



November 23, 2016

Mr. Todd Davis
Site Assessment Manager
U.S. Environmental Protection Agency, Region 7
11201 Renner Blvd.
Lenexa, Kansas 66219

**Subject: Analysis of Brownfields Cleanup Alternatives Report
Elkem Carbide, Keokuk, Iowa
EPA Region 7, START 4, Contract No. EP-S7-13-06, Task Order No. 0002.019.017
Task Monitor: Todd Davis, Site Assessment Manager**


Dear Mr. Davis:

Tetra Tech, Inc. (Tetra Tech) is submitting the attached Analysis of Brownfields Cleanup Alternatives regarding the Elkem Carbide site in Keokuk, Iowa. If you have any questions or comments pertaining to this submittal, please call the Project Manager at (816) 412-1775.

Sincerely,



Robert Monnig, PE
START Project Manager



Ted Faile, PG, CHMM
START Program Manager

Enclosures

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

ANALYSIS OF BROWNFIELDS CLEANUP ALTERNATIVES REPORT

**ELKEM CARBIDE
KEOKUK, IOWA**

Superfund Technical Assessment and Response Team (START) 4

Contract No. EP-S7-13-06, Task Order No. 0002.019.017

Prepared For:

U.S. Environmental Protection Agency
Region 7
11201 Renner Blvd.
Lenexa, Kansas 66219

November 23, 2016

Prepared By:

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

CONTENTS

<u>Section</u>	<u>Page</u>
1.0 INTRODUCTION	1
2.0 SITE BACKGROUND AND DESCRIPTION	2
2.1 SITE DESCRIPTION	2
2.2 PHYSICAL SETTING	2
2.2.1 Geologic Setting	3
2.2.2 Hydrogeology	3
2.2.3 Hydrology	3
2.3 SITE HISTORY AND LAND USE	4
2.4 ADJACENT PROPERTY USE	4
3.0 RECENT SITE ASSESSMENT FINDINGS	5
4.0 AFFECTED MEDIA	8
5.0 FUTURE USE	9
6.0 POTENTIAL CLEANUP ALTERNATIVES	10
6.1 CLEANUP STANDARDS	10
6.2 CLEANUP OBJECTIVES	10
6.3 POTENTIAL CLEANUP ALTERNATIVES	10
6.3.1 Alternative 1 – No Action	11
6.3.2 Alternative 2 – Limited Removal and Installation of Surface Cover	11
6.3.3 Alternative 3 – Wide-Area Soil Removal and Off-Site Disposal	13
6.4 RECOMMENDED CLEANUP ALTERNATIVE	15
7.0 REFERENCES	16

CONTENTS (Continued)

APPENDICES

Appendix

- A FIGURES
- B RACER[®] OUTPUT

TABLES

<u>Table</u>	<u>Page</u>
1 COMPARISON OF ALTERNATIVE COSTS	11
2 ALTERNATIVE 2 COSTS	13
3 ALTERNATIVE 3 COSTS	14

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) was tasked by the U.S. Environmental Protection Agency (EPA) under the Superfund Technical Assessment and Response Team (START) Contract (EP-S7-13-06) to conduct a Phase II Targeted Brownfields Assessment (TBA) and Analysis of Brownfields Cleanup Alternatives (ABCA) of the Elkem Carbide site, an approximately 79-acre property (subject property) at 365 Carbide Lane in the City of Keokuk (City), Lee County, Iowa (see Appendix A, Figure 1). The subject property was historically used for zinc refining, production of hardened lead alloy (Frary metal), and manufacture of various carbide products. The subject property is currently not in use and is owned by 365 Carbide Lane, LLC (365 Carbide Lane).

Tetra Tech conducted the Phase II TBA sampling of the site in July 2016. Samples of soil, sediment, and groundwater were collected, and analytical results were compared to Iowa Department of Natural Resources (IDNR) Statewide Standards for contaminants in soil and groundwater. Results exceeding these standards were further evaluated via preliminary evaluations of the site resident, site worker, and construction worker exposure scenarios to estimate cumulative cancer and non-cancer risk values that could be compared to IDNR Land Recycling Program (LRP) criteria. The primary risk drivers were lead and polycyclic aromatic hydrocarbons (PAH) (and especially the PAH benzo[a]pyrene). A description of Phase II TBA activities and a detailed analysis of results are conveyed in a separate report (Tetra Tech 2016b). This Analysis of Brownfields Cleanup Alternatives (ABCA) report examines alternatives for cleanup of soil contamination at the site, including preliminary cost estimates.

2.0 SITE BACKGROUND AND DESCRIPTION

This section briefly describes the site and physical setting, recounts site history, discusses land use at the site and at adjacent properties, and summarizes previous completed environmental investigations of the site.

2.1 SITE DESCRIPTION

The subject property is a 78.83-acre parcel (number 21-22-200-031) owned by 365 Carbide Lane, at the southeast corner of Carbide Lane and U.S. Highway 61 in Keokuk, Lee County, Iowa. The subject property is included on the Keokuk, IA, U.S. Geological Survey (USGS) 7.5-minute topographic series map (USGS 1977) (see Appendix A, Figure 1). The subject property is in the north ½ of the northeast ¼ of Section 22, and in the northwest ¼ of Section 23, all in Township 65 North, Range 5 West.

Coordinates at the approximate center of the subject property are 40.41956 degrees north latitude and 91.42108 degrees west longitude.

On the central portion of the subject property are buildings, roads, rail lines, and other improvements that from 1915 to 2007 supported manufacturing operations of previous owners, including River Smelting and Refining Company, United Lead Company, Midwest Carbide Corporation, and Elkem Metals. A capped and closed landfill that received calcium carbide and other wastes generated from manufacturing processes covers the east portion of the subject property. Unimproved grass and forest-covered areas are on the western portion of the subject property.

The subject property is in a mixed use area of the City, including industrial, commercial, agricultural, and residential properties. The subject property is bounded north by Carbide Lane; east by industrial properties; south by residential, industrial, and commercial properties; and west by U.S. Highway 61. Industrial properties are beyond to the north, northeast, east, southeast, south, and southwest. Agricultural and forested land are beyond to the west and northwest.

2.2 PHYSICAL SETTING

The following sections describe the geologic setting, hydrogeology, and hydrology of the subject property.

2.2.1 Geologic Setting

Soils in the area consist primarily of loamy Orthents and Weller silt loam. Orthents are on recent erosional surfaces where former soil has been completely removed or heavily manipulated (U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] 1999). The Weller series consists of deep, moderately well-drained, slowly permeable soils formed in loess. These soils are on convex ridgetops, side-valley slopes, and benches. Slope ranges from 0 to 14 percent (USDA 2014).

Subsurface geologic units in the area consist of Phanerozoic-, Paleozoic-, and Carboniferous Mississippian-Early-aged, Osage series. Total thickness of the Osage series is approximately 275 feet. The primary rock type within the Osage series is dolostone, a carbonate sedimentary rock composed of more than 50% of the mineral dolomite. The secondary rock type is limestone, a sedimentary rock consisting mainly of calcium carbonate in the form of the mineral calcite. Other rock types include shale, chert, and sandstone (USGS 2014).

2.2.2 Hydrogeology

Keokuk is within the Flint-Henderson watershed (USGS 2016). The subject property is underlain by three aquifers: (1) the Mississippian aquifer, which consists primarily of dolomite in the subject property area (southeastern Iowa); (2) the Silurian-Devonian aquifer beneath which are dolomite and limestone approximately 200 to 400 feet thick; and (3) the Cambrian-Ordovician aquifer beneath which are multiple bedrock formations ranging from 300 to 2,000 feet thick (USGS 2009).

Environmental Data Resources, Inc. (EDR), a START subcontractor, identified 23 records of wells within 1 mile of the subject property by searching federal, state, and USGS database listings. Of these, one federal USGS well was identified (total depth of 815 feet below ground surface [bgs]). EDR extracted no data on groundwater flow and velocity (EDR 2016). Groundwater flow is inferred to the east in the direction of the topographic gradient and surface water flow (generally east and southeast toward Soap Creek, which flows south).

2.2.3 Hydrology

The subject property straddles a ridge, with the eastern portion of the subject property sloping to the east toward Soap Creek and the western portion of the subject property sloping west toward drainages that empty into Hog Thief Creek. Surface water on the subject property follows surface topography, generally flowing into either Soap Creek to the east or into drainages to the west that flow into Hog Thief Creek.

Soap Creek flows south to the Mississippi River, and Hog Thief creek flows west and then south into the Des Moines River, which flows south and east into the Mississippi River.

2.3 SITE HISTORY AND LAND USE

Historical documentation indicates that the subject property was converted from farm use to industrial manufacturing in 1915, when a secondary zinc smelter plant was constructed on the property by River Smelting and Refining Company, a subsidiary of National Lead Company. The smelter operated on the property until around 1919. Before the smelter closed, an additional plant was constructed on the subject property in 1916 by United Lead (another subsidiary of National Lead Company), and produced Frary metal, a lead alloy hardened by calcium and barium. In 1929, the United Lead Company merged with Shawinigan Products to form Midwest Carbide Corporation (Midwest Carbide), and the subject property was used to produce calcium carbide (Terracon Consultants, Inc. [Terracon] 2009). In 1952, Midwest Carbide reportedly began production of Soderberg electrode paste by combining calcinated anthracite coal with coal tar pitch (Terracon 2009). In the late 1980s, the carbide plant was shut down, and in 2007, production of all other products ceased (Terracon 2009). Carbide Lane Properties, LLC purchased the subject property from Elkem Metals Company in 2008. The property was then sold to 365 Carbide Lane in 2015. The subject property is currently inactive.

2.4 ADJACENT PROPERTY USE

Adjacent to the subject property are the following: to the north, Carbide Lane, followed by Amsted Rail Company Griffin Wheel Division, which produces wheels for the railroad industry; to the northeast, the Keokuk Sewer Maintenance Department and Keokuk Animal Services; to the east, Burlington Railroad; to the southeast, Newberry Towing Recovery & Auto Salvage; to the south, a residential property and Archer Daniels Midland Milling Company, an agricultural processor; and to the west, U.S. Highway 61 with agricultural and forested land beyond.

3.0 RECENT SITE ASSESSMENT FINDINGS

This section describes findings of the 2016 Phase II TBA. A summary of previous site assessment findings is conveyed in the November 2016 Phase II report (Tetra Tech 2016b).

A Phase I TBA of the subject property in February 2016 identified numerous recognized environmental conditions (REC), and previous investigations had identified multiple contaminants on site (Tetra Tech 2016a). The Phase II TBA was conducted in June 2016 to determine if historical activities at the subject property had contaminated soils, sediment, and groundwater, and to identify the nature of contamination and risks posed by the contamination (Tetra Tech 2016b). Samples of soil, sediment, and groundwater were collected during the Phase II investigation at the subject property. Analytical results were compared to IDNR Statewide Standards for contaminants in soil and groundwater. Results exceeding these standards were further evaluated via preliminary evaluations of the site resident, site worker, and construction worker exposure scenarios to estimate cumulative cancer and non-cancer risk values that could be compared to IDNR LRP criteria. Chemical-specific criteria for this evaluation were obtained through use of the IDNR Cumulative Risk Calculator. Overall, the evaluation identified soil concentrations exceeding IDNR criteria for each of the pathways evaluated (site resident, site worker, and construction worker). The primary risk drivers were lead and polycyclic aromatic hydrocarbons (PAH) (and especially the PAH benzo[a]pyrene). The following summarizes sampling results from the areas investigated.

Decision Unit Sampling

Twelve decision units (DU) were defined, and multi-aliquot samples were collected by application of Incremental Sampling Methodology (ISM) to characterize mean concentrations of PAHs and lead within each DU. Each DU sample was found to contain PAH concentrations exceeding respective statewide standards, indicating apparent widespread PAH contamination of soil within the former manufacturing area of the subject property—likely related to former use, storage, and handling of coal, coke, or coal-tar pitch at the subject property. Lead concentrations exceeding the statewide soil standard of 400 milligrams per kilogram (mg/kg) were also detected in samples from five of the DUs. A preliminary screening of the site resident, site worker, and construction worker exposure pathways identified PAH and lead concentrations among the DU samples that exceeded IDNR criteria for each of these pathways.

Elevated Lead Investigation

Soil samples were collected within the central portion of the former manufacturing area, where a lead concentration of 20,000 mg/kg previously had been detected (Terracon 2010). One of the 20 samples of this sample group was found to contain lead at 520 mg/kg—above the statewide standard of 400 mg/kg. An additional analyte, arsenic, was detected at concentrations above the statewide standard. A preliminary screening of the site resident, site worker, and construction worker exposure pathways yielded risk values exceeding the IDNR criteria for the site resident pathway, but not the site worker or construction worker pathways (however, the previously detected lead concentration of 20,000 mg/kg is of potential concern for the site worker and construction worker scenarios).

Elevated PAH Investigation

Soil samples were collected within the southeast portion of the former manufacturing area where maximum PAH soil concentrations previously had been detected (Terracon 2010). Several soil samples were found to contain PAHs at concentrations above statewide standards. A preliminary screening of the site resident, site worker, and construction worker exposure pathways did not identify concentrations corresponding to risk values exceeding IDNR criteria (although the previously detected PAH concentrations could pose concern for the site resident, site worker, and construction worker scenarios).

Underground Storage Tanks (UST)/Hydraulic Lift Investigation

Soil and groundwater samples were collected to investigate five areas of concern related to USTs and a former hydraulic lift. Soil samples from each of the investigated five areas of concern were found to contain detectable concentrations of petroleum hydrocarbons (as diesel-range organics or gasoline-range organics); however, none of these concentrations exceeded a statewide standard for soil. In one sample from this group, lead concentration (5,600 mg/kg) exceeded the statewide standard for soil (400 mg/kg). A groundwater sample was collected within one of the five areas (near a closed UST at the east end of the Carbide Container Storage building). Comparisons of results from this groundwater sample to statewide standards did not indicate a contaminant exceedance of a statewide standard for a non-protected groundwater source; however, the sample was found to contain lead and cadmium at concentrations exceeding standards for a protected groundwater source.

Polychlorinated Biphenyls (PCB) Release Investigation

To assess for PCB contamination related to an approximately 400-gallon oil release from a transformer on December 20, 2000, a sample was collected within the reported area of release, and a multi-aliquot

sediment sample was collected from Soap Creek immediately downstream of the outfall. These samples did not contain detectable concentrations of PCBs.

Waste Characterization Sampling

Eight samples were collected where bulk amounts of coal-tar pitch, coke, or coal were observed during sampling activities. Analytical results from these samples were compared to toxicity characteristic leaching procedure (TCLP) regulatory limits. None of these samples exhibited TCLP extract concentrations exceeding regulatory limits—indicating that, if these materials would be removed, they would likely not be considered characteristic of a hazardous waste. Solid material from an oil-stained trench drain within the maintenance building was also sampled and analyzed for total petroleum hydrocarbons (TPH) and metals. This sample was found to contain a TPH oil-range organics concentration exceeding the statewide soil standard, indicating that the material in the trench drain would likely be classified as a special waste if removed.

4.0 AFFECTED MEDIA

Based on sampling during the Phase II TBA, arsenic, lead, and PAHs are present in surface and subsurface soil at concentrations exceeding Iowa Statewide Standards for Soil. A preliminary screening of the site resident, site worker, and construction worker pathways yielded cancer and non-cancer risk values exceeding IDNR's criteria ($1\text{E-}04$ for cancer risks and 1.0 for non-cancer risks) for each exposure pathway assessed. Lead and PAHs (and in particular, benzo(a)pyrene) were the predominant risk drivers. PAH concentrations exceeding IDNR cancer risk criteria for the site worker pathway were detected in 7 of the 12 DUs, indicating that PAH contamination is relatively widespread across the former manufacturing area. Figure 2 in Appendix A depicts DU sampling results. As a conservative assumption for cost estimating purposes, affected surface soils are assumed present in:

- (1) The DUs with contaminant concentrations of potential concern for the site worker scenario as identified in the Phase II TBA (Tetra Tech 2016b). This includes DU-03, -05, -07, -08, -09, -10, and -11.
- (2) DU-04, within which detected contaminant concentrations posed a cumulative cancer risk of $7.3\text{E-}05$ for the site-worker scenario—near the IDNR criteria of $1\text{E-}04$.
- (3) An unsampled area assumed to require cleanup west of the impacted DU-03 and north of the impacted DU-07. Within both of these DUs, contaminant concentrations were detected that pose potential concern for the site worker scenario. In aerial photography, that unsampled area also appears to contain remnant coal or coke dust.

Lead concentrations exceeding the non-cancer risk criterion for the site worker scenario were also detected in multiple surface and sub-surface soil samples.

One groundwater sample was collected during the Phase II TBA from boring B-61 near a reportedly closed UST at the east end of the Carbide Container Storage building. IDNR specifies statewide standards for groundwater of two classes: protected groundwater and non-protected groundwater. The two classes differ in likelihood that an aquifer would be used for a drinking-water supply, based on its hydraulic conductivity and presence of total dissolved solids. Based on the previously reported low hydraulic conductivity of the shallow aquifer at the subject property (Terracon 2010), the non-protected groundwater standards are likely the relevant standards. Comparisons of results from the groundwater sample to statewide standards did not identify contaminants at concentrations exceeding statewide standards for a non-protected groundwater source; however, the sample did contain lead and cadmium at concentrations exceeding standards for a protected groundwater source.

5.0 FUTURE USE

Future use of the subject property is anticipated to be industrial/commercial. Groundwater in the site vicinity is currently not used for drinking water, and no future use for this purpose is anticipated.

6.0 POTENTIAL CLEANUP ALTERNATIVES

The overall goal of a Brownfields cleanup action at a site is to address environmental conditions at that site prior to any potential future redevelopment. Future plans for the site are currently undetermined, but are anticipated to be non-residential.

Brownfields cleanup alternatives were evaluated to address environment impacts identified during the Phase II TBA. The purpose of the ABCA is to present viable cleanup alternatives based on site-specific conditions, technical feasibility, and preliminary cost evaluations.

6.1 CLEANUP STANDARDS

Cleanup of the site is anticipated to occur under the Iowa LRP with cleanup standards that accord with the Iowa Land Recycling and Environmental Remediation Standards Act (Section 455H.103). Applicable cleanup standards are one of the following: (1) background standards established pursuant to section 455H.202, (2) statewide standards established pursuant to section 455H.203, or (3) site-specific cleanup standards established pursuant to section 455H.204. Because anticipated future use of the site is non-residential, the relevant cleanup standards will likely be site-specific cleanup standards established to be protective of site worker and construction worker scenarios. These standards would likely be based on the IDNR LRP cumulative cancer risk criterion of 1 in 10,000 (or 1E-04) and the cumulative non-cancer risk criterion of 1.0 for site worker and construction worker scenarios. In its evaluation of site assessment data against these criteria, the November 2016 Phase II TBA report identified lead and PAH concentrations in soil posing cancer and non-cancer risks exceeding the IDNR LRP criterion for site worker and construction worker exposure scenarios (Tetra Tech 2016b).

6.2 CLEANUP OBJECTIVES

The following cleanup objective is anticipated:

Eliminate or render incomplete any exposure pathways from contaminated soil that could present an increased cancer risk greater than 1 in 10,000 or an increased non-cancer health risk greater than 1 (as defined in Chapter 455H.204) for site-worker and construction worker scenarios.

6.3 POTENTIAL CLEANUP ALTERNATIVES

Planned future use of the subject property is not known definitively, but anticipated to be non-residential. Redevelopment of the site for commercial or industrial purposes would likely require cleanup activities to mitigate worker exposure to soils impacted by PAHs and lead. Evaluated potential cleanup alternatives

are listed below in Table 1. Cost estimates provided are variable because final plans for the site are incomplete. Although site-specific conditions were applied for cost estimating, Remedial Action Cost Engineering and Requirements (RACER®) cost estimates may vary significantly from actual cleanup costs and are intended only for relative comparison. The RACER output is in Appendix B. Affected media evaluated as part of this ABCA include surficial and subsurface soils impacted by PAHs and lead. Table 1 compares costs of the cleanup alternatives.

TABLE 1
COMPARISON OF ALTERNATIVE COSTS

No.	Alternative	Cost*
1	No Action	\$0
2	Limited Removal and Installation of Surface Cover	\$3.2 million
3	Wide-Area Soil Removal and Off-site Disposal	\$1.6 million

Notes:

* Cost includes direct and indirect cost of each alternative. The following mark-ups were applied to each alternative as appropriate:

- Professional labor overhead/general and administrative costs – 132%
- Field office overhead/general and administrative costs – 25%
- Subcontractor profit – 8%
- Prime contractor profit – 8%
- Owner cost – 11%

Tetra Tech applied selected functions of RACER Version 11.2 (2013) software to assist in evaluation of appropriate cleanup objectives, and to obtain associated cost estimates.

6.3.1 Alternative 1 – No Action

The no action alternative is presented for baseline comparison. This alternative would provide no containment, treatment, removal, or monitoring of contaminants. Because the no action alternative would not be protective of human health or the environment, it is not considered effective. No costs are associated with this alternative.

6.3.2 Alternative 2 – Limited Removal and Installation of Surface Cover

This alternative would mitigate site worker and construction worker exposure to impacted surface soil by combining soil removal with installation of an asphalt surface cover. Under this alternative, areas with obvious surface spills of coal-tar pitch, coke, or coal would be excavated, and disposal of the removed material would occur off site. These areas were identified and sampled during the July 2016 Phase II TBA sampling. Sampling results indicated that the material from these spill areas would be considered

non-hazardous, and therefore disposal could likely occur at a nearby Resource Conservation and Recovery Act (RCRA) Subtitle D landfill. Following cleanup of the bulk spill areas, an asphalt surface cover would be installed over areas of the site where analytical testing has indicated that contaminant concentrations in surface soils exceed IDNR risk criteria. Figure 3 in Appendix A shows the conceptual design for this alternative, spill areas identified during the July 2016 Phase II TBA sampling, and the assumed area that would require a surface cover to prevent worker exposure to impacted surface soils.

The following assumptions underlay development of the cost estimate of this alternative:

- A total area of 1.5 acres would be excavated to an average depth of 6 inches to address bulk spills of coal-tar pitch, coke, or coal (these areas are depicted by blue boundaries on Figure 3 in Appendix A). Disposal of this material as non-hazardous waste would occur at a nearby landfill. The estimate includes costs of analysis of five samples to confirm that the material is non-hazardous.
- Following excavation of the spill areas, an approximately 13.7-acre area would require surface cover to prevent worker exposure to impacted surface soils (this area is depicted by a yellow boundary on Figure 3 in Appendix A). Assumedly, some surface would be covered during redevelopment of the site with buildings, surface parking, and roads. For purposes of the cost estimate, it was assumed that 3.5 acres of surface would be covered by redevelopment, leaving approximately 11 acres that would require an asphalt surface cover to prevent exposure to impacted surface soils. Thus, the cost estimate includes cost of installing an approximately 11-acre asphalt cover.
- The asphalt cover would be composed of a 6-inch base course layer and a 3-inch asphalt topping.
- Soil sampling would be required to confirm that the surface soil pathway will have been addressed. This would include collection of 20 surface soil samples for analyses for semivolatile organic compounds (SVOC) and metals.
- Impacted subsurface soil would be addressed by administrative controls, including development and implementation of a soil management plan.
- Professional environmental services would be necessary to implement land use controls (to restrict use of the property to non-residential use), conduct a risk assessment, develop site-specific cleanup standards, facilitate a public meeting to present the cleanup alternative, provide 2 weeks of field support during the cleanup, and prepare a cleanup report and a soil management plan.

Feasibility

This alternative would be effective in mitigating worker exposure to impacted surface and subsurface soil. Excavation of the bulk spill areas would eliminate site worker and construction worker exposure to soil with relatively high PAH concentrations. Exposure to remaining impacted surface and subsurface soils would be mitigated via the surface cover and administrative controls, including implementation of a soil management plan.

Cost

Estimated cost of this alternative is 3.2 million dollars, which includes approximately 2.8 million dollars for construction of the approximately 11-acre asphalt cover composed of a 6-inch base course and 3-inch asphalt topping. Component costs for Alternative 2 are listed in Table 2.

TABLE 2
ALTERNATIVE 2 COSTS

Component	Cost
Excavation and Sampling	\$154,592
Off-site Transportation and Waste Disposal	\$52,290
Asphalt Surface Cover	\$2,854,834
Risk Assessment	\$31,768
Public Meeting	\$35,642
Administrative Land Use Controls and Soil Management Plan	\$68,275
Cleanup Report	\$19,985
Total	\$3,217,385

6.3.3 Alternative 3 – Wide-Area Soil Removal and Off-Site Disposal

This alternative would mitigate site worker and construction worker exposure by removal and off-site disposal of surficial soil covering areas of the site where analytical testing has indicated that contaminant concentrations in surface soils exceed IDNR risk criteria. Figure 4 in Appendix A shows the conceptual design of this alternative and areas assumed to require excavation.

The following assumptions underlay development of the cost estimate of this alternative:

- A total area of 14.6 acres is assumed to require cleanup to address impacted surface soils (these areas are depicted by yellow boundaries on Figure 4 in Appendix A). Because this 14.6-acre area includes several existing manufacturing buildings that could remain in place, approximately

25 percent of the area assumedly would remain covered by existing structures and would not require excavation. Thus, excavation over a total area of approximately 11 acres was assumed.

- Average depth of excavation is assumed to be 6 inches.
- Soil sampling would be necessary over the wide area of excavation to confirm that the surface soil pathway will have been addressed. This would include collection of 200 surface soil samples for analyses for SVOCs and metals.
- Impacted subsurface soil would be addressed by administrative controls, including development and implementation of a soil management plan.
- Professional environmental services would be necessary to implement land use controls (to restrict use of the property to non-residential use), conduct a risk assessment, develop site-specific cleanup standards, facilitate a public meeting to present the cleanup alternative, provide 8 weeks of field support during the cleanup, and prepare a cleanup report and a soil management plan.

Feasibility

Excavation and off-site disposal of impacted surface soil would eliminate site worker and construction worker exposure to impacted soil, and implementation of this is feasible, particularly if impacted soils are generally near the surface (for cost estimating purposes, an average excavation depth of 6 inches is assumed). This alternative would become less feasible and less cost effective if increased excavation depths are required.

Cost

Estimated cost of this alternative is 1.6 million dollars, which includes approximately 1.4 million dollars for excavation and off-site disposal of surficial soil over an approximately 11-acre area. Component costs for Alternative 3 are listed in Table 3.

TABLE 3
ALTERNATIVE 3 COSTS

Component	Cost
Excavation and Sampling	\$1,060,195
Off-site Transportation and Waste Disposal	\$381,631
Risk Assessment	\$31,768
Public Meeting	\$35,642
Administrative Land Use Controls and Soil Management Plan	\$68,275
Cleanup Report	\$19,985
Total	\$1,597,496

6.4 RECOMMENDED CLEANUP ALTERNATIVE

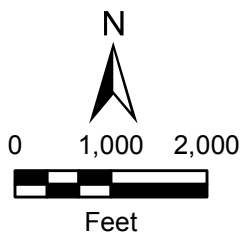
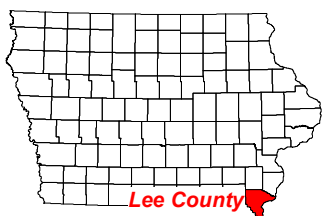
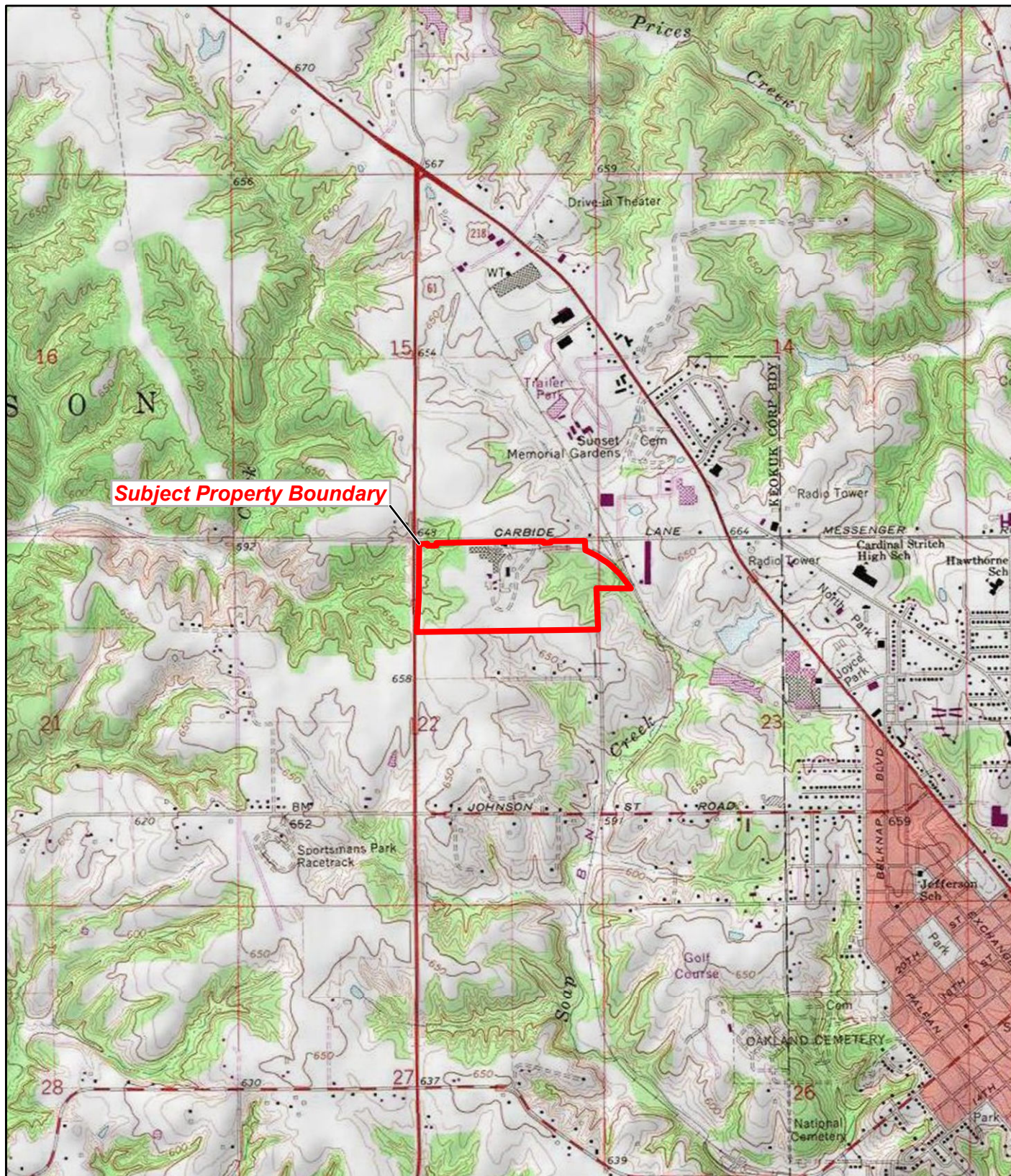
Alternatives 2 and 3 would mitigate exposure of site and construction workers to impacted soil. Because both cleanup alternatives involve cleanup over wide areas of the site, including areas that would likely be affected by redevelopment of the site, selection (and further development) of one of these cleanup alternatives will likely occur in coordination with future redevelopment plans for the site.

7.0 REFERENCES

- Environmental Data Resources, Inc. (EDR). 2016. EDR Radius Map with Geocheck. January 14.
- Terracon Consultants, Inc. (Terracon). 2009. Phase I Environmental Site Assessment. Former Elkem Carbide.
- Terracon. 2010. Phase II Environmental Site Assessment. Former Elkem Metals.
- Tetra Tech, Inc. (Tetra Tech). 2016a. Phase I Targeted Brownfields Assessment, Revision 01, Elkem Carbide, Keokuk, Iowa. May 18.
- Tetra Tech. 2016b. Phase II Targeted Brownfields Assessment, Elkem Carbide, Keokuk, Iowa. November 1.
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). 1999. Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys. Accessed on January 13, 2016.
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051232.pdf
- USDA. 2014. Soil Survey Staff. Official Soil Series Descriptions. Accessed on January 13, 2016.
<https://soilseries.sc.egov.usda.gov/osdname.asp>
- U.S. Geological Survey (USGS). 1977. Keokuk, Iowa Quadrangle. 7.5-Minute Topographic Series.
- USGS. 2009. Ground Water Atlas of the United States Archive. Accessed on February 9, 2016.
<http://pubs.usgs.gov/ha/ha730/gwa.html>
- USGS. 2014. Mineral Resources On-line Spatial Data. Official Series Descriptions. Accessed on January 13, 2016.
<http://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=IAMo;0>
- USGS. 2016. Science In Your Watershed. Accessed on February 9, 2016.
<http://water.usgs.gov/wsc/cat/07080104.html>

APPENDIX A

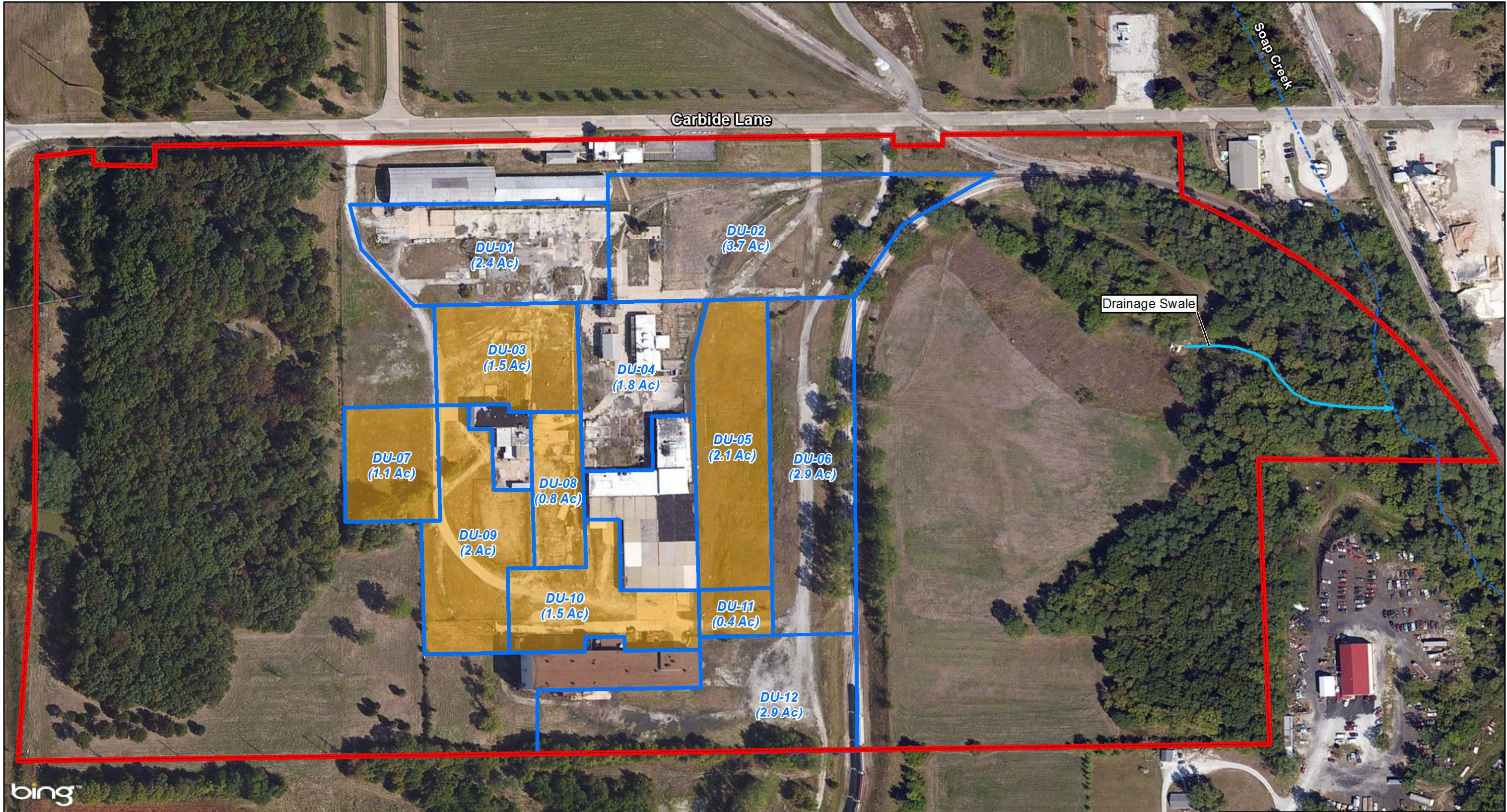
FIGURES



Elkem Carbide
365 Carbide Lane
Keokuk, Iowa

Figure 1
Site Location Map





Legend

Drainage swale

Soap Creek

Decision unit boundary

Decision unit with contaminant concentrations of potential concern under the Site Worker exposure scenario

Subject property boundary

Ac Acre

DU Decision unit

N

0 100 200
Feet

Elkem Carbide
365 Carbide Lane
Keokuk, Iowa

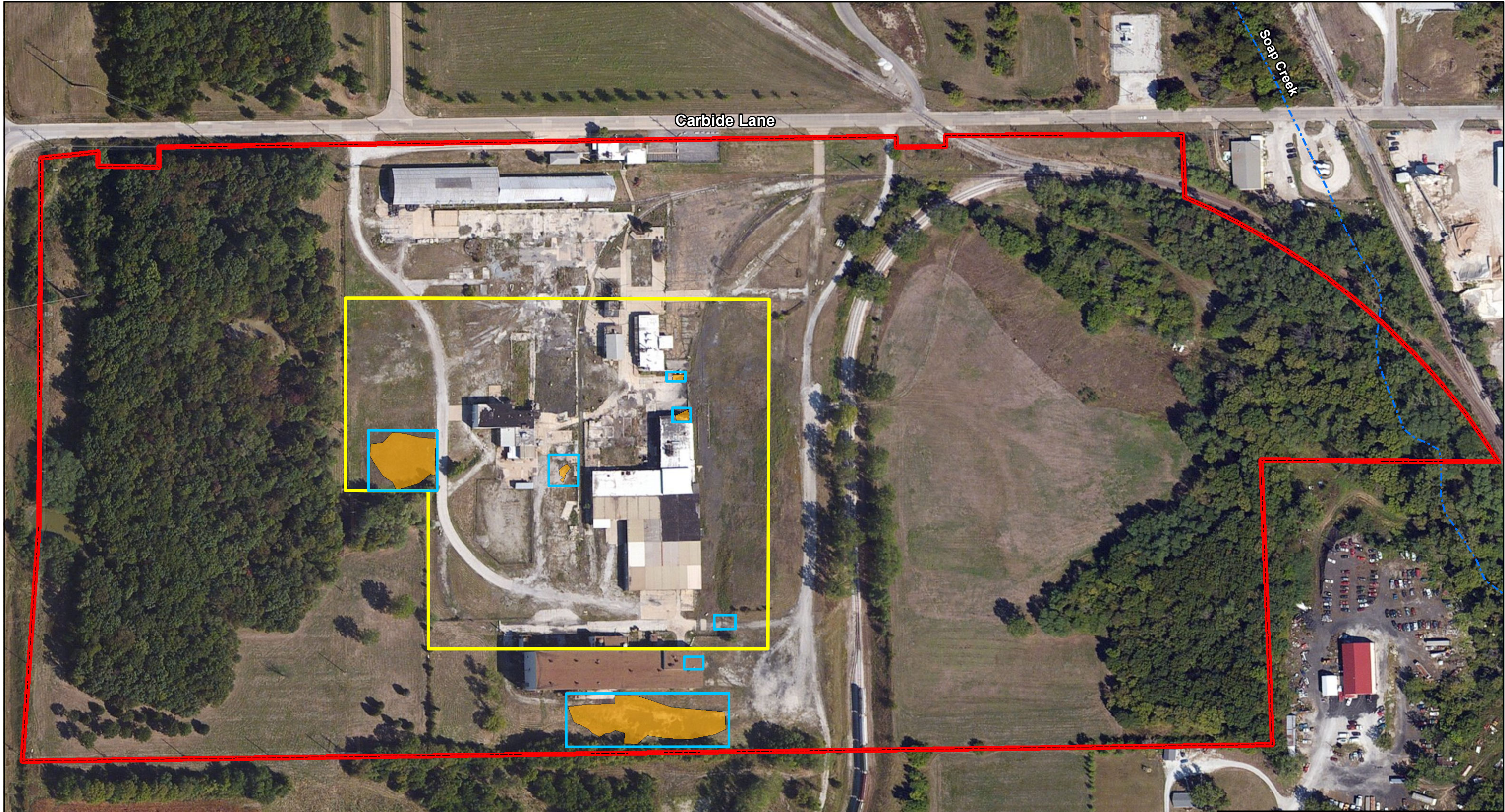
Figure 2
Decision Unit Sampling Areas

TETRA TECH

X:\G025\0002019\01\TetraTech\Map\Figure2_000116.mxd

Source: ESRI, ArcGIS Online, Bing Maps, 2011

Date: 9/19/2016 Drawn By: Nick Wiederholt Project No: X9025.14.0002.019.017



Legend

- Soap Creek
- Apparent coal or coal tar spill
- Subject property boundary
- Spill area addressed by shallow excavation and off-site disposal
- Wide area addressed by surface cover installation

0 100 200
Feet

Elkem Carbide
365 Carbide Lane
Keokuk, Iowa

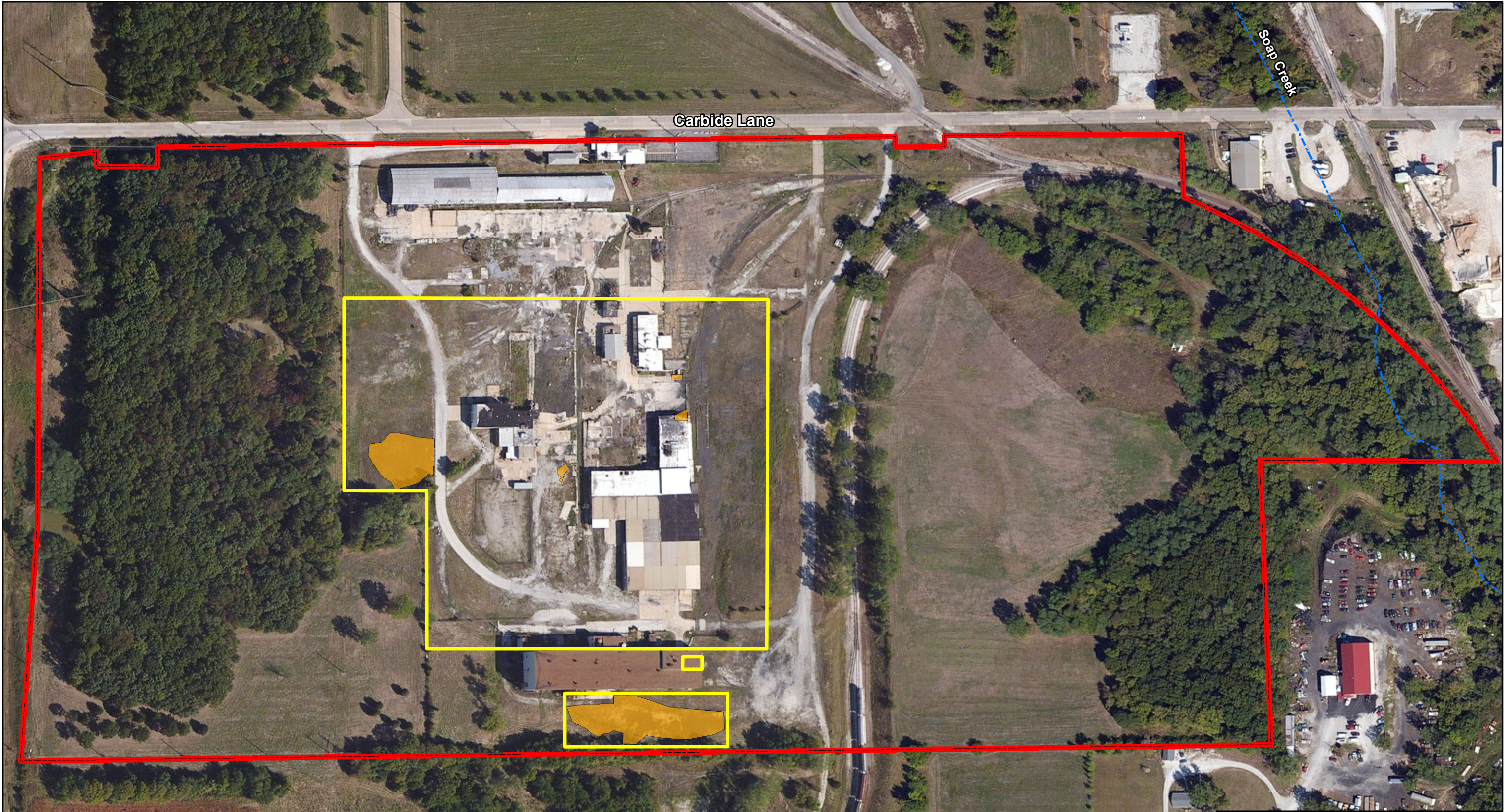
Figure 3
Cleanup Alternative 2 - Limited Removal
and Surface Soil Capping

TETRA TECH

Date: 11/15/2016 Drawn By: Nick Wiederholt Project No: X9025.14.0002.019.017

X:\G025\002019\017\Project\map\Figure2_111416.mxd

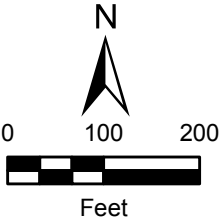
Source: ESRI, ArcGIS Online, Bing Maps, 2011



Legend

- Soap Creek
- Apparent coal or coal tar spill
- Subject property boundary
- Wide area addressed by surface cover installation

Source: ESRI, ArcGIS Online, Bing Maps, 2011



Elkem Carbide
365 Carbide Lane
Keokuk, Iowa

Figure 4
Cleanup Alternative 3 - Wide Area Soil
Removal and Off-site Disposal

TETRA TECH

Date: 11/15/2016 Drawn By: Nick Wiederholt Project No: X9025.14.0002.019.017

APPENDIX B
RACER® OUTPUT

Phase Cost Summary Report (with Markups)

System:

RACER Version: RACER® Version 11.2.16.0
Database Location: V:\START 4 (X9025 - I9025)\Task 0002 - CERCLA Assessment Umbrella\0002.019 - Brownfields Umbrella\0002.019.017 - Elkem Carbide\RACER\Elkem Carbide - ABCA Cost Estimates.mdb

Folder:

Folder Name: Elkem Carbide - ABCA Cost Estimates

Project:

ID: X9025.14.0002.019.017
Name: Elkem Carbide
Category: None

Location

State / Country: IOWA
City: KEOKUK

<u>Location Modifier</u>	<u>Default</u>	<u>User</u>	<u>Reason for changes</u>
	0.990	0.990	

Options

Database: System Costs
Cost Database Date: 2015
Report Option: Fiscal

Description ABCA Cost Estimates

Phase Cost Summary Report (with Markups)

Site:

ID: X9025.14.0002.019.017

Name: Elkem Carbide

Type: None

Media/Waste Type

Primary: Soil

Secondary: N/A

Contaminant

Primary: Semi-Volatile Organic Compounds (SVOCs)

Secondary: Metals

Phase Names

Pre-Study ☐

Study ☐

Design ☐

Removal/Interim Action ☐

Remedial Action ☒

Operations & Maintenance ☐

Long Term Monitoring ☐

Site Closeout ☐

Documentation

Description: NA

Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.

References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: Danielle Gibson

Estimator Title: Environmental Engineer

Agency/Org./Office: Tetra Tech, Inc.

Business Address: 415 Oak Street
Kansas City, MO 64106

Telephone Number: 816-412-1768

Email Address: danielle.gibson@tetrattech.com

Estimate Prepared Date: 11/11/2016

Estimator Signature: _____

Date: _____

Reviewer Information

Reviewer Name: Rob Monnig

Reviewer Title: Chemical Engineer

Agency/Org./Office: Tetra Tech, Inc.

Business Address: 415 Oak Street

Phase Cost Summary Report (with Markups)

Kansas City, MO 64106

Telephone Number: 816-412-1775

Email Address: rob.monntag@tetrattech.com

Date Reviewed: 11/11/2016

Reviewer Signature: _____

Date: _____

Phase Cost Summary Report (with Markups)

Phase Documentation:

Phase Type: Remedial Action
Phase Name: Alternative 2 - Limited Removal and Installation of Surface Cover
Description: Remediation
Approach: Ex Situ
Start Date: November, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

<u>Technology Markups</u>	<u>Markup</u>	<u>% Prime</u>	<u>% Sub.</u>
Excavation	True	100	0
Off-site Transportation and Waste Disposal	True	100	0
Capping	True	100	0
Site Close-Out Documentation	True	100	0
ADMINISTRATIVE LAND USE CONTROLS	True	100	0
Feasibility Study	True	100	0
RCRA Facility Investigation	True	100	0

Total Marked-up Cost: \$3,217,384.74

Technologies:

Phase Cost Summary Report (with Markups)

<u>Technology</u>	<u>Direct Cost</u>	<u>Markups</u>	<u>Total Cost</u>
ADMINISTRATIVE LAND USE CONTROLS	\$25,247	\$43,028	\$68,275
Capping	\$1,905,128	\$949,706	\$2,854,834
Excavation	\$96,445	\$58,147	\$154,592
Feasibility Study	\$12,932	\$22,710	\$35,642
Off-site Transportation and Waste Disposal	\$42,458	\$9,832	\$52,290
RCRA Facility Investigation	\$11,527	\$20,241	\$31,768
Site Close-Out Documentation	\$7,186	\$12,799	\$19,985
Total Phase Cost	\$2,100,922	\$1,116,463	\$3,217,385

Alternative 2 - Limited Removal and Installation of Surface Cover

Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Cost Override	Duplications
9	Excavation	17020416	12 CY Dump Truck Haul/Hour	75	HR	0.00	65.67	43.29	0.00	8,171.58	FALSE	FALSE
9	Excavation	17030277	Excavate and load, bank measure, medium material, 2 C.Y. bucket, hydraulic excavator	1205	BCY	0.00	0.99	0.68	0.00	2,011.98	FALSE	FALSE
9	Excavation	17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	1565.42	CY	25.92	1.09	0.89	0.01	43,688.42	FALSE	FALSE
9	Excavation	18050402	Seeding, Vegetative Cover	1.79	ACR	3,288.62	498.59	207.57	0.00	7,150.65	FALSE	FALSE
9	Excavation	33020401	Disposable Materials per Sample	25	EA	10.34	0.00	0.00	0.00	258.57	FALSE	FALSE
9	Excavation	33021705	Targeted TCLP (Metals, Volatiles, Semi-Volatiles only), Soil Analysis	5	EA	0.00	0.00	0.00	549.40	2,747.00	FALSE	FALSE
9	Excavation	33021709	Testing, TAL metals (6010/7000s)	20	EA	0.00	0.00	0.00	248.84	4,976.73	FALSE	FALSE
9	Excavation	33021721	Testing, semi-volatile organics (625, 8270)	20	EA	0.00	0.00	0.00	720.63	14,412.70	FALSE	FALSE
9	Excavation	33220102	Project Manager	6	HR	0.00	91.12	0.00	0.00	546.75	FALSE	TRUE
9	Excavation	33220108	Project Scientist	160	HR	0.00	75.99	0.00	0.00	12,158.38	FALSE	TRUE
9	Excavation	33220110	QA/QC Officer	2	HR	0.00	75.99	0.00	0.00	151.98	FALSE	TRUE
9	Excavation	33220114	Word Processing/Clerical	2	HR	0.00	41.02	0.00	0.00	82.04	FALSE	TRUE
9	Excavation	33220115	Draftsman/CADD	2	HR	0.00	43.99	0.00	0.00	87.97	FALSE	TRUE
9 Total										96,444.75		
10	Off-site Transportation and Waste Disposal	33190102	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	1205	BCY	0.94	1.24	0.39	0.00	3,086.77	FALSE	FALSE
10	Off-site Transportation and Waste Disposal	33190205	Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	1464	MI	0.00	0.00	0.00	2.57	3,768.34	FALSE	FALSE
10	Off-site Transportation and Waste Disposal	33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1	EA	0.00	0.00	0.00	49.50	49.50	FALSE	FALSE
10	Off-site Transportation and Waste Disposal	33190807	32 Ft. Dump Truck, 6 Mil Liner, disposable	61	EA	25.48	0.00	0.00	0.00	1,554.44	FALSE	FALSE
10	Off-site Transportation and Waste Disposal	33197270	Landfill Nonhazardous Solid Bulk Waste by CY	1205	CY	0.00	0.00	0.00	28.22	33,999.08	FALSE	FALSE
10 Total										42,458.12		
12	Capping	18020302	Asphalt Pavement- 6" Base Course Layer, 3" Topping	51088.3	SY	31.28	4.51	1.49	0.00	1,905,127.59	FALSE	FALSE
12 Total										1,905,127.59		
14	Site Close-Out Documentation	33220101	Senior Project Manager	2	HR	0.00	93.40	0.00	0.00	186.79	FALSE	FALSE
14	Site Close-Out Documentation	33220102	Project Manager	54	HR	0.00	91.12	0.00	0.00	4,920.71	FALSE	TRUE
14	Site Close-Out Documentation	33220109	Staff Scientist	7	HR	0.00	43.99	0.00	0.00	307.90	FALSE	TRUE
14	Site Close-Out Documentation	33220114	Word Processing/Clerical	26	HR	0.00	41.02	0.00	0.00	1,066.48	FALSE	TRUE
14	Site Close-Out Documentation	33220115	Draftsman/CADD	16	HR	0.00	43.99	0.00	0.00	703.78	FALSE	TRUE
14 Total										7,185.66		
17	ADMINISTRATIVE LAND USE CONTROLS	33010202	Per Diem (per person)	1	DAY	0.00	0.00	0.00	129.00	129.00	TRUE	FALSE
17	ADMINISTRATIVE LAND USE CONTROLS	33022037	Overnight Delivery, 8 oz Letter	3	EA	0.00	0.00	0.00	18.85	56.55	FALSE	FALSE
17	ADMINISTRATIVE LAND USE CONTROLS	33220102	Project Manager	1	HR	0.00	74.72	0.00	0.00	74.72	FALSE	TRUE

Alternative 2 - Limited Removal and Installation of Surface Cover

Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Cost Override	Duplications
17	ADMINISTRATIVE LAND USE CONTROLS	33220102	Project Manager	30	HR	0.00	74.72	0.00	0.00	2,241.66	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220102	Project Manager	20	HR	0.00	74.72	0.00	0.00	1,494.44	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220105	Project Engineer	60	HR	0.00	54.69	0.00	0.00	3,281.10	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220106	Staff Engineer	150	HR	0.00	66.28	0.00	0.00	9,942.13	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220110	QA/QC Officer	19	HR	0.00	62.31	0.00	0.00	1,183.92	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220114	Word Processing/Clerical	3	HR	0.00	33.64	0.00	0.00	100.91	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220114	Word Processing/Clerical	16	HR	0.00	33.64	0.00	0.00	538.16	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220114	Word Processing/Clerical	90	HR	0.00	33.64	0.00	0.00	3,027.16	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220115	Draftsman/CADD	45	HR	0.00	36.07	0.00	0.00	1,623.09	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220115	Draftsman/CADD	8	HR	0.00	36.07	0.00	0.00	288.55	FALSE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33220507	Attorney, Associate, Real Estate	3	HR	0.00	169.05	0.00	0.00	507.15	FALSE	FALSE
17	ADMINISTRATIVE LAND USE CONTROLS	33220509	Paralegal, Real Estate	3	HR	0.00	49.18	0.00	0.00	147.53	FALSE	FALSE
17	ADMINISTRATIVE LAND USE CONTROLS	33240101	Other Direct Costs	1	LS	532.48	0.00	0.00	0.00	532.48	TRUE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33240101	Other Direct Costs	1	LS	58.03	0.00	0.00	0.00	58.03	TRUE	TRUE
17	ADMINISTRATIVE LAND USE CONTROLS	33240101	Other Direct Costs	1	LS	20.76	0.00	0.00	0.00	20.76	TRUE	TRUE
17 Total										25,247.34		
22	Feasibility Study	33220102	Project Manager	12	HR	0.00	91.12	0.00	0.00	1,093.49	FALSE	TRUE
22	Feasibility Study	33220103	Office Manager	5	HR	0.00	74.85	0.00	0.00	374.26	FALSE	TRUE
22	Feasibility Study	33220105	Project Engineer	40	HR	0.00	66.69	0.00	0.00	2,667.56	FALSE	TRUE
22	Feasibility Study	33220106	Staff Engineer	58	HR	0.00	80.83	0.00	0.00	4,688.16	FALSE	TRUE
22	Feasibility Study	33220108	Project Scientist	29	HR	0.00	75.99	0.00	0.00	2,203.71	FALSE	TRUE
22	Feasibility Study	33220110	QA/QC Officer	6	HR	0.00	75.99	0.00	0.00	455.94	FALSE	TRUE
22	Feasibility Study	33220114	Word Processing/Clerical	27	HR	0.00	41.02	0.00	0.00	1,107.50	FALSE	TRUE
22	Feasibility Study	33220115	Draftsman/CADD	2	HR	0.00	43.99	0.00	0.00	87.97	FALSE	TRUE
22	Feasibility Study	33240101	Other Direct Costs	1	LS	253.57	0.00	0.00	0.00	253.57	TRUE	TRUE
22 Total										12,932.17		
23	RCRA Facility Investigation	33220102	Project Manager	13	HR	0.00	91.12	0.00	0.00	1,184.62	FALSE	TRUE
23	RCRA Facility Investigation	33220103	Office Manager	5	HR	0.00	74.85	0.00	0.00	374.26	FALSE	TRUE
23	RCRA Facility Investigation	33220105	Project Engineer	3	HR	0.00	66.69	0.00	0.00	200.07	FALSE	TRUE
23	RCRA Facility Investigation	33220106	Staff Engineer	20	HR	0.00	80.83	0.00	0.00	1,616.61	FALSE	TRUE
23	RCRA Facility Investigation	33220108	Project Scientist	3	HR	0.00	75.99	0.00	0.00	227.97	FALSE	TRUE
23	RCRA Facility Investigation	33220109	Staff Scientist	120	HR	0.00	43.99	0.00	0.00	5,278.33	FALSE	TRUE
23	RCRA Facility Investigation	33220110	QA/QC Officer	8	HR	0.00	75.99	0.00	0.00	607.92	FALSE	TRUE
23	RCRA Facility Investigation	33220111	Certified Industrial Hygienist	8	HR	0.00	79.81	0.00	0.00	638.47	FALSE	FALSE
23	RCRA Facility Investigation	33220114	Word Processing/Clerical	20	HR	0.00	41.02	0.00	0.00	820.37	FALSE	TRUE

Alternative 2 - Limited Removal and Installation of Surface Cover

Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Cost Override	Duplications
23	RCRA Facility Investigation	33220115	Draftsman/CADD	8	HR	0.00	43.99	0.00	0.00	351.89	FALSE	TRUE
23	RCRA Facility Investigation	33240101	Other Direct Costs	1	LS	226.01	0.00	0.00	0.00	226.01	TRUE	TRUE
23 Total										11,526.51		
Grand Total										2,100,922.14		

Phase Cost Summary Report (with Markups)

System:

RACER Version: RACER® Version 11.2.16.0

Database Location: V:\START 4 (X9025 - I9025)\Task 0002 - CERCLA Assessment Umbrella\0002.019 - Brownfields Umbrella\0002.019.017 - Elkem Carbide\RACER\Elkem Carbide - ABCA Cost Estimates.mdb

Folder:

Folder Name: Elkem Carbide - ABCA Cost Estimates

Project:

ID: X9025.14.0002.019.017

Name: Elkem Carbide

Category: None

Location

State / Country: IOWA

City: KEOKUK

Location Modifier

Default

0.990

User

0.990

Reason for changes

Options

Database: System Costs

Cost Database Date: 2015

Report Option: Fiscal

Description

ABCA Cost Estimates

Phase Cost Summary Report (with Markups)

Site:

ID: X9025.14.0002.019.017

Name: Elkem Carbide

Type: None

Media/Waste Type

Primary: Soil

Secondary: N/A

Contaminant

Primary: Semi-Volatile Organic Compounds (SVOCs)

Secondary: Metals

Phase Names

Pre-Study ☐

Study ☐

Design ☐

Removal/Interim Action ☐

Remedial Action ☒

Operations & Maintenance ☐

Long Term Monitoring ☐

Site Closeout ☐

Documentation

Description: NA

Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.

References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: Danielle Gibson

Estimator Title: Environmental Engineer

Agency/Org./Office: Tetra Tech, Inc.

Business Address: 415 Oak Street
Kansas City, MO 64106

Telephone Number: 816-412-1768

Email Address: danielle.gibson@tetrattech.com

Estimate Prepared Date: 11/11/2016

Estimator Signature: _____

Date: _____

Reviewer Information

Reviewer Name: Rob Monnig

Reviewer Title: Chemical Engineer

Agency/Org./Office: Tetra Tech, Inc.

Business Address: 415 Oak Street

Phase Cost Summary Report (with Markups)

Kansas City, MO 64106

Telephone Number: 816-412-1775

Email Address: rob.monntag@tetrattech.com

Date Reviewed: 11/11/2016

Reviewer Signature: _____

Date: _____

Phase Cost Summary Report (with Markups)

Phase Documentation:

Phase Type: Remedial Action
Phase Name: Alternative 3 - Wide Area Soil Removal and Off-site Disposal
Description: Remediation
Approach: Ex Situ
Start Date: November, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups

	<u>Markup</u>	<u>% Prime</u>	<u>% Sub.</u>
Excavation	True	100	0
Off-site Transportation and Waste Disposal	True	100	0
Site Close-Out Documentation	True	100	0
ADMINISTRATIVE LAND USE CONTROLS	True	100	0
Feasibility Study	True	100	0
RCRA Facility Investigation	True	100	0

Total Marked-up Cost: \$1,597,495.69

Technologies:

Phase Cost Summary Report (with Markups)

<u>Technology</u>	<u>Direct Cost</u>	<u>Markups</u>	<u>Total Cost</u>
ADMINISTRATIVE LAND USE CONTROLS	\$25,247	\$43,028	\$68,275
Excavation	\$701,156	\$359,039	\$1,060,195
Feasibility Study	\$12,932	\$22,710	\$35,642
Off-site Transportation and Waste Disposal	\$309,888	\$71,743	\$381,631
RCRA Facility Investigation	\$11,527	\$20,241	\$31,768
Site Close-Out Documentation	\$7,186	\$12,799	\$19,985
Total Phase Cost	\$1,067,936	\$529,560	\$1,597,496

Alternative 3 - Wide-Area Soil Removal and Off-Site Disposal

Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Cost Override	Duplications
6	Excavation	17020416	12 CY Dump Truck Haul/Hour	547	HR	0.00	65.67	43.29	0.00	59,598.09	FALSE	FALSE
6	Excavation	17030278	Excavate and load, bank measure, medium material, 3-1/2 C.Y. bucket, hydraulic excavator	8817	BCY	0.00	0.79	0.76	0.00	13,668.71	FALSE	FALSE
6	Excavation	17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	11461.7	CY	25.92	1.09	0.89	0.01	319,877.23	FALSE	FALSE
6	Excavation	18050402	Seeding, Vegetative Cover	13.12	ACR	3,288.62	498.59	207.57	0.00	52,411.48	FALSE	FALSE
6	Excavation	33020401	Disposable Materials per Sample	210	EA	10.34	0.00	0.00	0.00	2,171.99	FALSE	FALSE
6	Excavation	33021705	Targeted TCLP (Metals, Volatiles, Semi-Volatiles only), Soil Analysis	10	EA	0.00	0.00	0.00	549.40	5,494.01	FALSE	FALSE
6	Excavation	33021709	Testing, TAL metals (6010/7000s)	200	EA	0.00	0.00	0.00	248.84	49,767.30	FALSE	FALSE
6	Excavation	33021721	Testing, semi-volatile organics (625, 8270)	200	EA	0.00	0.00	0.00	720.63	144,126.97	FALSE	FALSE
6	Excavation	33220102	Project Manager	24	HR	0.00	91.12	0.00	0.00	2,186.98	FALSE	TRUE
6	Excavation	33220108	Project Scientist	640	HR	0.00	75.99	0.00	0.00	48,633.51	FALSE	TRUE
6	Excavation	33220110	QA/QC Officer	20	HR	0.00	75.99	0.00	0.00	1,519.80	FALSE	TRUE
6	Excavation	33220114	Word Processing/Clerical	20	HR	0.00	41.02	0.00	0.00	820.37	FALSE	TRUE
6	Excavation	33220115	Draftsman/CADD	20	HR	0.00	43.99	0.00	0.00	879.72	FALSE	TRUE
6 Total										701,156.17		
7	Off-site Transportation and Waste Disposal	33190102	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	8817	BCY	0.94	1.24	0.39	0.00	22,585.96	FALSE	FALSE
7	Off-site Transportation and Waste Disposal	33190205	Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	10584	MI	0.00	0.00	0.00	2.57	27,243.22	FALSE	FALSE
7	Off-site Transportation and Waste Disposal	33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st	1	EA	0.00	0.00	0.00	49.50	49.50	FALSE	FALSE
7	Off-site Transportation and Waste Disposal	33190807	32 Ft. Dump Truck, 6 Mil Liner, disposable	441	EA	25.48	0.00	0.00	0.00	11,237.83	FALSE	FALSE
7	Off-site Transportation and Waste Disposal	33197270	Landfill Nonhazardous Solid Bulk Waste by CY	8817	CY	0.00	0.00	0.00	28.22	248,771.66	FALSE	FALSE
7 Total										309,888.16		
15	Site Close-Out Documentation	33220101	Senior Project Manager	2	HR	0.00	93.40	0.00	0.00	186.79	FALSE	FALSE
15	Site Close-Out Documentation	33220102	Project Manager	54	HR	0.00	91.12	0.00	0.00	4,920.71	FALSE	TRUE
15	Site Close-Out Documentation	33220109	Staff Scientist	7	HR	0.00	43.99	0.00	0.00	307.90	FALSE	TRUE
15	Site Close-Out Documentation	33220114	Word Processing/Clerical	26	HR	0.00	41.02	0.00	0.00	1,066.48	FALSE	TRUE
15	Site Close-Out Documentation	33220115	Draftsman/CADD	16	HR	0.00	43.99	0.00	0.00	703.78	FALSE	TRUE
15 Total										7,185.66		
19	ADMINISTRATIVE LAND USE CONTROLS	33010202	Per Diem (per person)	1	DAY	0.00	0.00	0.00	129.00	129.00	TRUE	FALSE
19	ADMINISTRATIVE LAND USE CONTROLS	33022037	Overnight Delivery, 8 oz Letter	3	EA	0.00	0.00	0.00	18.85	56.55	FALSE	FALSE
19	ADMINISTRATIVE LAND USE CONTROLS	33220102	Project Manager	30	HR	0.00	74.72	0.00	0.00	2,241.66	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220102	Project Manager	1	HR	0.00	74.72	0.00	0.00	74.72	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220102	Project Manager	20	HR	0.00	74.72	0.00	0.00	1,494.44	FALSE	TRUE

Alternative 3 - Wide-Area Soil Removal and Off-Site Disposal

Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Cost Override	Duplications
19	ADMINISTRATIVE LAND USE CONTROLS	33220105	Project Engineer	60	HR	0.00	54.69	0.00	0.00	3,281.10	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220106	Staff Engineer	150	HR	0.00	66.28	0.00	0.00	9,942.13	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220110	QA/QC Officer	19	HR	0.00	62.31	0.00	0.00	1,183.92	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220114	Word Processing/Clerical	90	HR	0.00	33.64	0.00	0.00	3,027.16	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220114	Word Processing/Clerical	3	HR	0.00	33.64	0.00	0.00	100.91	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220114	Word Processing/Clerical	16	HR	0.00	33.64	0.00	0.00	538.16	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220115	Draftsman/CADD	8	HR	0.00	36.07	0.00	0.00	288.55	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220115	Draftsman/CADD	45	HR	0.00	36.07	0.00	0.00	1,623.09	FALSE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33220507	Attorney, Associate, Real Estate	3	HR	0.00	169.05	0.00	0.00	507.15	FALSE	FALSE
19	ADMINISTRATIVE LAND USE CONTROLS	33220509	Paralegal, Real Estate	3	HR	0.00	49.18	0.00	0.00	147.53	FALSE	FALSE
19	ADMINISTRATIVE LAND USE CONTROLS	33240101	Other Direct Costs	1	LS	20.76	0.00	0.00	0.00	20.76	TRUE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33240101	Other Direct Costs	1	LS	532.48	0.00	0.00	0.00	532.48	TRUE	TRUE
19	ADMINISTRATIVE LAND USE CONTROLS	33240101	Other Direct Costs	1	LS	58.03	0.00	0.00	0.00	58.03	TRUE	TRUE
19 Total										25,247.34		
20	Feasibility Study	33220102	Project Manager	12	HR	0.00	91.12	0.00	0.00	1,093.49	FALSE	TRUE
20	Feasibility Study	33220103	Office Manager	5	HR	0.00	74.85	0.00	0.00	374.26	FALSE	TRUE
20	Feasibility Study	33220105	Project Engineer	40	HR	0.00	66.69	0.00	0.00	2,667.56	FALSE	TRUE
20	Feasibility Study	33220106	Staff Engineer	58	HR	0.00	80.83	0.00	0.00	4,688.16	FALSE	TRUE
20	Feasibility Study	33220108	Project Scientist	29	HR	0.00	75.99	0.00	0.00	2,203.71	FALSE	TRUE
20	Feasibility Study	33220110	QA/QC Officer	6	HR	0.00	75.99	0.00	0.00	455.94	FALSE	TRUE
20	Feasibility Study	33220114	Word Processing/Clerical	27	HR	0.00	41.02	0.00	0.00	1,107.50	FALSE	TRUE
20	Feasibility Study	33220115	Draftsman/CADD	2	HR	0.00	43.99	0.00	0.00	87.97	FALSE	TRUE
20	Feasibility Study	33240101	Other Direct Costs	1	LS	253.57	0.00	0.00	0.00	253.57	TRUE	TRUE
20 Total										12,932.17		
21	RCRA Facility Investigation	33220102	Project Manager	13	HR	0.00	91.12	0.00	0.00	1,184.62	FALSE	TRUE
21	RCRA Facility Investigation	33220103	Office Manager	5	HR	0.00	74.85	0.00	0.00	374.26	FALSE	TRUE
21	RCRA Facility Investigation	33220105	Project Engineer	3	HR	0.00	66.69	0.00	0.00	200.07	FALSE	TRUE
21	RCRA Facility Investigation	33220106	Staff Engineer	20	HR	0.00	80.83	0.00	0.00	1,616.61	FALSE	TRUE
21	RCRA Facility Investigation	33220108	Project Scientist	3	HR	0.00	75.99	0.00	0.00	227.97	FALSE	TRUE
21	RCRA Facility Investigation	33220109	Staff Scientist	120	HR	0.00	43.99	0.00	0.00	5,278.33	FALSE	TRUE
21	RCRA Facility Investigation	33220110	QA/QC Officer	8	HR	0.00	75.99	0.00	0.00	607.92	FALSE	TRUE
21	RCRA Facility Investigation	33220111	Certified Industrial Hygienist	8	HR	0.00	79.81	0.00	0.00	638.47	FALSE	FALSE
21	RCRA Facility Investigation	33220114	Word Processing/Clerical	20	HR	0.00	41.02	0.00	0.00	820.37	FALSE	TRUE
21	RCRA Facility Investigation	33220115	Draftsman/CADD	8	HR	0.00	43.99	0.00	0.00	351.89	FALSE	TRUE
21	RCRA Facility Investigation	33240101	Other Direct Costs	1	LS	226.01	0.00	0.00	0.00	226.01	TRUE	TRUE
21 Total										11,526.51		
Grand Total										1,067,936.01		