FIFTH ADDENDUM TO THE WORKPLAN FOR ADDITIONAL INVESTIGATION OF HAWTHORN GROUP FORMATION DNAPL SOURCE EVALUATION FOR THE KOPPERS INDUSTRIES PROPERTY

CABOT CARBON/KOPPERS SUPERFUND SITE, GAINESVILLE, FLORIDA

Prepared for:

Beazer East, Inc.

February 10, 2004

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February 9, 2004

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Subject: Transmittal of Fifth Addendum to the Workplan for Additional Investigation of Hawthorn Group Formation DNAPL Source Evaluation for the Koppers Industries Property, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

Dear Mr. Budeir:

Attached is a copy of the Fifth Addendum to the Workplan for Additional Investigation of Hawthorn Group Formation DNAPL Source Evaluation for the Koppers Industries Property, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida. We welcome your comments on the workplan. Please feel free to contact me at (703) 444-7000 if you have any comments or questions.

Sincerely,

James W. Mercer

James W. Mercer, Ph.D., P.G.
Executive Vice President
Principal Hydrogeologist

Enclosure

cc: Kelsey Helton, FDEP
John Mousa, ACEPD
Brett Goodman, GRU
Mike Slenska, Beazer East
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1.0 INTRODUCTION

1.1 BACKGROUND

This Fifth Addendum to the Workplan describes activities that are planned as part of an ongoing field investigation at the Koppers portion of the Cabot Carbon/Koppers Superfund Site in Gainesville, Florida (the Site). The work involved herein involves sampling and analysis to further define the vertical and lateral extent of dense non-aqueous phase liquid (DNAPL) free-phase and residual impacts. There are other activities planned as part of the investigation that are described in additional Workplan addenda.

The Site was added to the National Priorities List (NPL) in August 1983. In 1987, Florida Department of Environmental Regulation completed a Remedial Investigation (RI) under a cooperative agreement with EPA (IT Corp., 1987). Additional site characterization was performed in 1989 (Hunter/ESE, 1989), and in 1993 (McLaren/Hart, 1993) with additional evaluation and site characterization in 1999, 2002, and 2003 (TRC, 1999, 2002a, and 2003). The initial groundwater remedy for the Site selected in 1990 included perimeter extraction wells in the Surficial Aquifer and a granular activated carbon (GAC) treatment system. This system was installed and began operation in August 1995 and includes the collection of monitoring and performance data. Consequently, considerable information and data are available for the Site.

1.2 APPROACH

Because the Site has been extensively studied since 1987, the approach taken here is to rely on data collected during previous investigations to delineate creosote source zones. Creosote is no longer used at the Site. Consequently, creosote source zones are the result of historic usage of creosote. According to the Material Safety Data Sheet (MSDS Number KMG 0026 issued March 2003) for creosote, creosote has a specific gravity in the range of 1.03 to 1.18 (avg.: 9.1 lbs/gal). Because these values are greater than the specific gravity of water (1.0), creosote is considered a dense non-aqueous phase liquid (DNAPL). Unlike many DNAPLs (e.g., chlorinated solvents), creosote can be detected visually in the field and

has a distinctive odor, both in soil and liquid samples. Odor observations are less reliable than visual observations as an indication of DNAPL; however, for this effort, both visual and odor observations are used to help define potential DNAPL zones.

The MSDS also indicates that naphthalene is a significant component (up to 15% by weight) of creosote. Naphthalene has a liquid-phase water solubility of 100 mg/l (at 25° C) (Feenstra et al., 1991). Dissolved naphthalene concentrations that are in the range of several percent of the aqueous solubility are considered an indicator of DNAPL presence in the vicinity or up gradient of the well where the concentrations are observed. About 10 years ago (Feenstra et al., 1991), soil concentrations on the order of about 10,000 mg/kg (of creosote chemicals) were thought to indicate DNAPL. Because naphthalene is only about 15% of the DNAPL creosote, naphthalene soil concentrations on the order of about 1,500 mg/kg indicate creosote using this rule. More recently (Mott, 1995; Mariner et al., 1997), soil concentrations that represent DNAPL have been shown to be a function of chemical solubility and soil properties, and can be much lower than 10,000 mg/kg. For this reason, a soil concentration for naphthalene of 1,000 mg/kg is used in this report as a likely indication of creosote presence. Therefore, in addition to noting visual and odor observations, elevated naphthalene concentrations in groundwater and soil are considered as an indicator compound for creosote.

This DNAPL source-area characterization is based upon geologic logs from soil borings, monitor well installations and test-pit excavations from the Site documents. Geologic report data quality is often difficult to assess because some reports present geologic boring logs with comparatively more geology and contamination observations than others. For instance, the SFS soil boring logs (TRC, 1999) have a substantially greater quantity of data than the M-boring logs (Law Engineering and Testing, 1984). Therefore, comparing boring logs from different geologists and companies over decades of investigations and with different data quality objectives in order to formulate a site-wide representation of subsurface conditions can be subjective. For instance, odor and headspace screening observations are frequently a less reliable indicator of residual creosote from soil samples collected below the water table than above. It is often challenging for the geologist to distinguish soil contamination from dissolved groundwater contamination on saturated soil grains. However, because of the general scarcity of contamination characterization provided in many of the

older geologic logs, headspace screening results and odor observations from aquifer soils are used as qualitative indicators of residual creosote for this analysis. As discussed later, this approach has limitations especially for the Hawthorn Group.

A brief discussion of the Site hydrogeology is provided in Section 2. Both visual and odor observations from soil borings and excavations and naphthalene concentrations of soil are plotted on maps of previously determined source areas and on cross sections through source areas in order to outline the horizontal and vertical extent of creosote, respectively (Section 3). Areas with data gaps that preclude the determination of the lateral and/or vertical extent of DNAPL free phase and residual contamination are identified on the plans and in the text (summarized in Section 4). Finally, a supplemental DNAPL investigation is proposed to fill the identified data gaps and is provided in Section 5.

2.0 HYDROGEOLOGY

The hydrogeology has been described in other Site reports; only a summary is provided here as a backdrop for the DNAPL source evaluation. According to TRC (1999), the Site is underlain by a 20- to 30-foot-thick unit of Plio-Pleistocene marine terrace deposits consisting primarily of fine- to medium-grained quartz sand with trace amounts of silt and clay interbedded with laterally discontinuous zones of clayey sands and sandy clays. Within this unit is the Surficial Aquifer where depth to water ranges from 3 to 15 feet below ground surface (bgs). Underlying the terrace deposits, the Hawthorn Group ranges from approximately 120 to 125 feet in thickness. It is comprised of interbedded and intermixed clays, silty-clayey sand, sandy clay, and occasional carbonate beds (limestone nodules and moderately indurated sands). The upper surface of the Hawthorn Group is a green-gray clay layer that is undulating and dips generally toward the northeast at the Site. This layer is described as hard, plastic clay that ranges from 0.5 to 7 feet in thickness. The hydraulic conductivity of this clay layer is 6.7×10^{-8} cm/sec, as determined from the average laboratory permeameter test results from 11 site-perimeter boring cores (TRC 2002).

Below this clay is the clayey-sand zone (34 to 42 feet thick), which is referred to as the Upper Hawthorn Group. The Upper Hawthorn Group hydraulic heads are approximately 1-2 feet lower than hydraulic heads in the Surficial Aquifer. Below the Upper Hawthorn Group is a second hard, plastic clay layer (2 to 15 feet thick). Below this clay layer is a clayey-sand layer referred to as the Lower Hawthorn Group. The second clay layer appears to be a more effective confining bed, as hydraulic heads in the Lower Hawthorn Group are nearly 30 ft deeper than the heads in the Surficial Aquifer. A third hard, plastic clay layer (20 to 32 feet thick) is found below the Lower Hawthorn Group. Below this clay layer is the Upper Eocene Ocala Limestone of the Floridan Aquifer. These hydrogeologic layers are shown on cross sections to help display vertical creosote observations and naphthalene soil concentrations.

3.0 DNAPL SOURCE ZONES

DNAPL source zones have been identified at the former North and South Lagoons, the former Cooling Pond and the Former Drip Track Areas (IT Corp., 1987). Residual DNAPL (immobile under current conditions) and a limited amount of free-phase DNAPL (appears mobile in cores – a subjective interpretation by the geologist) have been observed at the four source areas. Although DNAPL is present, there appears to be only relatively small quantities of mobile free-phase DNAPL and there does not appear to be any definitive evidence of significant lateral DNAPL migration. Only one well on Site has had any accumulation of DNAPL. There was a 2-foot layer of creosote in the bottom of PW-1 in the Cooling Pond area following a 48-hr pump test. DNAPL observations include creosote staining and odors, tarry soil or hardened creosote, and oil. Alshafie and Ghoshal (2002) have shown that semi-gelatinous interfacial films or 'skins' are observed to form at the interface of creosote and water when creosote is aged (contacted over an extended time period). Given the period of time that creosote has been in the subsurface at the Site, the observation of hardened creosote may be an indication of aging, causing the creosote to be less mobile with reduced dissolution.

The boundaries of DNAPL-impacted soil areas are based on: (1) visual and odor observations recorded in the logs of the boreholes, wells and test pits; (2) concentrations of naphthalene in soil samples collected from boreholes and excavations at the characterized DNAPL source-areas; and (3) concentrations of dissolved naphthalene in groundwater down gradient of areas where DNAPL has been identified. Each of these is discussed below.

Figure 1 is the Site Plan, showing source areas, source-area sampling locations, borings and wells, and the elevation of the top of the Hawthorn Group Clay. Figure 2 provides a plan and section for the Former North Lagoon. Figure 3 provides a plan and section for the Former South Lagoon. Figure 4 provides a plan and section for the Former Cooling Pond (Including Former Tank Containment and Process Areas) and Drip Tracks.

3.1 FORMER NORTH LAGOON

The Former North Lagoon was used to manage wastewater generated by the treatment process. Based on aerial photographs, the North Lagoon operated from 1956 until the 1970s. This lagoon has been closed, covered and graded, and is currently used for utility pole storage. Four to 12 inches of limerock fill are present within the upper 1 foot of surface soil. Below this shallow fill are the terrace deposits. Data for DNAPL characterization of the Former North Lagoon includes geologic logs and analytical results from 30 source-area borings and two monitor wells, as shown in Figure 2. There are no Former North Lagoon source-area borings through the Upper Hawthorn Clay. Therefore, the local thickness of this clay layer cannot be determined. However, the clay is estimated to be approximately 2 to 3 feet thick for this area (TRC, 2003). The Surficial Aquifer water table is approximately 6 feet below grade.

As shown on the cross section A-A' in Figure 2, amber-colored free-phase oily liquid (DNAPL) with very strong creosote odors was reported in the silty-sand soil within the saturated zone in two of the three source-area borings that were advanced to the top of the Upper Hawthorn Clay. Boring SFS-B4 encountered free-phase DNAPL for most of the soil column below the water table and into the Upper Hawthorn Clay; approximately 15 feet of DNAPL-impacted core. Soil samples from this DNAPL-impacted core had naphthalene concentrations of 1,900 and 1,000 mg/kg. Boring SB-38 encountered free-phase NAPL in a 2-ft interval directly above the Upper Hawthorn Clay. The third and final fully penetrating source-area terrace deposit boring, SB-36, encountered residual creosote for the entire soil column, but no free product was noted in the log. As shown on section A-A', the lateral extent of free product is incompletely delineated within the terrace deposits.

Residual creosote indicators also are shown on Figure 2. The A-A' section displays the naphthalene concentration for each sample at the midpoint elevation of the composite. The plan view shows the maximum naphthalene concentration per boring. The naphthalene concentrations ranged from non-detect to 13,000 mg/kg. Only three of the 62 source-area SVOC investigation soil samples were collected below 12 feet. The generalized distribution of the naphthalene in soil is provided in plan view by contouring the maximum concentrations at each boring.

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Visual observations of residual creosote are graphically shown on section A-A' with color-coded well logs. The vast majority of the source-area borings provided continuous soil cores from the ground surface to between 8 to12 feet below grade. Within this horizon, the lateral extent of residual creosote is well defined; however, 15 of the 22 borings shown on section A-A' note visual/odor evidence of residual creosote at the deepest point of characterization. This indicates that the vertical extent of residual creosote was not bounded at those borings.

Monitor Well M-1 is the only well located within the DNAPL source-area of the Former North Lagoon. This well is located approximately 220 feet down gradient and down dip (along the top of the Upper Hawthorn Clay) from the approximately 15-ft of DNAPL-impacted soil core noted in Soil Boring SFS-B4. The drilling logs are inconclusive with regard to contamination that may have been encountered during the construction of M-1. The well screen was installed approximately one foot above the Upper Hawthorn Clay contact, which would limit the extent of DNAPL that could be encountered at the clay contact. The local geology for M-1 was confirmed with boring SB-36 located approximately 15 feet down gradient and down dip. Naphthalene has been detected in M-1 groundwater at 6,800 µg/L (McLaren/Hart, 1993), which is approximately 7 percent of its liquid-phase water solubility.

Monitor Well M-14 is located approximately 230 feet up gradient and up dip from the closest observed location of free product (SB-38). A naphthalene concentration of 430 µg/L has been detected in groundwater from this well (McLaren/Hart, 1993), which is screened across the water table.

The well cluster MW-3A and MW-3B is located approximately 700 feet down gradient from the free product noted in Soil Boring SFS-B4, as shown on Figure1. The drilling logs are inconclusive with regard to contamination that may have been encountered during the construction of these monitor wells. The well screens are installed across the water table (MW-3A) and at the top of the Upper Hawthorn Clay (MW-3B). Naphthalene has been detected in MW-3B groundwater at 5,600 µg/L (McLaren/Hart, 1993), which is approximately 6 percent of its liquid-phase water solubility. Notably, water-table groundwater from MW-3A did not have a detectable naphthalene concentration during the same sample event. This supports the conceptual model of DNAPL on top of the Upper

Hawthorn Clay, where the DNAPL produces a dissolved, down gradient naphthalene plume in the deeper portion of the Surficial Aquifer. Non-detects of naphthalene in the shallow Surficial Aquifer well may be an indication of minimal residual DNAPL in the vadose zone and shallow Surficial Aquifer up gradient of this well.

Borings SFS-B7 and SFS-B2 were installed approximately 320 and 620 feet down gradient and down dip from the Former North Lagoon, respectively, to investigate the potential lateral migration of DNAPL within the terrace deposits. Continuous soil cores were collected and characterized from ground surface to the top of the Upper Hawthorn Clay. There was no visual evidence or odors of impacted soil at these locations. Soil headspace screening with an OVA flame ionization detector did not provide elevated readings from any of the soil samples tested. Laboratory analytical results are non-detect for PAHs from soil samples collected one-ft above the Upper Hawthorn Clay at SFS-B2 and from a mid-depth soil sample at SFS-B7 (TRC, 1999). Thus, DNAPL has not migrated laterally along the top of the clay layer to the vicinity of this location.

In summary, beneath the Former North Lagoon, visible staining in sand and clayey-sand lenses containing free-phase DNAPL is present throughout the saturated zone down to the clay at the top of the Hawthorn Group. The upper 3 to 4 feet of terrace deposits consists generally of black, fine-grained silty sand with black, oily staining, visible sheens and creosote odors. Dry, orange-brown sandy hardpan deposits were intermittently encountered from about 5 to 9 feet in the source-area borings. Below this hard pan, bluish-green (creosote impacted) silty sands are present down to the clay at the top of the Hawthorn Group (from 19 to 25 feet), which is also bluish-green in color. Interbedded lenses of clayey sand and/or sandy clay ranging from 2 to greater than 10 feet in thickness are present throughout the terrace deposits. For the most part, these lenses are limited to less than 50 feet in lateral extent. The DNAPL entry area associated with the Former North Lagoon is well defined. The extent of the DNAPL zone on top of the Upper Hawthorn Clay is uncertain and vertical extent of the DNAPL zone below the Upper Hawthorn Clay is uncertain.

3.2 FORMER SOUTH LAGOON

The Former South Lagoon was used to manage wastewater generated by the treatment process. Based on aerial photographs, the South Lagoon operated from 1943 (or earlier) through 1975 or 1976. This lagoon has been closed, covered and graded, and currently used for storage of utility poles (TRC, 1999). The surface soil contains fill of black, silty fine, loose sand and organic topsoil with chunks of concrete and limerock. Below the shallow fill are the terrace deposits. Data for DNAPL characterization of the Former South Lagoon includes geologic logs and analytical results from 40 source-area borings and four monitor well clusters, as shown in Figure 3. Boring MW-32B is the only Former South Lagoon source-area boring installed through the Upper Hawthorn Clay. The thickness of the Upper Hawthorn Clay ranges from 2 to 6 feet (TRC, 2003). The water table was encountered at a depth of approximately 4 feet.

As shown on the cross section B-B' in Figure 3, amber-colored free-phase oily liquid (DNAPL) with very strong creosote odors was reported in the clayey-sand soil within the saturated zone of Boring SFS-B6 at two horizons: one from 15 to 16 feet; and, another from 19 feet to the approximate contact with the Upper Hawthorn Clay at 23 feet. None of the other six fully penetrating terrace deposit borings in the Former South Lagoon source-area detected free-phase DNAPL. As shown on section B-B', the lateral extent of free product is incompletely delineated within the terrace deposits down dip to the northeast.

Residual creosote indicators also are shown on Figure 3. The B-B' section displays the naphthalene concentration for each sample at the midpoint elevation of the composite. The plan view shows the maximum naphthalene concentration per boring. The naphthalene concentrations ranged from non-detect to 13,000 mg/kg. All 82 source-area SVOC investigation soil samples were collected in the vadose and shallow saturated soils down to 12 feet bgs. The generalized distribution of the naphthalene in soil is provided in plan view by contouring the maximum concentrations at each boring. As shown in this figure, there are two DNAPL source-area "hot spots" located within the Former South Lagoon separated by relatively clean vadose zone soil.

Visual observations of residual creosote are graphically shown on section B-B' with color-coded well logs. There are seven borings installed into the top of the Upper Hawthorn

Clay at this source area. Five of these seven borings show visual evidence of DNAPL and/or residual creosote for nearly the full thickness of the terrace deposits and the penetrated portion of the Upper Hawthorn Clay (SB-8, SFS-B6, SB-15, SB-11, and MW-21B). The remaining two fully penetrating terrace deposit borings do not show evidence of creosote contamination (M-27B and M-32B). Because 5 of the 7 fully penetrating terrace deposit borings shown on section B-B' note visual/odor evidence of residual creosote at the deepest point of characterization, the vertical extent of residual creosote was not bounded at these locations.

Monitor well cluster MW-27A,B and single water-table well M-28R are located approximately 180 ft and 150 ft up gradient and up dip from the free product noted in Boring SFS-B6, respectively. Naphthalene has been detected in groundwater from these three wells in low concentrations from non-detect to 10 µg/L (McLaren/Hart, 1993).

Monitor Well cluster M-21A and M-21BR is located within the DNAPL source area of the Former South Lagoon. This well cluster is located approximately 360 feet down gradient and down dip (along the top of the Hawthorn Clay) from the free product noted in Soil Boring SFS-B6. In addition, this cluster is located approximately 50 feet down gradient from the soil sample location with the highest detected naphthalene concentration, 13,000 mg/kg (TP-4). Naphthalene has been detected in groundwater from MW-21A and MW-21B at 230 µg/L and 7,900 µg/L, respectively (McLaren/Hart 1993). This is approximately 0.2 and 8 percent of naphthalene's liquid-phase water solubility, respectively. This supports the conceptual model of DNAPL on top of the Upper Hawthorn Clay. Lower concentrations in the shallow Surficial Aquifer well may be an indication of less residual NAPL in the vadose zone and shallow Surficial Aquifer up gradient of this well.

The well cluster M-32AR and M-32B is located approximately 420 feet down gradient from the free product noted in Soil Boring SFS-B6, and 170 feet from the soil sample location TP-4. No evidence of residual DNAPL was observed during well construction. The well screens are installed across the water table (MW-32A) and at the top of the Upper Hawthorn Clay (MW-32B). Naphthalene has been detected in groundwater from MW-32A and MW-32B at 8,400 µg/L, and 6,650 µg/L, respectively (McLaren/Hart, 1993). This is approximately 8 percent and 7 percent of naphthalene's liquid-phase water solubility, respectively. The presence of elevated concentrations in the shallow and deeper

Surficial Aquifer wells is an indication that residual DNAPLs may be present above (or near) and below the water table up gradient of this location.

In summary, beneath the Former South Lagoon, visible staining in sand and clayey-sand lenses containing free-phase DNAPL is present throughout the saturated zone down to the top of the Upper Hawthorn Clay. Below the fill, the upper 2 to 3 feet of vadose zone soil generally consists of gray to tan, fine- to medium- grained sand with little silt with common thin layers of solidified black tarry sand and occasional creosote odors. Below, bluish-green (creosote impacted) silty sands were present down to the top of the Upper Hawthorn Clay (from 19 to 24 feet), which is also bluish-green in color. Interbedded lenses of clayey sand and/or sandy clay ranging from 2 to greater than 10 feet in thickness are present throughout the terrace deposits. Black, oily staining, visible sheens and creosote odors are present throughout the thickness of the terrace deposits. Dry, orange-brown sandy hardpan deposits were encountered from about 5 to 9 feet in several borings. For the Former South Lagoon, the DNAPL entry area is well defined, but the extent of the DNAPL zone on top of and below the Upper Hawthorn Clay is uncertain.

3.3 FORMER COOLING POND (INCLUDING FORMER TANK CONTAINMENT AND PROCESS AREAS)

Waste liquids from the treating operations were discharged to the cooling pond located in the southeastern corner of the Site. Data for DNAPL characterization of the Former Cooling Pond Area includes geologic logs and analytical results from 22 source-area borings and five monitor well clusters, as shown in Figure 4.

As shown on the cross section in Figure 4, clear amber-colored free-phase oily liquid (DNAPL) with very strong creosote odors was reported in the silty-sand and clayey sand soil within the saturated zone in two source-area borings (SFS-B3 and SB-44) and one test pit excavation (TP-11). Boring SFS-B3 encountered free-phase oil in the saturated alternating layers of silty-sand and clayey-sand in the lower 6 feet of terrace deposits comprising the gradational contact with the top of the Upper Hawthorn Clay. Odors in this boring became very strong in the silty sand at about 15 feet, and free-phase oils were observed in sandy stringers within generally silty zones beginning at an 18-ft depth. The upper foot of the

Upper Hawthorn Clay was visually noted to be unimpacted by creosote. These observations indicate that DNAPL may have migrated laterally along the top of the Upper Hawthorn Clay approximately 60 ft from the Former Cooling Pond/Process Area.

Boring SB-44 encountered free-phase DNAPL in fine sand seams beginning at 9 feet below grade through 21 ft below grade. No DNAPL was noted at the contact with the Upper Hawthorn Clay at 24 feet bgs; however, the headspace screening results from this soil horizon more than doubled the results from soil screened across noted DNAPL zones within the same boring (30 and 114 ppm to 249 ppm). This is an indication that elevated dissolved-phase groundwater concentrations may be present in the vicinity of this boring.

There was a 2-foot layer of creosote DNAPL in the bottom of PW-1 in the Cooling Pond area following a 48-hr pump test. PW-1 is the only Site well that contained measurable DNAPL.

Residual creosote indicators also are shown on Figure 4. The C-C' section displays the naphthalene concentration for each sample at the midpoint elevation of the composite. The plan view shows the maximum naphthalene concentration per boring. The naphthalene concentrations ranged from non-detect to 4,600 mg/kg. All source-area SVOC investigation soil samples were collected in the vadose and shallow saturated soils above 10 feet bgs. The generalized distribution of the naphthalene in soil is provided in plan view by contouring the maximum concentrations at each boring.

Visual observations of residual creosote are graphically shown on section C-C' with color-coded well logs. There are six borings installed into the top of the Upper Hawthorn Clay at this source area. All six borings show visual evidence of DNAPL and/or residual creosote for nearly the full thickness of the terrace deposits (M-30B, SB-47, SB-44, SFS-B3, MW-25, and SB-42 (not shown on the section C-C' for clarity). The extent of creosote impacts upon the Upper Hawthorn Clay, if any, cannot be determined by the available information.

Monitor Wells M-24A and M-24B are located between the Former Tank Containment and Process Areas. This well cluster is located approximately 60 feet up dip, east of PW-1, the only Site well that contained DNAPL. Naphthalene has been detected in groundwater from M-24A and M-24B at 5,350 µg/L and 9,350 µg/L, respectively (McLaren/Hart, 1993),

which is approximately 5 percent and 9 percent of its liquid-phase water solubility, respectively.

Monitor Wells M-29, M30A and M-30B, and M-31 are located from 40 to 80 feet up gradient from this DNAPL source area. Naphthalene concentrations of less than 5 µg/L have been detected in groundwater from these background wells (McLaren/Hart, 1993), which are screened across the water table (with M-30B at the top of the Upper Hawthorn Clay).

In summary, the vadose zone soil in the Former Cooling Pond Areas typically exhibits a surficial fill layer of dark brown, fine- to medium- grained sand with little silt and trace clay. Commonly below this surface fill is a 1-ft thick layer of black, tarry sand, hardened with creosote. Below this hardpan layer are black (stained) and tan silty sands exhibiting creosote odors, which are underlain by odorous red-brown silty sands extending to the water table (at about 5 feet below grade). Interbedded lenses of clayey sand and/or sandy clay ranging from 2 to greater than 10 feet in thickness are present throughout the terrace deposits. Iridescent bluish-green sheens and vertically-oriented black staining, indicative of downward oil seepage, were commonly observed. For the Former Cooling Pond Areas, the DNAPL entry area is well defined, but the extent of the DNAPL zone on top of and below the Upper Hawthorn Clay is uncertain.

3.4 FORMER DRIP TRACK AREA

After the treated wood was removed from the cylinders in the Process Area, it was transported to the Drip Track Area where the excess fluids dripped onto the ground. The Drip Tank Area is located down gradient and down dip from the Former South Lagoon, Former Cooling Pond, Former Tank Containment, and Process Areas. Naphthalene concentrations in down gradient wells suggest that DNAPL may be present below the water table in the Former Drip Track Area or one or more of these other areas. Data for DNAPL characterization of the Creosote/Penta Drip Track Area include geologic logs and analytical results from 23 source-area borings and five monitor well clusters, as shown in Figure 4. Soil data for the CCA Drip Track borings do not indicate the presence of free phase product.

Surface soil in the Creosote/Penta Drip Track Area is characterized as yellow/brown to dark gray fine- to medium-grained loose sand with trace to some silt. Creosote odors and

oil-like sheens on wet grains were commonly noted from 1 ft bgs to the bottom of the borings, approximately 7 to 10 feet deep. Backhoe refusal on red-brown, silty-fine, hardpan was encountered at 6.5 feet in TP-13. Evidence of oil migration downward through cracks in the hard pan was observed. The water table was encountered at a depth of approximately 7 feet.

No free phase DNAPL was observed from any of the Drip Track borings and excavations. Residual creosote indicators are shown on Figure 4. The C-C' section displays the naphthalene concentration for each sample at the midpoint elevation of the composite. The plan view shows the maximum naphthalene concentration per boring. The naphthalene concentrations ranged from non-detect to 1,200 mg/kg. All 22 source-area SVOC investigation soil samples were collected in the vadose and shallow saturated soils above 10 feet bgs. The generalized distribution of the naphthalene in soil is provided in plan view by contouring the maximum concentrations at each boring.

Visual observations of residual creosote are graphically shown on section C-C' with color-coded well logs. Borings and excavations ranged in depth from 6 to 10 feet bgs. There were no borings installed into the top of the Upper Hawthorn Clay at this source-area. Because 7 of the 11 borings shown on section C-C' note visual/odor evidence of residual creosote at the deepest point of characterization, the vertical extent of residual creosote was not bounded.

Monitor Well M-15B is located within the DNAPL source area of the Drip Track at the top of the Upper Hawthorn Clay. This well also is located approximately 1,300 feet down gradient and down dip (along the top of the Upper Hawthorn Clay) from the free product noted in both the Former South Lagoon and Former Cooling Pond. In addition, this monitor well is located approximately 150 feet down gradient from the Drip Track Area soil sample (SB-62) with the highest detected naphthalene concentration, 1,200 mg/kg. Naphthalene has been detected in M-15B at 7,550 µg/L (McLaren/Hart, 1993). This is approximately 8 percent of naphthalene's liquid-phase water solubility. Monitor well M-12 is located approximately 280 feet due north of MW-15B and screens the Surficial Aquifer water table. Naphthalene has been detected in M-12 groundwater at 159 µg/L (McLaren/Hart, 1993). Dissolved-phase concentrations in wells M-15B and M-12 support

the conceptual model of DNAPL accumulating above the Upper Hawthorn Clay and limited residual DNAPL in the upper part of the Surficial Aquifer.

4.0 DATA SUMMARY AND LIMITATIONS

The nature and extent of the four Site DNAPL source areas within shallow subsurface soil is thoroughly characterized by the existing data to a depth of approximately 12 feet below grade. This includes vadose zone soils and soils within the groundwater table smear zone. From approximately 12 feet to the top of the Upper Hawthorn Clay (19 to 26 feet), residual and free-phase creosote contamination is characterized, but the lateral extent (especially on top of the Upper Hawthorn Clay) has not been completely bounded at any of the four source areas. In addition, the vertical extent of creosote contamination has not been defined at any of the creosote source areas.

Most of the DNAPL that has been observed at the Site appears to be at residual saturation (immobile under current conditions), with some of this residual showing evidence of weathering by becoming hardened. This is consistent with the long Site history. DNAPL has only accumulated in one Surficial Aquifer well. Given the number of wells drilled at the Site, it is unlikely that significant pools of DNAPL exist in the Surficial Aquifer at the Site. There have been no visual observations of DNAPL below the Upper Hawthorn Clay, although sampling near the source zones below the clay is limited. In addition, an electrical resistivity feasibility survey was conducted recently over three known areas of creosote sources and adjacent areas. Preliminary results reinforce the conceptual model that DNAPL appears limited to areas near the DNAPL entry locations.

Groundwater data from wells down gradient of the DNAPL source areas that are installed in the Surficial Aquifer demonstrate higher naphthalene concentrations at depth near the top of the Upper Hawthorn Clay. This supports the conceptual model that this clay acted as a permeability and capillary pressure barrier to downward migration of creosote, trapping DNAPL at or near the clay surface. Lateral DNAPL migration along the surface of the Upper Hawthorn Clay appears to be limited, but needs to be confirmed.

Well logs from recently drilled deeper wells (wells screened below the Upper Hawthorn Clay) and the well log from FW-5 provide results that are difficult to interpret. Elevated naphthalene concentrations and other PAHs characteristic of creosote are observed in some of these wells (e.g., wells at HG-4) that may be related to cross contamination (due to the recently drilled wells and/or the result of older wells that are screened/sand-packed

across multiple zones in the Hawthorn) or may indicate creosote migration below the Upper Hawthorn Clay. In some cases (i.e., HG-2D, -5D, and –6D), however, elevated naphthalene concentrations in Hawthorn Group (HG) wells are neither down dip nor down gradient of known DNAPL sources. Naphthalene was detected in groundwater from HG-6 during the November 2003 sampling event at concentrations of 296 µg/L and 5,210 µg/L for the shallow and deep wells, respectively. During the same sampling event, naphthalene was detected in groundwater from HG-4 at concentrations of 7,800 µg/L, 6,179 µg/L, and 3,000 µg/L for the shallow, intermediate and deep-screened intervals, respectively. The water quality data from the wells completed in the deeper interval generally indicate a distinct chemical signature that includes phenols (i.e., phenol, and 2-, 3-, or 4-methylphenol), which are generally non-detect in groundwater in the Surficial Aquifer and Upper Hawthorn Group wells. This suggests a source that may not be related to creosote.

As shown in section C-C', geologic logs for wells HG-4D, HG-6D and FW-5 have elevated PID readings in sandy layers below the Upper Hawthorn Clay, but none of these layers demonstrated visual or odor characteristics associated with creosote. Instead, no staining was observed and the odor was reported to be either "burnt" or "plastic". There is no reference to the customary creosote odor commonly noted in the source-area shallow borings. No visible contamination (i.e., staining) of any kind was noted. Soil headspace screening results indicated a substantial increase in FID readings at these "plastic odor'" horizons but with little change to the PID readings. The elevated FID readings may be an indication of an increase in VOC contamination. These observations could indicate an off-site source. These wells are along the boundary between Koppers and Cabot Carbon. The "burnt " odor may be associated with the production of charcoal from pine at the former Cabot Carbon facility.

Given (1) the difficulty in interpreting the naphthalene concentrations from these wells and (2) the approximately 30-ft downward hydraulic gradient between the Surficial Aquifer and the Lower Hawthorn Group, enhancing the possibility of cross contamination during well construction and at improperly screened wells, additional HG wells and borings are necessary to both delineate vertical extent of sources and to help interpret data from the Lower Hawthorn Group.

5.0 FIELD INVESTIGATION ACTIVITIES

5.1 FIELD INVESTIGATIONS

As indicated above, there are two areas where additional data are needed: (1) down gradient and down dip of the DNAPL source areas along the top of the Upper Hawthorn Clay and (2) below the Upper Hawthorn Clay. Field activities to fill these data needs are discussed in this section.

In order to examine the lateral extent of DNAPL on top of the Upper Hawthorn Clay, direct push technology (i.e., Geoprobe®) will be used. Geoprobe® will be used to explore the Surficial Aquifer, and based on experience at other Florida locations, should be able to reach the 25-30 feet to the top of the Upper Hawthorn Clay. The Geoprobe® membrane interface probe (MIP) and soil conductivity (SC) system will be used. The soil conductivity provides rapid, real-time, detailed characterization of the stratigraphy, to ensure that the Upper Hawthorn Clay will not be unintentionally penetrated. The MIP will be used with both the photo-ionization detector (PID) and a flame-ionization detector (FID) to provide rapid, real-time detailed characterization of the creosote contamination. The advantages of direct push borings (DPB) include: (1) rapid stratigraphic logging, (2) rapid, depth-discrete soil sampling, (3) no drill cuttings, little investigation-derived waste (IDW), (4) minimally invasive and effective grouting and sealing, and (5) reduced potential for contaminant drag-down.

DPB will focus down gradient and down dip of and within each of the DNAPL source areas. Twenty-three proposed DPB locations are shown on Figure 5. These locations were selected primarily to define the DNAPL extent on top of the Upper Hawthorn Clay. The final locations of the DPB will be selected, in part, based on access (due to active facility) and the results of the surface geophysics (locating potential features in the top of clay). Surface geophysical surveys will be employed before the Geoprobe® to delineate the top of the clay and near-surface stratigraphy. An earlier pilot study indicated that electrical resistivity might be a useful tool to help delineate the extent of the DNAPL zones. Depending on the results from the initial DPB program (i.e., outer limit of DNAPL zone not

reached), additional DPB locations (moving away from the source area down dip on the clay) may be necessary to define the DNAPL zone on top of the clay.

In addition, up to three DPB locations at each source area will be selected for monitoring well locations to be completed in the Upper Hawthorn Group. These wells will be installed to investigate the vertical extent of DNAPL. The locations will be selected based on soil conductivity and MIP results. At these locations a separate DPB will be used to collect soil samples near the top of the Upper Hawthorn Clay to confirm the MIP results prior to drilling the wells. Direct-push soil sampling will follow ASTM D-6001. Soil samples will be analyzed for naphthalene and other semi-volatile organic compounds by analytical method EPA 8270.

In order to minimize the potential for DNAPL short-circuiting at the Upper Hawthorn Group wells, telescopic drilling will be conducted using multiple casings. The mud rotary drilling method will be used. A large-diameter isolation casing will be set and grouted into the Upper Hawthorn Clay. Subsequently, a smaller diameter boring will be extended into the Upper Hawthorn Group, where it will be screened and completed as a monitoring well. These wells will be screened in the lower portion of the Upper Hawthorn Group. Depending on the results of these Upper Hawthorn Group wells (i.e., DNAPL creosote is suspected to be deeper), it may be necessary to construct up to two Lower Hawthorn Group wells within each source area. The Lower Hawthorn Group wells also will be completed using telescopic casing (as shown in Figure 6). During drilling of all wells, continuous split-spoon soil samples will be examined by visual and odor methods for creosote. Well development and sampling and analysis will follow approved procedures described in the Site Sampling and Analysis Plan. Data collection and reporting will follow procedures used in previous fieldwork.

5.2 REPORTING

The information will be compiled into a technical memorandum summarizing the field investigations and results of testing. The memorandum will include updates to the key tables and figures presented in the Field Investigation Activities Report (TRC, 2002a).

5.3 PROJECT MANAGEMENT PLANS

The project management plans that will be utilized to guide the work outlined in this chapter include the following:

- Health and Safety Plan (HSP)
- Sampling and Analysis Plan (SAP)
- Quality Assurance Project Plan (QAPP)

The location and content of each of these is discussed briefly below.

A HSP and QAPP were prepared that incorporated the items listed below (TRC, 2002b; TRC, 2002c).

HSP

- Discussion of health and safety responsibilities.
- Hazard analysis.
- Personnel training requirements.
- Medical surveillance program.
- Site control procedures.
- Decontamination requirements.
- Safety procedures and emergency procedures.

QAPP

- Quality assurance (QA) objectives.
- Sampling procedures.
- Sampling custody.
- Analytical procedures.
- Calibration and controls and frequency.
- Data reduction validation and reporting.
- Quality Control (QC) procedures.
- Performance and system audits.

- Assessment procedures for data acceptability.
- Preventive maintenance.
- Corrective action.
- QA reports to management.
- SOPs for laboratory sampling control and custody.
- Data validation in analytical reports.
- Analysis for PCP

A SAP will be amended to accommodate new procedures needed for this fieldwork. The relevant SAP sections deal with:

- Collection procedures.
- Sampling procedures.
- Field measurement procedures.
- Sampling handling.
- Chain-of-Custody procedures.
- Field analytical procedures.
- Sample control.
- Sample analysis.

6.0 REFERENCES

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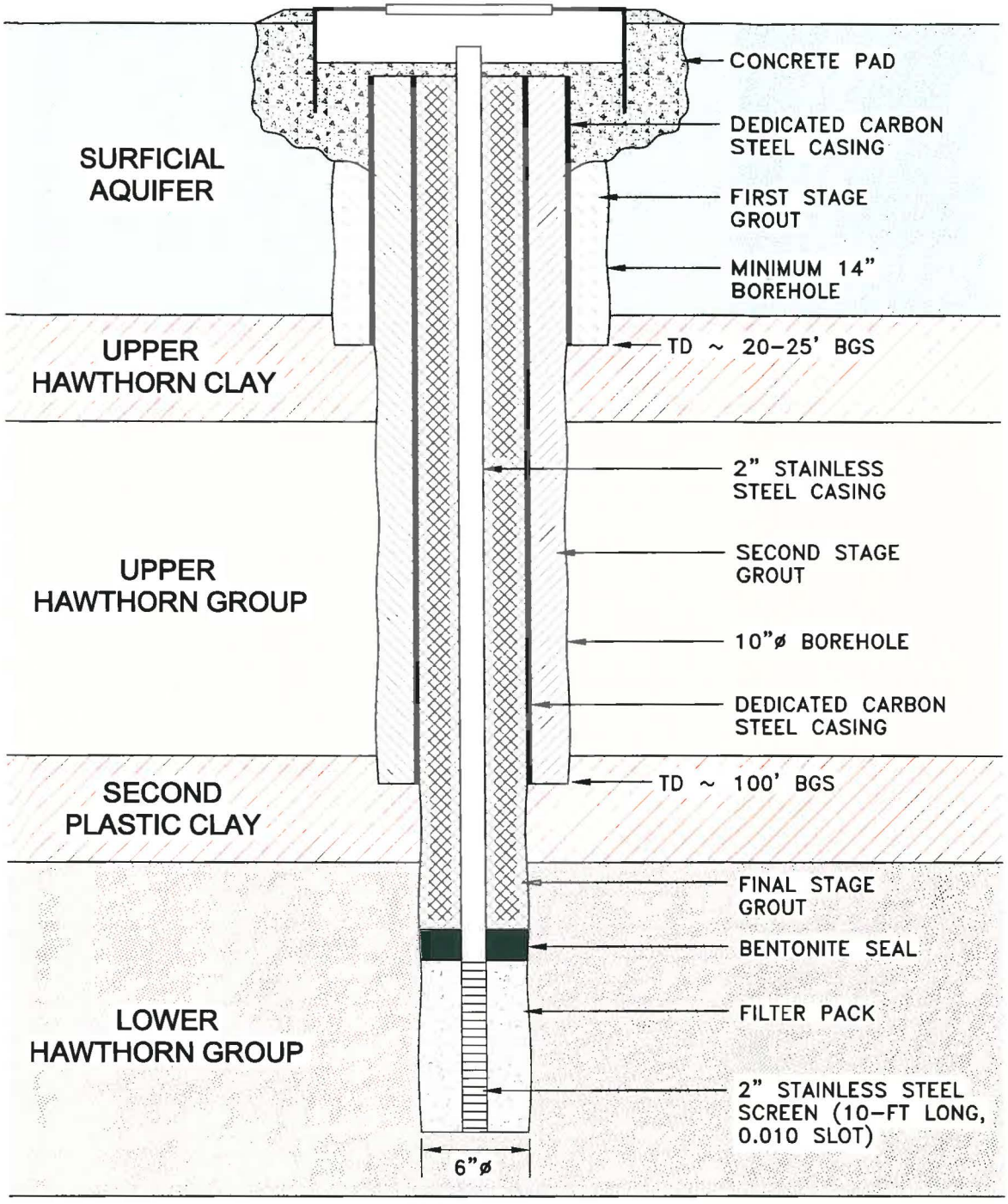
TRC, 2002a. Field Investigation Activities Report, Cabot Carbon/Koppers Superfund Site, Gainesville, FL, September 2002.

TRC, 2002b. Soil and Ground Water Sampling Plan and Health and Safety Plan. Cabot Carbon/Koppers Superfund Site, Gainesville, Florida. January 2002.

TRC, 2002c. Quality Assurance Project Plan for the Additional Characterization of the Hawthorn Group Formation Workplan. Cabot Carbon/Koppers Superfund Site, Gainesville, Florida. January 2002.

TRC, 2003. Addendum Hawthorn Group Field Investigation Report, Cabot Carbon/Koppers Superfund Site, Gainesville, FL, August 2003.

FLUSH MOUNT SURFACE COMPLETION



NOT TO SCALE

TITLE: WELL COMPLETION DIAGRAM SHOWING TELESCOPIC CASING TO HELP PREVENT SHORT CIRCUITING OF DNAPL TO LOWER LAYERS

LOCATION: Cabot Carbon/Koppers Superfund Site
Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JM
DRAFTED	CP
FILE	2201040012A.DWG
DATE	2-5-04

FIGURE: 6

GeoTrans, Inc.
A TETRA TECH COMPANY

46010 Manekin Plaza
Suite 100
Sterling, Virginia 20166

www.geotransinc.com

703-444-7000 FAX 703-444-1685

March 29, 2004

Mr. Maher Budeir, P.E.
Remedial Project Manager
Superfund Remedial and Technical Services Branch
U.S. Environmental Protection Agency, Region IV
61 Forsyth Street
Atlanta, Georgia 30303-3104

Subject: Response to U.S. EPA February 27, 2004 Letter with Comments on the "Fifth Addendum to the Workplan for Additional Investigation of the Hawthorn Group Formation DNAPL Source Evaluation for the Koppers Industries Property, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

Dear Mr. Budeir:

On behalf of Beazer East, Inc., GeoTrans would like to express our appreciation for the U.S. Environmental Protection Agency (EPA) detailed review of the February 9, 2004 workplan referenced above. Your review has identified some areas of the workplan that required additional explanation. Our specific response to each of EPA's comments and the proposed changes to the workplan are provided in Attachment A. An updated work plan will be provided when we have received comments from other parties. If you have any additional questions or comments, please call me at (703) 444-7000.

Sincerely,

James W. Mercer

James W. Mercer, Ph.D., P.G.
Executive Vice President
Principal Hydrogeologist

cc: William N. O'Steen (USEPA)
John Mousa (ACEPD)
Kelsey Helton (FDEP)
Brett Goodman, Bob McVay, David Richardson, Rick Hutton, Kim Zoltek (GRU)
John Herbert (JEA)
Mike Slenska (BEI)

in the Former Cooling Pond areas.

Response: The DNAPL entry areas were identified in previous investigations based upon several sources of information, including historical site use, historical aerial photography, and surface and subsurface characterization (test pits, soil borings and wells). The workplan provides figures with historical qualitative and quantitative data in both plan and section views to help define the DNAPL source areas at each of the previously identified creosote entry areas. It is not the intent of this DNAPL Evaluation Workplan to refine the "Entry Points" that have been identified in previous investigations. Rather, the goal of the workplan is to refine the lateral and vertical extent of DNAPL that has already entered the environment.

WP Changes: The second to last sentence on the last paragraph of page 8 will be modified to "The DNAPL entry area associated with the Former North Lagoon has been defined from previous investigations."

The last sentence in Section 3.2 will be modified to "For the Former South Lagoon, the DNAPL entry area was defined in previous site investigations, but the extent of the DNAPL zone on top of and below the Upper Hawthorn Clay is uncertain."

The last sentence in Section 3.2 will be modified to "For the Former Cooling Pond Areas, the DNAPL entry area was defined in previous site investigations, but the extent of the DNAPL zone on top of and below the Upper Hawthorn Clay is uncertain."

The last sentence in the second paragraph of Section 4.0 will be modified to read: "Preliminary results reinforce the conceptual model that DNAPL appears limited to areas near the DNAPL entry locations, as described in previous site investigations."

Comment #5: *On page 10, the text in the second complete paragraph begins "Monitor Well cluster M-21A and M-21BR is located within the DNAPL source area of the Former South Lagoon." Based on some of the concentration data, it is questionable whether or not this well cluster is actually in a DNAPL source area or is positioned slightly downgradient of the source area. The wording should probably be changed to state that the well cluster is within or immediately downgradient of the DNAPL source area.*

Response: Agree.

WP Changes: The referenced sentence on page 10 will be changed to "Monitor Well cluster M-21A and M-21BR is located within or immediately down gradient of the DNAPL source area of the Former South Lagoon."

Comment #6: *Unless there are absolutely no impacts that might attributable to the Koppers property, the text at the top of page 13, second to last paragraph of Section 3.3, should avoid terming M-29, M30A and M-31 as "background" wells.*

Response: Agree.

WP Changes: The first full paragraph at the top of page 13 will be changed to "Monitor Wells M-29, M-30A, B and M-31 are located from 40 to 80 feet up gradient from this DNAPL source area. These wells also are located up dip on the Upper Hawthorn Clay and up slope topographically from this DNAPL source area. Naphthalene concentrations of less than 5 µg/L have been detected in groundwater from these wells (McLaren/Hart, 1993), which are screened across the water table (with M-30B at the top of the Upper Hawthorn Clay)."

Comment #7: *Similar to comment 5, the identification of MW-15B as being located within the DNAPL source area of the Drip Track is questionable. There are no nearby soil data points available to confirm the presence of any DNAPL or creosote in the vicinity of this well. The text of the last paragraph on page 14 needs to be changed to state that this well is located within or somewhat downgradient of the Drip Track DNAPL source area.*

Response: Agree.

WP Changes: The referenced sentence on page 14 will be changed to "Monitor Well M-15B is located within or immediately down gradient of the DNAPL source area of the Drip Track at the top of the Upper Hawthorn Clay."

Comment #8: *In the first sentence of Section 4.0, the text states "the nature and extent of the four Site DNAPL source areas within shallow subsurface soil is thoroughly characterized by the existing data to a depth of approximately 12 feet below grade." I do not fully concur with this statement. For example, the color coding on the various cross sections through DNAPL source areas along with the text of the Addendum implies that the orange color zones represent DNAPL, or at least potential DNAPL areas.*

However, for many of these areas, there are no analytical data available, or the analytical data that are available conflict with the supposition that DNAPL is present.

The approximate DNAPL source areas appear to be divisible into three categories: (1) areas where there is clearly DNAPL present, (2) areas where there is probably (or more likely than not) DNAPL present, and (3) areas where there may be DNAPL present. For the latter two types of areas, there is a need for some further characterization before concluding that an area is or is not part of the DNAPL source area. For a number of those areas, samples could be obtained at shallower depths while advancing to depths closer to the base of the surficial aquifer, where the lateral extent of DNAPL has not been defined. For example, there is a proposal in the Addendum for some definition of the lateral extent of DNAPL contamination extending away from location SFS-B3 in the Former Cooling Pond area. Referring to Figure 4, there is an inferred 1,000 mg/Kg naphthalene contour extending for several tens of feet northeast of that boring; a 1,000 mg/Kg naphthalene concentration is taken as being potentially indicative of DNAPL contamination. Given that some type of visual/odor indicator of potential DNAPL contamination is present at SFS-B3 at a depth approximately 12 feet shallower than the apparent presence of confirmed DNAPL at SFS-B3, it makes sense to evaluate shallower soil northeast of that boring to determine if there is any DNAPL present at shallower depths in that area, when defining the lateral extent of the deeper DNAPL observed at SFS-B3.

Specific areas of potentially shallower DNAPL contamination that appear to need some type of confirmation sampling in order to be able to provide reasonable bounds on the lateral extent of DNAPL contamination cannot be fully defined based on the data presented in the Addendum. However, in general terms, such areas would include locations where (1) there are equivocal indicators of DNAPL without confirmatory soil analytical data and (2) areas where there are concerns about potential downgradient (or downdip) migration of deeper surficial aquifer DNAPL contamination where there is also some potential for shallower DNAPL contamination (such as the aforementioned area to the northeast of Former Cooling Pond area boring SFS-B3. The Addendum needs to include some proposed confirmatory shallower soil or surficial aquifer sampling in such areas.

Response: We agree that DNAPL source areas can be divided into four categories: (1)

areas where there is clearly DNAPL present, (2) areas where there is probably DNAPL present, (3) areas where there may be DNAPL present, and (4) areas where DNAPL is not present. However, it would be problematic to use historical qualitative and quantitative data to differentiate between cases (2) and (3), above. This classification would be highly subjective in many cases, and of limited use.

Unlike chlorinated solvents, creosote has can be identified visually. A trained geologist can determine the presence or absence of residual creosote in subsurface soil based upon physical examination and real-time headspace analysis with organic vapor analyzing instrumentation. The distinctive physical properties of creosote allow the investigator to refine further spatial investigation based upon real-time, observable information.

The use of MIP (or CPT/ ROST™) at this site is proposed to rapidly locate heavily impacted zones where free-phase and/or residual DNAPL are present. Analytical confirmatory sampling is not necessary for MIP (or CPT/ ROST™) correlations with observed creosote impacts. The workplan shall specify the collection of confirmatory soil core samples at several MIP (or CPT/ ROST™) locations to correlate MIP (or CPT/ ROST™) responses to both visible creosote-impacted soil and unimpacted soil.

The vast majority of the hundreds of analytical soil samples from the vicinity of the four identified source-areas were from soil horizons less than 12 feet deep. None of the boring logs indicate the presence of free-phase creosote NAPLs at these horizons. Nevertheless, as part of the workplan, the MIP (or CPT/ ROST™) technology will continuously characterize stratigraphy and creosote NAPLs in soils in real-time throughout the entire thickness of the Surficial Aquifer (below and above the water table).

The use of MIP was also proposed because it is generally more available than other technologies, such as the Rapid Optical Screening Tool (ROST™). We have now found a ROST™ system that is available during the time period that we will be performing the fieldwork. ROST™ combined with Cone Penetration Testing (CPT) can continuously characterize stratigraphy and creosote NAPLs in soils in real-time without collecting samples. Beazer has used CPT/ ROST™ successfully at similar creosote sites and ROST™ correlated well with visual observation of creosote in soil core. This technology uses a laser-induced fluorescence sensor deployed by CPT equipment to characterize the nature and extent of DNAPL creosote contamination in unconsolidated soils. In addition, ROST™ should have less of a problem with clogging sensors with creosote

than MIP. The same correlation program using visually characterized creosote-impacted and non-impacted soil cores that was proposed for the GeoProbe® w/ MIP workplan will be utilized for CPT/ ROST™.

Also, samples of aquifer material will be collected during probing and drilling. These samples will be collected at the base of the Surficial Aquifer and other locations where creosote is found (e.g., lower portion of the Upper Hawthorn Group. The samples will be analyzed by a geotechnical laboratory for grain size distribution, Unified Soil Classification System (USCS) designation, and Atterberg Limits. The purpose of the work is to characterize soils properties where active remediation may be necessary.

In addition, samples of creosote-impacted soil and groundwater will be collected for use in bench-scale tests. These bench-scale tests will focus on In-Situ Biogeochemical Stabilization (ISBS). ISBS is a remedial technology where potassium permanganate is injected as a means to destroy dissolved contaminants through oxidation and to contain DNAPL via precipitation of manganese dioxide that coats globules of creosote, reducing dissolution, and clogs pores, reducing permeability. This source remediation results in a reduced contaminant flux leaving the source area that can more easily naturally attenuate.

WP Changes: Modify the first sentence in Section 4.0 by removing "thoroughly."

Add the following paragraph that describes the soil confirmatory sampling procedure and response factor correlations with DNAPL on page 19: "Beside the first MIP (or CPT/ ROST™) boreholes (approximately 6 boreholes within and adjacent to DNAPL zones), additional DPB will be made with continuous core collected. The core will be visually examined for stratigraphy and the presence of creosote NAPLs. The use of MIP (or CPT/ ROST™) at this site is to identify and locate DNAPL-impacted zones. The confirmatory soil core samples with various extents of creosote contamination will be visually examined for creosote and correlated to the MIP (or CPT/ ROST™) results. Unlike chlorinated solvents, creosote has excellent visual characterization properties, and therefore we do not anticipate analytical sampling for real-time correlations. MIP (or CPT/ ROST™) confirmation will be based on visual observations of creosote NAPLs in soil cores."

The workplan also will be modified to include the additional work described above.

Comment #9: *Section 5.1 of the report proposes to use the membrane interface probe as*

a tool to evaluate DNAPL contamination in the deeper surficial aquifer. This technique is a screening tool that may not provide an adequate definitive indication of DNAPL presence. At the very least, it should be backed up by confirmatory sampling at enough locations sufficient to establish a correlation between definitive indications of creosote DNAPL presence and field results from the MIP investigations. While this confirmatory sampling approach may be a consequence of additional investigative work already described in Section 5.1 of the draft Addendum, the text of this section should explicitly state that because of the potential limitations to the MIP for definitively identifying DNAPL, there will be confirmatory sampling done to establish a correlation between MIP data and actual soil contaminant concentrations (which should provided definitive evidence of the presence or absence of DNAPL). Some additional text will probably then been (sic) needed in Section 5.1 to define how such confirmatory sampling will be accomplished.

Response: Agree.

WP Changes: See comment 8 response.

Comment #10: *Considering the relatively tight clustering of significant (i.e. probably indicative of DNAPL) naphthalene contamination in the x-y plane in parts of the Site where there is the most significant contamination (e.g. Former North Lagoon, comparison of SO-003 to SB-35 or comparison of SO-007 and SO-008 to SB-33) and the conceptual model as expressed in the second paragraph of Section 4.0 of the Addendum, the locations of some of the proposed DPB locations shown on Figure 5 appears to be somewhat too distant from identified DNAPL locations. Specifically, the following proposed locations appear to be somewhat too distant from areas of known or likely DNAPL contamination:*

- *In the Former South Lagoon area, the proposed DPB location slightly to the west of the SO-021 location needs to be moved somewhat closer to the area of fairly significant naphthalene contamination in the lowermost samples at SO-022 and SO-016. This would be roughly 50 or 60 feet to the south-southwest of the proposed location. This alternate location should be more useful for determining if there is any basal surficial aquifer DNAPL that is suggested by the 800 to 1,000 mg/Kg naphthalene concentrations in the middle part of the aquifer at SO-022 and SO-*

016.

- *In the Former South Lagoon area, the placement of a DPB location to the east-northeast of SB-07 seems to be slightly outside of the most critical area of interest. Figure 3 shows an SB-07 naphthalene concentration of 1300 mg/Kg. This boring location is not illustrated on the B-B• cross section, so it is not clear if there is enough naphthalene data showing significant contamination at SB-07 to justify placing the DPB location almost 50 feet away from that location. Soil borings 20 to 40 feet further away from SB-07 had no detections of naphthalene (no information on the sample depths at these locations is indicated on Figure 3). The inferred 1,000 mg/Kg naphthalene isoconcentration contour is somewhat closer to SB-07. Given these observations, it seems that the DPB location should be 15 to 20 feet closer to SB-07 than the proposed location.*

- *In the Former South Lagoon area, there is a proposed DPB location near SB-08. SB-08 had some indication of DNAPL from the surface to the base of the surficial aquifer, but according to the map view on Figure 3, the maximum naphthalene concentration at this boring was only 2.1 mg/Kg. The proposed DPB location is also outside the inferred 100 mg/Kg naphthalene isoconcentration contour. Considering these observations, it seems that unless there is a strong case to be made that the evidence of DNAPL at SB-08 is compelling, the proposed DPB location should be moved westward a few tens of feet, closer to the part of the Former South Lagoon area where there is confirmed significant DNAPL present.*

- *In the Former Cooling Pond Area, the two locations that are outside the inferred 1,000 mg/Kg naphthalene contour extending to the northeast of SFS-B3 might be moved to a point in the area from the 1,000 mg/Kg approximated contour to 10 to 20 feet inside that contour.*

- *Given the relatively low concentration of naphthalene at TP-13 and the apparently very linear distribution of contamination along the drip track area, the proposed DPB location to the north of TP-13 should probably be shifted slightly westward.*

Response: The sample locations shown are preliminary and were provided to give the approximate number and location of DPB. As stated in the workplan:

The final locations of the DPB will be selected, in part, based on access (due to active facility) and the results of the surface geophysics (locating potential features in the top of clay). Surface geophysical surveys will be employed before the Geoprobe® to delineate the top of the clay and near-surface stratigraphy. An earlier pilot study indicated that electrical resistivity might be a useful tool to help delineate the extent of the DNAPL zones. Depending on the results from the initial DPB program (i.e., outer limit of DNAPL zone not reached), additional DPB locations (moving away from the source area down dip on the clay) may be necessary to define the DNAPL zone on top of the clay

As part of the process of determining the final locations of DPB, given the constraints listed above, we also will consider your comments.

WP Changes: We will add log of SB-07 to the section in Figure 3.

Comment #11: *In the Former North Lagoon area, there needs to be a DPB location of the area between SB-38 and SFS-B4. Figure 2 shows something of an inlier to the 1,000 mg/Kg naphthalene concentration contour, suggesting that DNAPL may not be present between SB-38 and SFS-B4. However, at those two locations, there is both confirmed DNAPL and significant naphthalene concentrations at multiple sample depths. Therefore, some definition of the potential for DNAPL to be present between these two points is needed. The suggested location is equidistant and directly between SB-38 and SFS-B4.*

Response: Agree.

WP Changes: The proposed location shall be added to Figure 2.

Comment #12: *In the drip track area, there should probably be one additional DPB location near SB-58. The deepest sample from this location had a naphthalene concentration of 780 mg/Kg. Given the overall conceptual model for the Site, there is a potential for more significant naphthalene contamination (i.e. DNAPL) to be present deeper in the surficial aquifer materials at this location.*

Response: Agree.

presence of creosote. If no DNAPL is observed immediately below the Upper Hawthorn Clay, then it may be concluded that DNAPL did not penetrate the clay at this location. If creosote penetrated the clay up gradient of this location, then an elevated PID/FID response is expected and will be used to help site the next well up gradient. However, because creosote may have penetrated the clay at other locations, we want to target the most likely zone where DNAPL may have accumulated, which is the lower part of the Upper Hawthorn Group on top of the next clay layer. Therefore, we will continue drilling to the lower part of the Upper Hawthorn Group. If DNAPL is present there based on visual examination of the split-spoon soil sample, then the well will be completed in the lower portion of the Upper Hawthorn Group. If no DNAPL is observed there, then the borehole will be back filled and the well completed in the upper portion of the Upper Hawthorn Group. Lower Hawthorn Group wells only will be drilled if DNAPL is observed in the lower portion of the Upper Hawthorn Group. The logic for well completion in the Lower Hawthorn Group will be the same as that just described for the Upper Hawthorn Group.

WP Changes: The workplan will be modified to include the above logic.