to a 1 to 1 slope. Furthermore, it is not clear that IDEM would regard the mixing box as a “container” under the Resource Conservation Recovery Act (RCRA). If not, then treatment of the PCP >54 ppm would qualify for RCRA Treatment Storage and Disposal (TSD). If the mixing box is a “container,” then several additional requirements would apply including Land Disposal Restriction (LDR) limits. Using this technology would be either costly or not feasible and therefore is discounted.

1. **Effectiveness** – Medium to High
2. **Implementability** – The removal actions are relatively easy, however, the non-hazardous waste would have to be disposed at an approved landfill. The soil with elevated PCP would have to be treated by excavating, adding and mixing amendments, and replacing the soil in the excavation. Permitting issues may render this option not feasible.
3. **Cost** – Medium to high

Alternative 6 – In-situ Soil S/S of All Contaminated Soils

A cost-competitive option is to treat all the contaminated soil (i.e., above ICL-direct and construction for SVOCs other than PCP and above ICL-direct for PCP). This alternative requires less confirmation sampling (than Alternative 7) due to only sampling of clean soil overburden and side-wall closure samples. This in-situ soil S/S method of remediation is accepted by the IDEM and also provides a cohesive, homogeneous mixture of the contaminated soil and amendments over the entire treatment area. This option is only slightly more expensive than Alternative 7 below. However, it reduces the risks associated with the process of disposing of the soil off-Site.

1. **Effectiveness** – High
2. **Implementability** – The treatment actions are easy relatively simple to implement. Separation of clean overburden soils and closure sampling are also relatively simple to implement.
3. **Cost** – Medium to high

Alternative 7 – Soil Excavation / Disposal and In-situ Soil S/S

The lowest cost option considered is source removal / disposal of soil containing SVOCs greater than clean up levels and in-situ S/S of soil containing greater than ICL-direct of PCP at 54 ppm.

Removal of contaminated soils on-Site is still limited by the property lines to the west and south. However, in-situ soil S/S has the capability of treating soils in-place. Soil excavation would be limited to SVOC-contaminated soil greater than ICL-direct at an average depth of 12 feet bgs. In-situ soil S/S will treat the PCP contaminated soil above ICL-direct from an average of 12 feet bgs to the water table. Using in-situ soil S/S allows for treatment at the property lines and within the water table.

1. **Effectiveness** – High
2. **Implementability** – The treatment actions are relatively easy. Separation of low-contaminated soils for landfill disposal and demonstration that the soil is non-hazardous are somewhat more complex than Alternative 6. Confirmation/closure soil sampling is also more complex.
3. **Cost** – Medium to high

Recommendation

Alternative 7 is the lowest cost option for source removal/disposal of soil containing SVOCs and in-situ S/S for soil containing greater than 54 ppm PCP. The future end use of the contaminated area will be a parking lot. Source remediation by in-situ soil S/S will treat the contaminated soil above ICL-direct (<10 feet bgs) and above construction limit (10 feet bgs to water table), and will allow for a new sub-grade to be established for the parking lot. The Program will provide oversight of remediation activities. Institutional Controls (IC) will be required in the form of an Environmental Restrictive Covenant (ERC) on the property limiting land use to commercial/industrial with no groundwater use and maintenance of the paved cover. ERC's will be necessary on the adjoining properties or an Environmental Restrictive Ordinance (ERO) for the local area to prohibit groundwater use near the Site.

Decision Document

A decision document will be issued at the close of the 30-day public comment period with additional details on the selected alternative. This document will serve as a notice to proceed with RLF-funded remediation activities and will be available in the local information repositories for public view, along with this Site ABCA and other Site-related documents for public view.

FIGURE 1

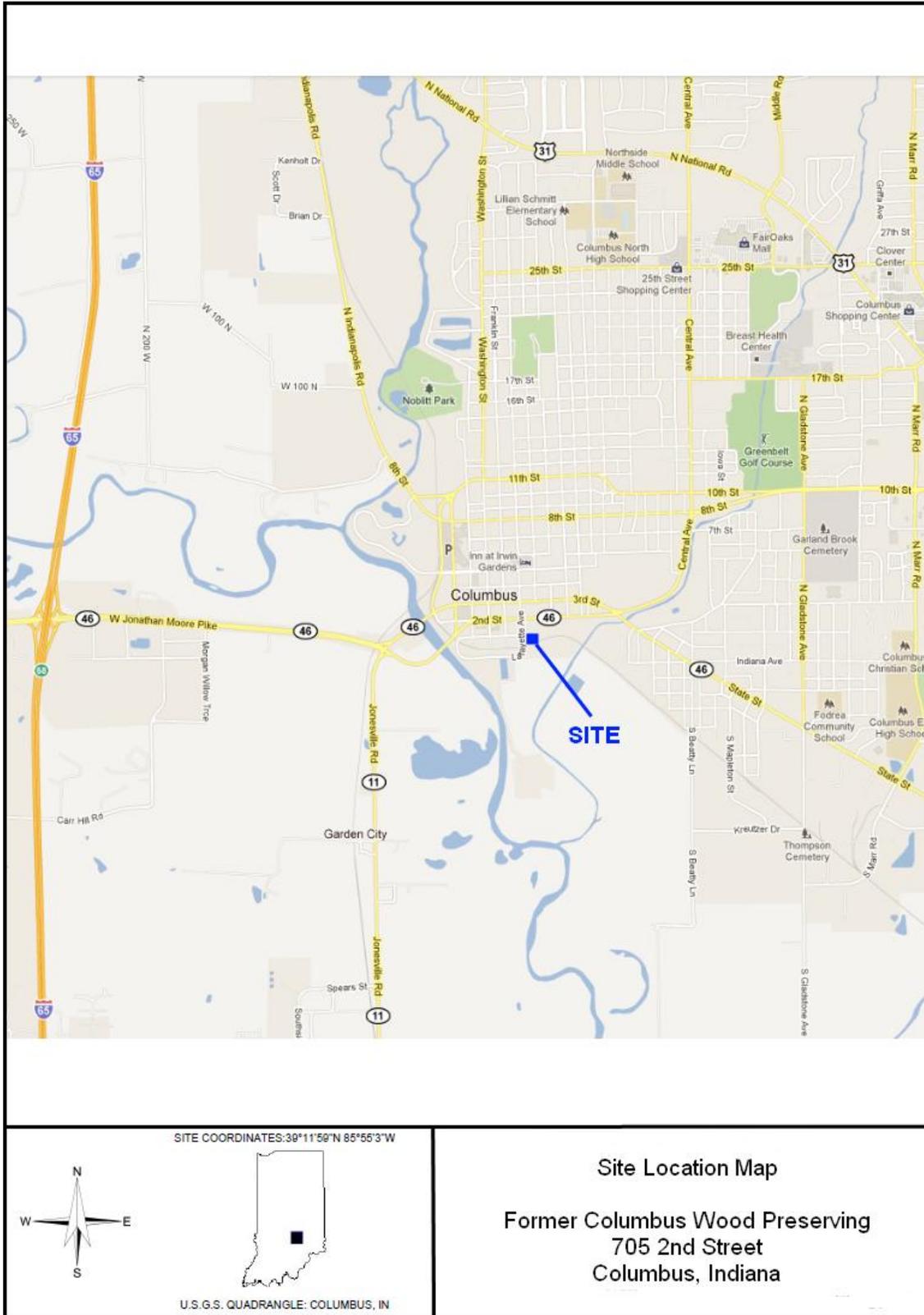


FIGURE 2

