EXPLANATION OF SIGNIFICANT DIFFERENCES

(ESD)

KOPPERS SUPERFUND SITE

MORRISVILLE, NORTH CAROLINA

August 2012

U.S Environmental Protection Agency
Region 4

10903413

KOPPERS SUPERFUND SITE

EXPLANATION OF SIGNIFICANT DIFFERENCES

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I. INTRODUCTION

A. Site Name and Location

Site Name: Koppers Superfund Site (Site)

Site Location: Morrisville, North Carolina

B. Lead and Support Agencies

Lead Agency: United States Environmental Protection Agency (EPA)

Support Agency: North Carolina Department of Environment and Natural Resources (NCDENR)

C. Legal Authority

Under Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §9617(c), Section 300.435(c) of the National Contingency Plan (NCP), 40 C.F.R § 300.435(c)(2)(1), if the EPA determines that differences in the remedial action significantly change but do not fundamentally alter the remedy selected in the Record of Decision (ROD) with respect to scope, performance, or cost, EPA shall publish an Explanation of Significant Differences (ESD). The ESD shall explain the differences between the remedial action being undertaken and the remedial action set forth in the ROD and the reasons for such changes. The remedy remains protective and continues to meet Applicable or Relevant and Appropriate Requirements under Sections 300.430(f)(1)(ii)(B)(1) and (2).

D. Summary of Circumstances Necessitating this Explanation of Significant Differences

This ESD is being written to address modifications and enhancements to the remedy in the ROD signed on December 23, 1992.

1. Groundwater

EPA is changing the implementation of the groundwater remedy for the Site. The selected groundwater remedy of extraction with treatment by granular activated carbon was implemented in 1997 with extraction occurring at well PW-1. The ROD identified Contaminants of Concern (COCs) for groundwater at the Site including pentachlorophenol (PCP), polychlorinated dibenz-p-dioxins and dibenzofurans (PCDDs/PCDFs) and 2,4-dichlorophenol. Since implementation of the groundwater remedy, sampling shows that PCDDs/PCDFs and 2,4-dichlorophenol levels do not exceed cleanup levels. In 1996, prior to remedy implementation the concentration of the pentachlorophenol plume ranged from less than 1 microgram per liter (ug/L) to 3500 ug/L. Sampling data shows a decrease to a range of less than 1 ug/l to 100 ug/l in 2010. The cleanup level for pentachlorophenol is 1 ug/L. Review of the Site groundwater data indicates that while the pentachlorophenol plume is stable, the current levels of the

groundwater contamination appear to be at a steady state, and the extraction system is unable to significantly reduce the residual site plume and meet cleanup levels.
A Pilot Test was performed from June 28 to July 2, 2010, which implemented in-situ chemical oxidation (ISCO) by injecting persulfate solution into groundwater wells onsite to determine whether the current system could be enhanced to further reduce groundwater contamination levels. The assessment of the ISCO event indicated that the Pilot Test reduced the residual pentachlorophenol plume to below cleanup levels. This ESD amends the groundwater remedy by adding ISCO to accelerate the remediation of residual pentachlorophenol plume.

2. Soils

In addition to modifying the groundwater remedy, EPA is changing the soil remedy for the Site. The selected soil remedy of excavation and off-site incineration was implemented in 1995; approximately 790 tons of soil was transported to an off-site permitted incineration facility. During implementation of the ISCO Pilot Test, a residual source area of pentachlorophenol in surface soil was identified at three of the injection well points. The cuttings generated from the installation of injection wells were segregated, and characterization of these cuttings indicated a pentachlorophenol concentration of 44 milligrams per kilogram. The upper five feet of soil in this area (roughly 50 feet by 30 feet) were impacted. As a result EPA determined that this additional residual source of pentachlorophenol needs to be remediated by blending base-catalyzed sodium persulfate into the upper five feet of soil in the vicinity of the three temporary well points.

3. Institutional Controls

The original ROD does not include institutional controls (ICs) on access and use of groundwater. The groundwater plume is primarily contained within the boundaries of the Site and the cleanup levels have been achieved at most areas of the site. However, until the cleanup levels and remedial action objectives are achieved, ICs are required for the Site. This ESD also includes ICs as part of the groundwater remedy and IC's here may include placing a "Notice of Contaminated Site" future use restriction on the Site in accordance with North Carolina state law.

4. Applicable or Relevant and Appropriate Requirements (ARARs)

Section 9.6 of the ROD originally stated that, because North Carolina Well Construction Regulations at 15A NCAC 2C apply to injection wells, they were therefore not applicable to the Site. The ROD stated, however, that those regulations are relevant and appropriate to the construction of the additional groundwater monitoring wells to be installed at the Site. Because this ESD adds ISCO to the groundwater remedy, certain North Carolina Well Construction Regulations at 15A NCAC 2C pertaining to the installation of in-situ groundwater remediation wells are applicable to the modified groundwater remedy. The Supplemental Action- and Location-Specific ARARs for the modified remedy are included in Tables 4 and 5 of this ESD. The remaining regulations identified in Section 9.6 of the ROD continue to be ARARs for the Site, and, as required by CERCLA

Section 121(d)(2), the remedy at the Site, including the modifications outlined in this ESD, must attain such ARARs.

E. Availability of Documents

This 2012 ESD and supporting documents shall become part of the Administrative Record for the Site. The Administrative Record, including its index, is available to the public and may be reviewed at the following locations. The ESD will become part of the Administrative Record file (NCP 300.825(a) (2)).

Information Repository

West Regional Library
4000 Louis Stephens Drive
Cary, North Carolina 27519
(910) 655-4145

EPA Region 4 Office

U.S. EPA
61 Forsyth Street
Atlanta, Georgia 30303
(404) 562-8816

II. SUMMARY OF SITE HISTORY

The Koppers Co. Inc. (Morrisville Plant) Site was an active lumberyard which treated wood from 1968 to 1975 in Wake County, North Carolina, approximately 1 mile northwest of the Morrisville Town Hall along North Carolina State Route 54. The original site was approximately 52 acres bounded on the south/southeast by McCrimmon Parkway (formerly Koppers Road), the west by Church Street, the north by a home site with open fields, and the east/northeast by a Norfolk Southern Railroad right-of-way. A site location map is presented as Figure 1, illustrating remedial site conditions.

The Site consisted of four separate and distinct areas. The original 52 acres is characterized as two separate areas: the Unit Structures, Inc. property and the Beazer East, Inc. property on the western and eastern portion of the original Site respectively. The Unit Structures, Inc. property is approximately 33 acres and operates as a wood processing facility. In September 1997, the EPA approved a partial deletion of the Unit Structures, Inc. property from the NPL.

The Beazer East, Inc. property is approximately 16.6 acres and consisted of a wood preserving process area, two lagoons which received wastewater from the process area, and a 3 acre man-made Fire Pond. The former process area now consists of a grassy area with no structures. The Fire Pond was filled as a result of the remedial action (Figure 3). Afterwards, it was graded to promote drainage and vegetated with native trees and shrubs. The majority of the Site is currently fenced with gates at two vehicular access points entering the adjacent Unit Structures property.

The third area associated with the Site was the Medlin Pond. This area was approximately 4.6 acres and accepted drainage from the outflow of the former Fire Pond. The Medlin Pond was filled as a result of the remedial action. Similar to the Fire Pond, the backfilled area was graded to promote drainage and vegetation. Drainage from the

Medlin Pond was to the southeast approximately 1 ¾ mile south to Crabtree Creek, which flows through Crabtree Lake and into the Neuse River.

The final location associated with the Site was the 4.5 acre Seagondollar area. This area was located approximately 2.5 miles to the west of the rest of the Site and was part of the wetland mitigation portion of the remedial action. Through a conservation easement Beazer East utilized the site for wetland mitigation. Drainage from the Seagondollar area flows to the north-northwest approximately 2 miles along an intermittent stream into Kit Creek. Kit Creek flows into Northeast Creek which ultimately flow into B. Everett Jordan Lake.

In 1986, Beazer and the NCDENR began investigation of the groundwater and sampled off-site private residential wells. Based on the results of this investigation, Beazer began providing bottled water to all residents whose wells showed detectable amounts of PCP in September 1988. The results of the investigation were used in the development of the Hazard Ranking System (HRS) package. The Site was proposed for the National Priority List on June 24, 1988, and finalized on March 31, 1989.

In March 1989, the EPA and Beazer signed an Administrative Order on Consent (AOC) to allow Beazer to conduct the Remedial Investigation (RI) and Feasibility Study (FS). In May 1989, Beazer began installing public water lines to the affected area under an AOC. Beazer provided bottled water to some residences which did not connect to the water line extension. The EPA approved the RI/FS in September 1992 and the ROD was signed on December 23, 1992.

III. Description of the Remedy

The Proposed Plan identified both a primary remedy and a contingency remedy for contaminated soils. The contingency remedy was excavation of contaminated soils and on-site treatment by base-catalyzed dechlorination (BCD). Because the community preferred BCD, the EPA delayed selection of the remedy until completion of a treatability study for BCD. The BCD pilot study was conducted in August 1993, results were inconclusive, and the contingency remedy was eliminated from further consideration. Therefore, the primary remedy, excavation of contaminated soils and off-site incineration was implemented at the site. The major components of the selected remedy for contaminated soils selected in the ROD include:

1. Excavate contaminated soils from the lagoon and process areas on-site to meet cleanup standards, which was 95 milligrams/kilogram (mg/kg) or parts per million (ppm) for soils contaminated with PCP and 7.0 micrograms/kilogram (µg/kg) or parts per billion (ppb) for soils contaminated with PCDDs/PCDFs;

2. Transport soils to an off-site permitted incineration facility;

3. Backfill of excavated areas with clean fill; and

4. Regrade and revegetate the excavated areas.

The major components of the groundwater remedy selected in the ROD include:

1. Extract contaminated groundwater from within the plume via extraction well(s) to an onsite, aboveground treatment unit;
2. Treat extracted groundwater through a primary carbon adsorption unit and secondary carbon-polishing unit;

3. Discharge effluent to the surface water in accordance with National Pollutant Discharge Elimination System (NPDES) requirements; and

4. Further delineate the horizontal and vertical extent of groundwater contamination.

5. Groundwater cleanup levels were identified as 1 ppb for PCP and 2.2 x 10-7 ppb for PCDDs/PCDFs. Because the cleanup level for PCDD/PCDF was below the practical quantitation limit (PQL), the cleanup level was selected as 3 x 10-7 ppb.

The major components of the surface water remedy selected in the ROD include:

1. Dewater the Fire and Medlin Ponds;
2. Treat the surface water by carbon adsorption;
3. Discharge effluent to the surface water in accordance with NPDES requirements;
4. Backfill the ponds with clean fill;
5. Regrade and implement drainage control in the pond areas; and
6. Conduct wetland mitigation due to the loss of wetlands.

IV. BASIS FOR THE 2012 ESD

Persulfate is a strong oxidant that has been widely used for initiating emulsion polymerization reactions, clarifying swimming pools, hair bleaching, micro-etching of copper printed circuit boards, and total organic carbon (TOC) analysis. Among all the persulfate salts typically manufactured (sodium, potassium and ammonium salts), the sodium form is commonly used for environmental applications in the last few years. Sodium persulfate has the potential to destruct in-situ chlorinated and non-chlorinated organic compounds commonly encountered in both soil and groundwater. The persulfate anion is one of the strongest oxidants used in remediation.

Persulfate is known to be highly reactive at acidic conditions, but it is also highly reactive at pH values greater than 10. It is thus possible to "activate" persulfate by creating an alkaline condition. A laboratory study showed that alkaline activated persulfate has a broad reactivity, and that it is effective even on some historically difficult to destroy compounds, such as chlorinated ethanes and methanes. The alkaline activation of persulfate appears to be possible with a number of different bases, including potassium hydroxide, sodium hydroxide, and lime. The alkaline-activated persulfate oxidation of contaminants is not just a matter of high pH, but also of the buffering capacity (mole ratio of pH modifier to persulfate). It is essential to have sufficient base supply (excess buffering capacity) in application of the alkaline-persulfate activator technology.

The Pilot Test at the Koppers Site was performed from June 28 to July 2, 2010, and included injecting persulfate solution into well C-14A and at nine locations in the vicinity of well C-14A, in accordance with Injection Permit WI0500155. The area targeted by the persulfate injection was approximately 200 feet by 100 feet, as shown on Figure 2. The topography of this area was relatively flat, and elevations of the injection locations were not measured. The Geoprobe rig was refused at several locations, therefore, solid stem augers were used to install 1-inch diameter temporary injection wells.

Sodium persulfate solution at a concentration of 18.6% by weight was injected into the wells. The injectant was diluted using municipal water. Sodium hydroxide was used as a base to catalyze the persulfate. The injection solution was determined based on the anticipation that the radius of influence at each injection location would be approximately 15 feet and the vertical interval receiving the injectate would be approximately 5 feet. The average total oxidant demand (TOD) in this area ranged from 1 to 3 grams oxidant per kilogram of soil. The injection flow rate ranged from approximately 2 to 15 gpm at a pressure ranging from 25 to 60 pounds per square inch using air powered diaphragm pumps.

The injection solution was prepared in the field by filling 500 gallons of water in a 550-gallon capacity tank. Approximately 17.25 bags of persulfate were added followed by approximately 14 gallons of sodium hydroxide. A motorized mixing wand was used to homogenize the injectate. A total of 7,200 gallons of sodium persulfate solution were injected into the nine temporary injection wells and well C-14A. The amount of solution injected into each well varied from 525 gallons in IW-6 to 1,300 gallons in C-14A. A summary of injection field data is provided in Table 1.

Extraction at well PW-1 resumed at approximately 1.5 gpm on July 14, 2010, following collection of the week two post-treatment groundwater samples. Water elevations at selected Site wells continued to be measured after extraction at PW-1 resumed. Groundwater samples were collected at intervals of two weeks, six weeks, ten weeks, and then six months following the treatment. The pentachlorophenol concentrations in well C-14A had ranged from 19 to 100 ug/L approximately twelve months before the injections. Pentachlorophenol was not detected above 1 ug/L since the injection event. The pentachlorophenol concentrations detected at wells C-14B and C-29B prior to the injection appeared to have remained relatively unchanged since the injection event. The pentachlorophenol concentrations detected at extraction well PW-1 varied from 2.5 to 29 ug/L prior to the injections; post-injection pentachlorophenol concentrations remained below 2 ug/L for the first six months, but the pentachlorophenol concentration in the February 2011 sample (collected approximately eight months after the injection) was 3.4 ug/L and in the April 2011 sample was 3.2 ug/L. The analytical results are presented in Table 2. Field parameters collected during the sampling events are presented in Table 3. Effectiveness monitoring was also conducted to assess whether:

- The field parameters indicated evidence of oxidation;
- The sodium persulfate remained active in the wells;
- The pentachlorophenol concentrations decreased; and
- Metals mobilized as a result of the injections.

Increases in specific conductance and oxidation reduction potential (ORP) indicated that oxidation due to the ISCO injection was occurring in groundwater. Wells C-14A, C-29B and PW-1 all exhibited significant increases of both specific conductance and ORP values, effective immediately after the injection and continuing at least for ten weeks after the injection. The sodium persulfate appeared to have remained active in wells C-14A and PW-1 for at least six weeks following the injection, based on the detections of this compound.

RCRA-8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) were analyzed from groundwater samples collected post-injection, in accordance with the Injection Permit, to help assess whether the injection mobilized metals in groundwater. It appeared that chromium concentrations at C-14A increased temporarily at two and six weeks after the injection, however, chromium concentrations appeared to have returned to pre-injection levels at this well. Corresponding increases in chromium concentrations was not observed in extraction well PW-1. Mercury concentrations detected in C-14A increased slightly since the injections; the concentrations exceeded the EPA maximum contaminant level (MCL) of 2 ug/L and the North Carolina groundwater standard of 1 ug/L. Mercury concentrations at PW-1 exceeded the MCL and North Carolina standard in the August and September 2010 samples, but the detected concentrations were below the groundwater standard in the subsequent three samples. Arsenic concentrations remained below the EPA MCL and North Carolina groundwater standard of 10 ug/L at all wells, with the exception of the August 2010 sample at well PW-1, where 15.1 ug/L arsenic were detected. The arsenic detections in the subsequent four samples from PW-1 were either below the standard of 10 ug/L or below reporting limits. Lead concentrations were below the groundwater standard (both EPA and North Carolina) of 15 ug/L, with the exception of the August 2010 sample from C-14A and the exception of the August and December 2010 samples from PW-1. The assessment of the ISCO event indicated that the Pilot Test reduced the residual pentachlorophenol plume.

The Applicable or Relevant and Appropriate Requirements (ARARs) identified in the ROD should be modified to include as applicable citations to State groundwater injection well regulations, in order to satisfy the stated Remedial Action Objective (RAO) to return the groundwater to safe drinking water levels.

V. DESCRIPTION OF SIGNIFICANT DIFFERENCES

The EPA is making four changes to the ROD. The first change consists of including ISCO to assist the current remedy to achieve remedial action objectives and cleanup levels for groundwater in particular pentachlorophenol. Review of the Site groundwater data indicates that while the pentachlorophenol plume is stable, the current levels of the groundwater contamination appear to be at a steady state and the extraction system is unable to significantly reduce the residual site plume and meet cleanup levels. Potentiometric (Figures 4 & 5) and isoconcentration maps (Figures 6 & 7) indicates that the groundwater extraction system captured the pentachlorophenol plume. The concentration of the pentachlorophenol plume ranged from less than 1 microgram per liter (ug/L) to 3,500 ug/L in 1996 and decreased to a range of <1 ug/L to 100 ug/L by February 2010. The groundwater extraction system operates at approximately 1.5 gpm. The extraction well is completed in fractured bedrock (30 to 49 feet bgs) and the current

pumping rate represents the maximum sustainable pumping rate for the bedrock formation. Groundwater extraction and treatment is required to continue until remedial goals are met.

The second change affects remediation of the residual source area. A residual source area of pentachlorophenol in surface soil was identified at three injection well points during implementation of the Pilot Test. The cuttings generated from installation of these injection points were segregated and characterization of these cuttings indicated a pentachlorophenol concentration of 44 milligrams per kilogram. The upper five feet of soil in this area (roughly 50 feet by 30 feet) was found to be contaminated. This is approximately 7,500 cubic feet of contaminated soil.

This ESD modifies the soil remedy in the ROD to add remediation of this residual source of pentachlorophenol by blending base-catalyzed sodium persulfate into the upper five-feet of soil in the vicinity of the three temporary well points. The target depth is ground surface to five-feet below surface (Figure 2). The mixing ratio of soil to persulfate will be at a ratio of one kilogram of soil to ten grams of persulfate. The chemical dosing rate is based on the local injection contractor's experience both with soil blending and with the apparent oxidant demand of local soils. The large majority of the oxidant demand is generally the reduced minerals or natural organic carbon of the solids and only a small portion of the demand is driven by the contaminant. The oxidant demand for several local soils tested by the local injection contractor has been low (~2-3 g/Kg or less). The higher chemical dose rate of 10 grams persulfate per one kilogram of soil provides a conservative safety margin and will enable some persulfate rinsing through the soil column below the blending depths. This ratio will provide enough oxidant to account for both the background oxygen demand and the residual pentachlorophenol in the shallow soil. Composite soil samples will be collected from three locations within the treatment area prior to the persulfate blending. The sample locations will be in the vicinity of the injection well points.

Each composite sample will consist of two distinct depths at a given location. The depths will be between 0.5-feet to 5-feet below ground surface. The sample will be field composited. The X-Y coordinates of each sample location will be documented. Post-blending composite samples will be collected at the same locations and consist of the same two depth intervals. The pre- and post-blending soil samples will be analyzed for pentachlorophenol, sulfate, sodium persulfate and RCRA-8 metals to assess the effectiveness of the soil blending.

In addition to the pre- and post-blending soil sampling and analysis, an assessment of the soil blending will also include reviewing the results of the three semiannual groundwater sampling events that follow the soil blending, which will include wells C-14A, C-14B, C-29B and PW-1. The analyses for these wells will include pentachlorophenol and RCRA-8 metals as well as field parameters of dissolved oxygen (DO) and ORP.

The third change to the ROD will document a final decision to implement institutional controls as part of the groundwater remedy for the Site. The groundwater plume is primarily contained within the Site boundaries, and the cleanup levels have been achieved at most areas of the Site. Institutional controls must be implemented at the Site, however, because the remedial action resulted in hazardous substances, pollutants, or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure to groundwater. The remedial action

provided in the ROD does not include institutional controls for groundwater. As a result, an explanation of significant differences is needed to implement institutional controls in the form of in the form of restrictive covenants, ordinances, or other enforceable instruments as part of the groundwater remedy for the Site.

Finally, Tables 4 and 5 of this ESD presents the supplemental ARARs that are to be appended to Section 9.6 of the ROD.

VI. SUPPORTING AGENCY COMMENTS

The NCDENR has participated with the EPA in reviewing the Initial Assessment Implementing the Pilot Test Work Plan prepared by Beazer East on May 20, 2011 and a Final Assessment dated October 3, 2011. NCDENR has also participated with EPA in developing this ESD and concurs with the changes. See Appendix A for the NCDENR concurrence letter.

VII. STATUTORY DETERMINATIONS

The EPA has determined that the remedy selected in the ROD and the revised remedy described in this ESD are protective of human health and the environment, comply with Federal and State requirements that are applicable or relevant and appropriate to this remedial action and are cost-effective. In addition, the revised remedy utilizes permanent solutions and resource recovery technologies to the maximum extent practicable for this Site.

VIII. PUBLIC PARTICIPATION COMPLIANCE

This ESD and supporting information are available for public review at the locations identified within this document. In addition, a notice of availability of the ESD will be provided to a local newspaper of general circulation.

IX. DECLARATION

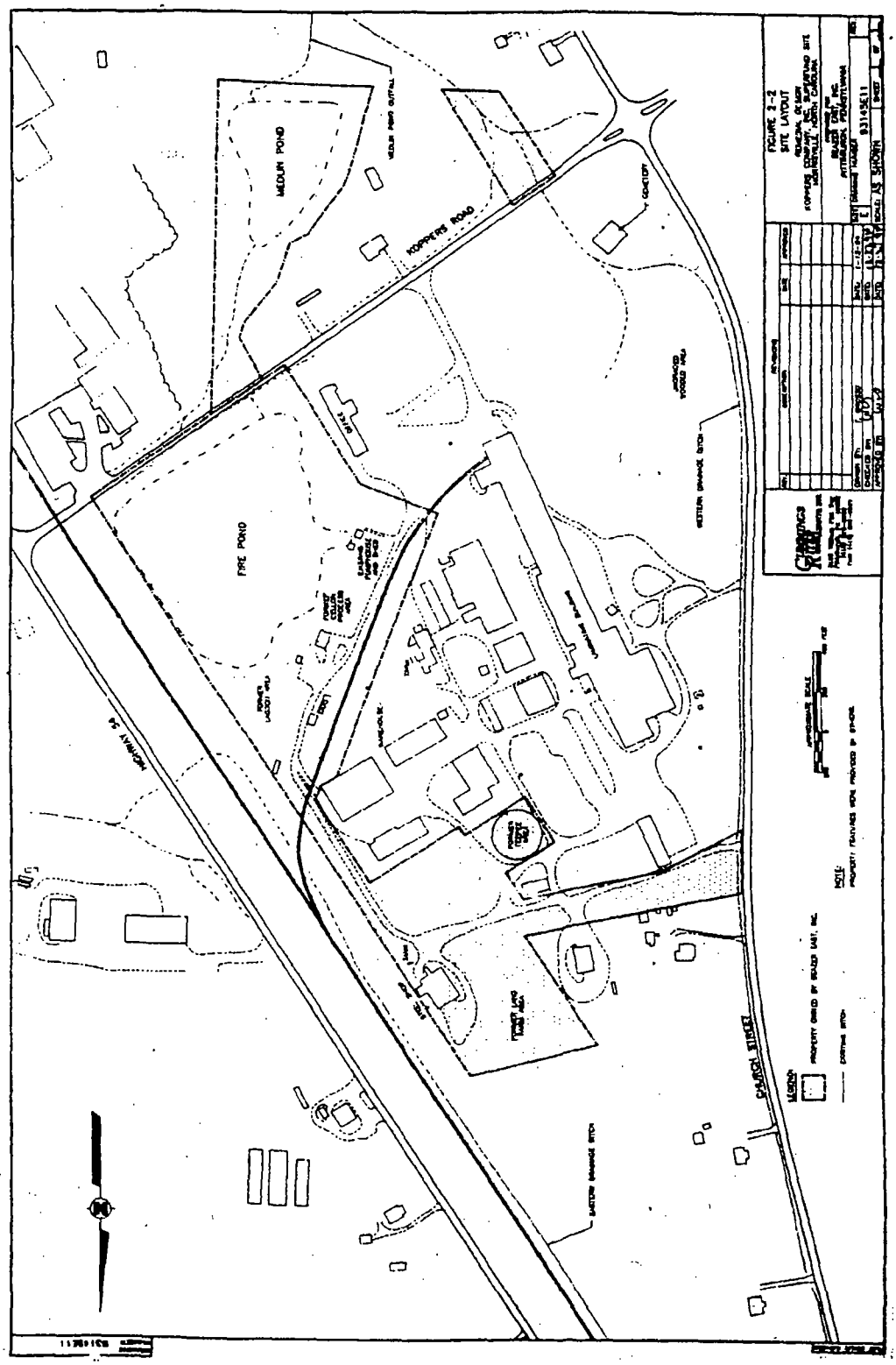
For the foregoing reasons, by my signature below, I approve the issuance of this August 2012 Explanation of Significant Differences for the Koppers Superfund Site located in Morrisville, North Carolina and the changes and conclusions stated therein.

Franklin E. Hill, Director
Superfund Division

Figures

Figure 1 Site Map

(Source: Final Design Report, Volume I of III, Soil, Groundwater and Surface Water Remediation, Koppers Company, Inc. Superfund Site, Morrisville, North Carolina, (December 28, 1994), Cummings/Riter Consultants, Inc.)



P:\PROJECTS\BEAZER\Raleigh\Figure 1 – IW Locations.ppt

Former Lagoon and Process Area Excavation Locations

LEGEND:
MONITORING WELL
PUMPING WELL
RAILROAD TRACKS
FENCELINE
DRAINAGE/STREAM
PROPERTY BOUNDARY - BEAZER EAST, INC.
PROPERTY BOUNDARY - UNIT STRUCTURES INC.
PROPERTY BOUNDARY - UNKNOWN
200 0 400
SCALE: 1"=400'

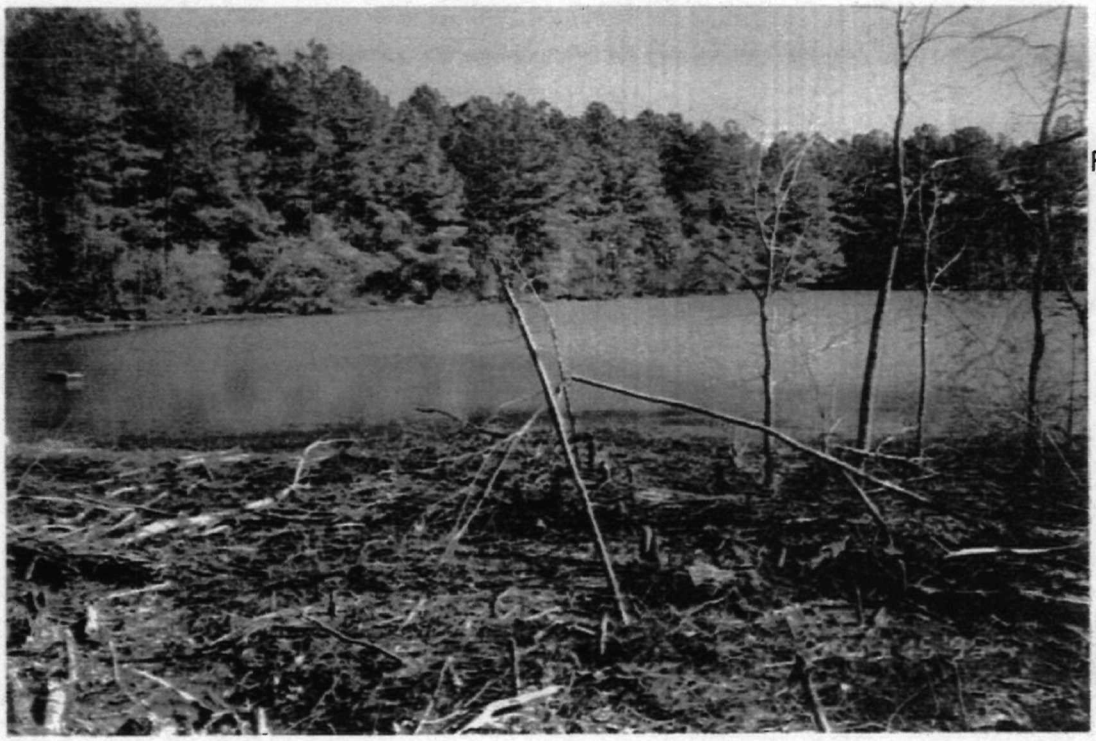
TITLE: Location of Pilot Study Temporary Injection Wells

LOCATION: Former Koppers Co. Raleigh
Morrisville, North Carolina

TETRA TECH GEO

CHECKED	JA	FIGURE
DRAFTED	GK	
FILE	FIGURE 1.IDW	2
DATE	9/20/2010	

Featured below are "before" and "after" pictures of the Site.



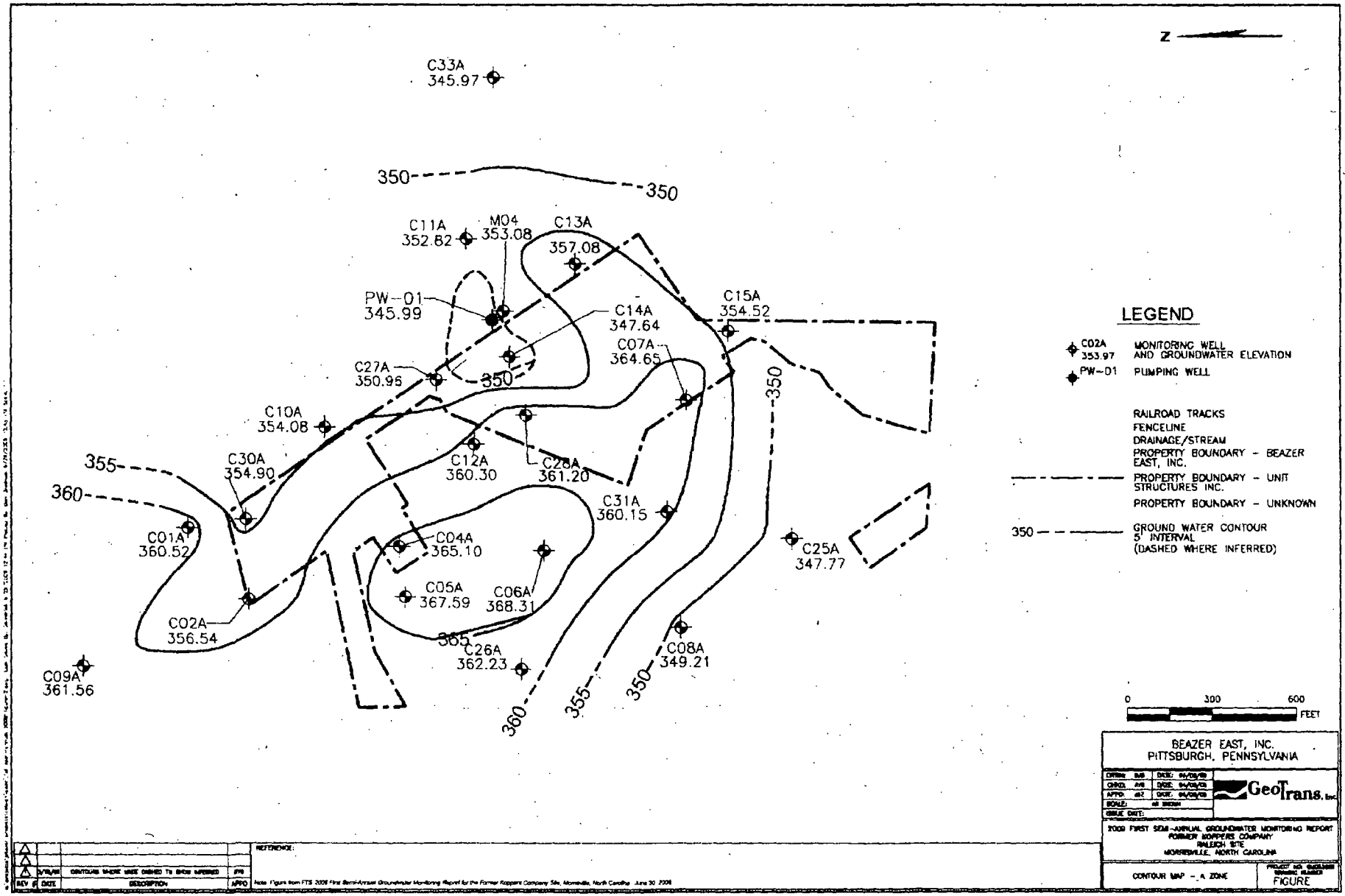
Fire Pond Before Remediation

Figure 3

Fire Pond After Remediation

Need More Information? Please call EPA 's toll free number 1-800-435-9233 if you have questions or want more information about this Site. Contact Beverly Hudson, EPA Project Manager, or Diane Barrett, Community Relations Coordinator.

Copies of documents developed during the Superfund process are housed in the Wake County Public Library, Cary Branch, 310 South Academy Street, Cary, North Carolina, (910) 460-3350.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M04
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PW-01
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C15A
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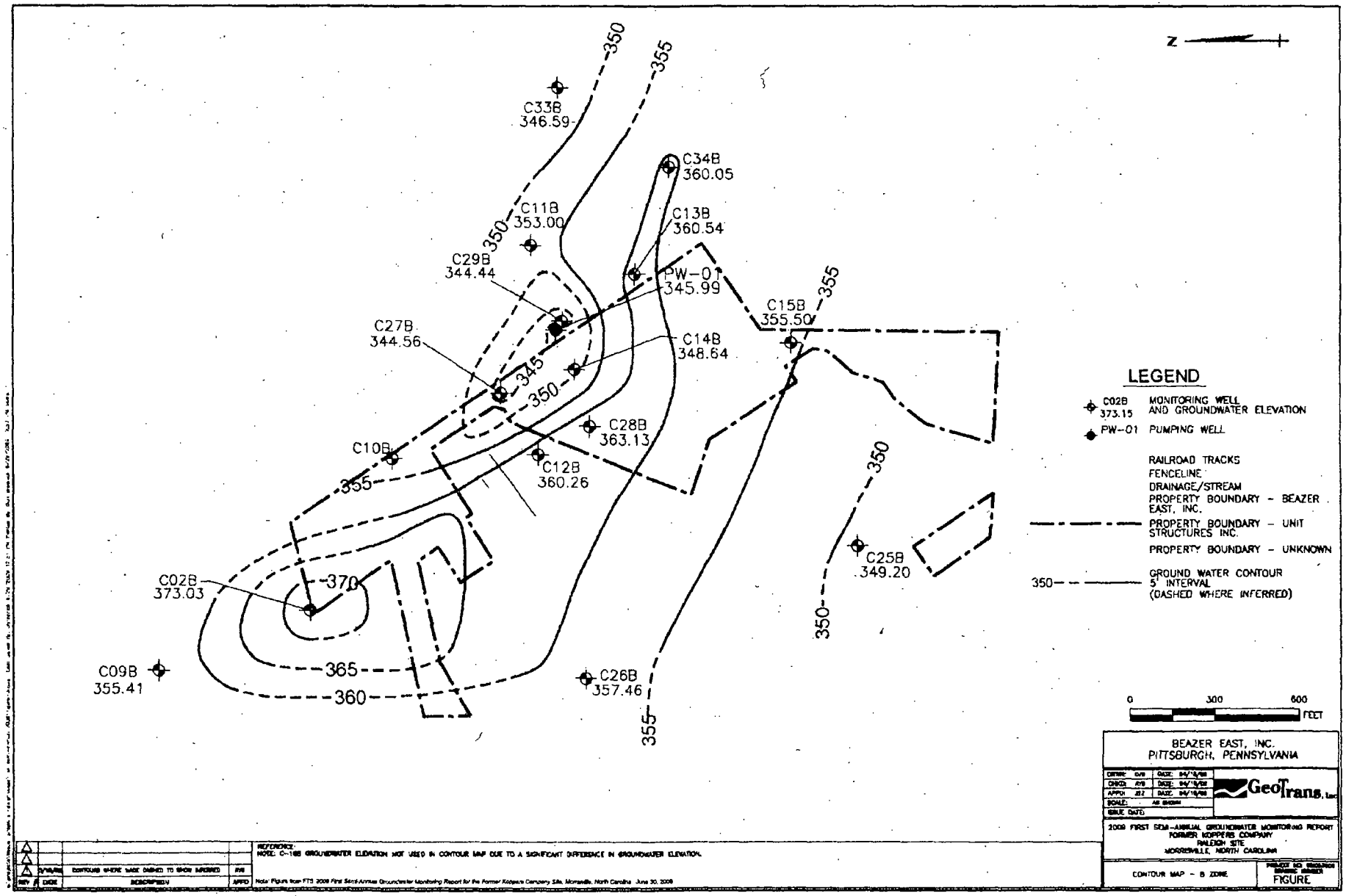
C07A
364.65
C27A
350.96
350
C10A
354.08
C30A
354.90
C12A
360.30
C28A
361.20
355
360
C31A
360.15
C01A
360.52
C04A
365.10
C25A
347.77
C05A
367.59
C06A
368.31
C02A
356.54
365
C26A
362.23
C08A
349.21
C09A
361.56
360
355
350
LEGEND
C02A
353.97
MONITORING WELL AND GROUNDWATER ELEVATION
PW-01
PUMPING WELL
RAILROAD TRACKS
FENCELINE
DRAINAGE/STREAM
PROPERTY BOUNDARY - BEAZER EAST, INC.
PROPERTY BOUNDARY - UNIT STRUCTURES INC.
PROPERTY BOUNDARY - UNKNOWN
350
GROUND WATER CONTOUR 5' INTERVAL (DASHED WHERE INFERRED)
0
300
600
FEET
BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA
GeoTrans, Inc.
2008 FIRST SEMI-ANNUAL GROUNDWATER MONITORING REPORT
FORMER KOPPERS COMPANY
RALEIGH SITE
MORRISVILLE, NORTH CAROLINA
CONTOUR MAP - A ZONE
FIGURE

Figure 4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C34B
360.05
C11B
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C13B
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C29B
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C10B
C12B
360.26
C02B
373.03
C09B
355.41
C26B
357.46
C25B
349.20
350
355
345
360
365
370
LEGEND
C02B 373.15 MONITORING WELL AND GROUNDWATER ELEVATION
PW-01 PUMPING WELL
RAILROAD TRACKS
FENCELINE
DRAINAGE/STREAM
PROPERTY BOUNDARY - BEAZER EAST, INC.
PROPERTY BOUNDARY - UNIT STRUCTURES INC.
PROPERTY BOUNDARY - UNKNOWN
350 GROUND WATER CONTOUR 5' INTERVAL (DASHED WHERE INFERRED)
0
300
600
FEET
BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA
GeoTrans, Inc.
2009 FIRST SEMI-ANNUAL GROUNDWATER MONITORING REPORT
FORMER KOPPERS COMPANY
RALEIGH SITE
MORRISVILLE, NORTH CAROLINA
CONTOUR MAP - B ZONE
FIGURE
REFERENCE:
NOTE: C-19B GROUNDWATER ELEVATION NOT USED IN CONTOUR MAP DUE TO A SIGNIFICANT DIFFERENCE IN GROUNDWATER ELEVATION.
CONTOURS WHERE BASE DASHED TO SHOW INFERRED
DESCRIPTION

Figure 5

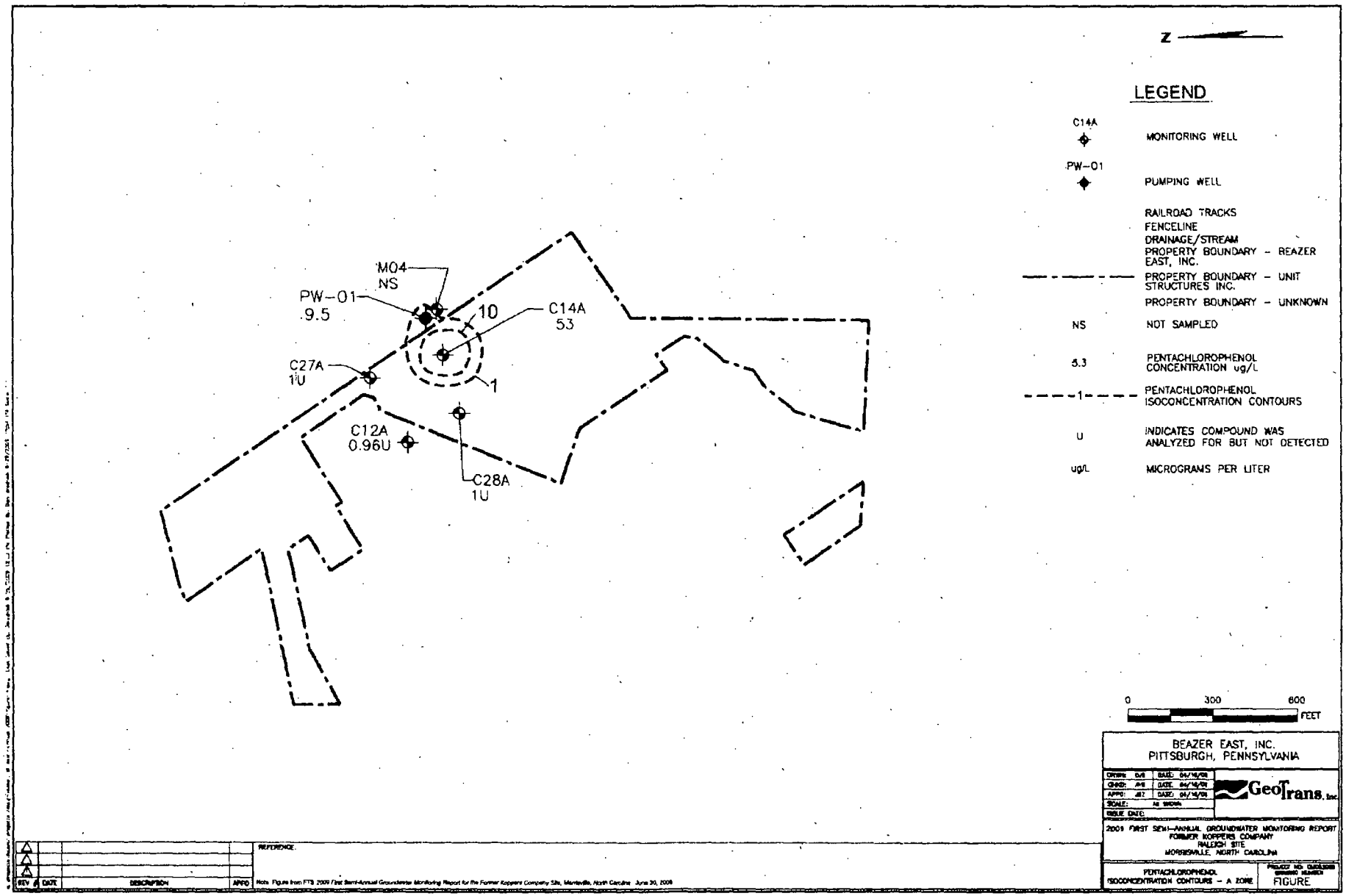
N
LEGEND
C14A
MONITORING WELL
PW-01
PUMPING WELL
RAILROAD TRACKS
FENCELINE
DRAINAGE/STREAM
PROPERTY BOUNDARY - BEAZER EAST, INC.
PROPERTY BOUNDARY - UNIT STRUCTURES INC.
PROPERTY BOUNDARY - UNKNOWN
NS
NOT SAMPLED
5.3
PENTACHLOROPHENOL CONCENTRATION ug/L
1
PENTACHLOROPHENOL ISOCONCENTRATION CONTOURS
U
INDICATES COMPOUND WAS ANALYZED FOR BUT NOT DETECTED
ug/L
MICROGRAMS PER LITER
M04
NS
PW-01
9.5
10
C14A
53
C27A
1U
1
C12A
0.96U
C28A
1U
0
300
600
FEET
BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA
GeoTrans, Inc.
2009 FIRST SEMI-ANNUAL GROUNDWATER MONITORING REPORT
FORMER KOPPERS COMPANY
RALEIGH SITE
MORRISVILLE, NORTH CAROLINA
PENTACHLOROPHENOL ISOCONCENTRATION CONTOURS - A ZONE
FIGURE
REFERENCE:
REV
DATE
DESCRIPTION
APPD

Figure 6

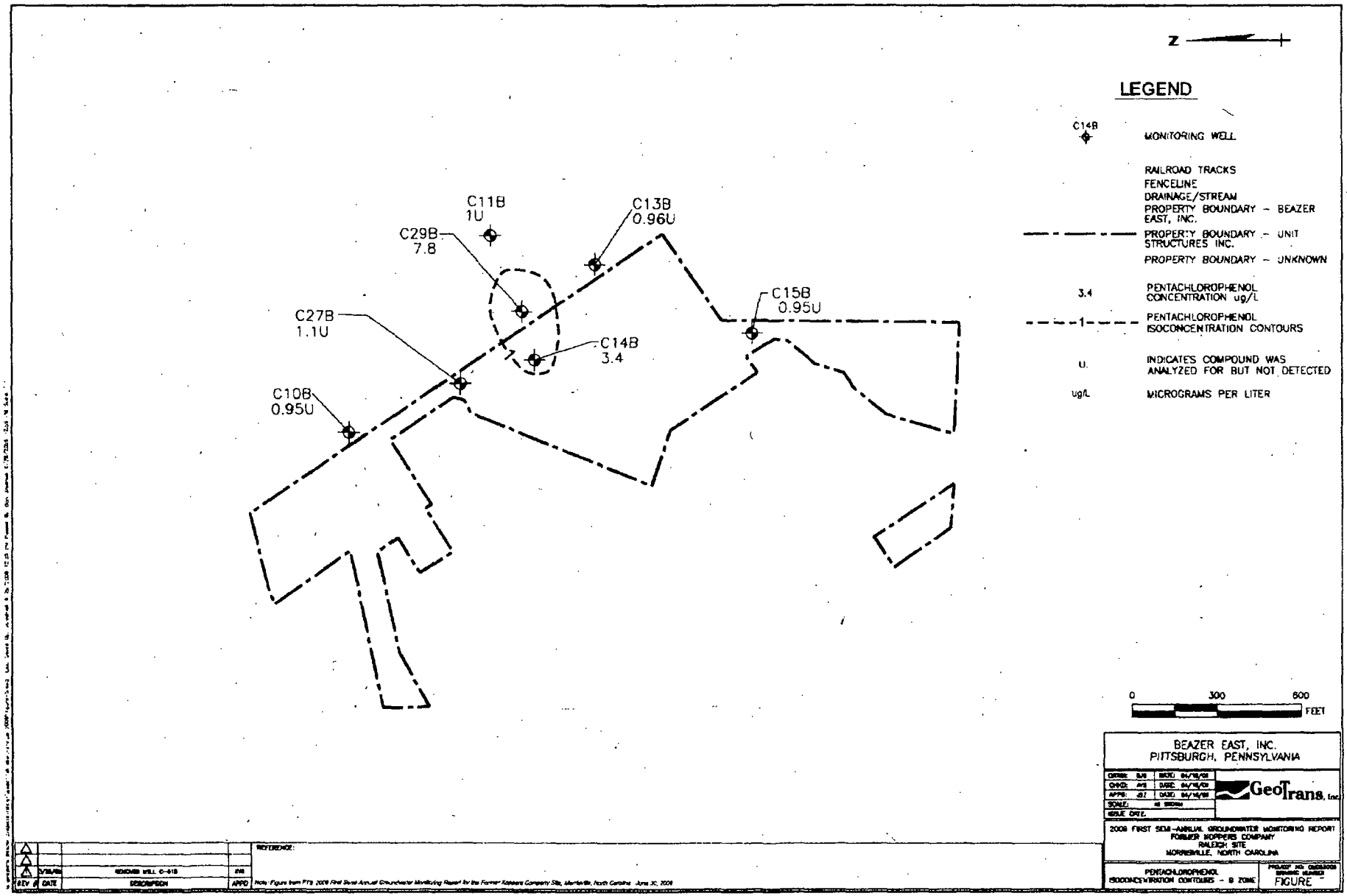
C11B
1U
C13B
0.96U
C29B
7.8
C15B
0.95U
C27B
1.1U
C14B
3.4
C10B
0.95U
N
LEGEND
C14B
MONITORING WELL
RAILROAD TRACKS
FENCELINE
DRAINAGE/STREAM
PROPERTY BOUNDARY - BEAZER EAST, INC.
PROPERTY BOUNDARY - UNIT STRUCTURES INC.
PROPERTY BOUNDARY - UNKNOWN
3.4
PENTACHLOROPHENOL CONCENTRATION ug/L
1
PENTACHLOROPHENOL ISOCONCENTRATION CONTOURS
U.
INDICATES COMPOUND WAS ANALYZED FOR BUT NOT DETECTED
ug/L
MICROGRAMS PER LITER
0
300
600
FEET
BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA
GeoTrans, Inc.
2008 FIRST SEMI-ANNUAL GROUNDWATER MONITORING REPORT
FORMER KOPPERS COMPANY
RALEIGH SITE
MORRISVILLE, NORTH CAROLINA
PENTACHLOROPHENOL
ISOCONCENTRATION CONTOURS - B ZONE
FIGURE
REFERENCE:

Figure 7

Tables

Table 1
In-Situ Sodium Hydroxide Catalyzed Persulfate Injection Field Data
Former Koppers Company Site
Morrisville, North Carolina

Injection Point	Injection Date(s)	Injection Pressure (psi)	Total Volume Added (gal)	Northing[1]	Easting[1]
C-14	06/28/11 06/29/11 07/02/11	25-75	1,300	N 35° 50.814'	W078° 50.306'
IW-1	07/01/11	40	25	N 35° 50.815'	W078° 50.310'
IW-2	06/30/11	40	25	N 35° 50.812'	W078° 50.302'
IW-2A	07/02/11	60	750	N 35° 50.820'	W078° 50.312'
IW-3A	07/02/11	60	650	N 35° 50.811'	WO78° 50.309'
IW-4	07/01/11	50-60	650	N 35° 50.821'	W078° 50.314'
IW-5	07/02/11	45-60	650	N 35° 50.817'	W078° 50.311'
IW-6	07/01/11	60	525	N 35° 50.821'	W078° 50.311'
IW-7	07/01/11 07/02/11	60	650	N 35° 50.812'	W078° 50.320'
IW-8	07/01/11	45	650	N 35° 50.816'	W078° 50.320'
IW-9	06/30/11	40	25	N 35° 50.824'	W078° 50.310'
IW-9A	07/02/11	60	650	N 35° 50.826'	W078° 50.307'
IW-10	07/02/11	50	650	N 35° 50.823'	W078° 50.318'

Notes:

[1] = World Geodetic System 1984, revised 2004

Table 2
Groundwater Sample Results
Former Koppers Company Site
Morrisville, North Carolina

Well	Date Sampled	Sample Type	Arsenic - Total (µg/L)	Barium - Total (µg/L)	Cadmium - Total (µg/L)	Chromium - Total (µg/L)	Lead - Total (µg/L)	Mercury - Total (µg/L)	Selenium - Total (µg/L)	Silver - Total (µg/L)	Pentachlorophenol (µg/L)	Sodium Persulfate (g/L)	Sulfate (mg/L)
USEPA Primary MCL			10	2000	5	100	15	2	50	100 (S)	1	No MCL	500,000
C-14A	2/6/2009	SMP	NS	NS	NS	NS	NS	NS	NS	NS	53	NS	NS
C-14A	9/14/2009	SMP	NS	NS	NS	NS	NS	NS	NS	NS	65	NS	NS
C-14A	2/16/2010	SMP	NS	NS	NS	NS	NS	NS	NS	NS	100	NS	NS
C-14A	06/21/10	SMP	<10	140B	<10	174	<3.0	<3.0	3.0B	<5.0	19	<0.005	14.9
C-14A	06/21/10	DUP	NS	NS	NS	NS	NS	NS	NS	NS	NS	<0.005	16.2
C-14A	07/07/10	SMP	NS	NS	NS	NS	NS	NS	NS	NS	NS	81.6	1979
C-14A	07/07/10	DUP	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.5	2044.9
C-14A	07/14/10	SMP	<20	368B	<10	186	<30	16.4	20	3.4B	<1	71	2353
C-14A	08/11/10	SMP	4.8B	146B	1.2B	671	22.3	22.4	7.3	5.5	<0.95	27.6	1843
C-14A	09/08/10	SMP	3.0B	104B	0.38B	75.3	<3.0	22.8	6.1	4.1B	0.65J	NS	NS
C-14A	12/29/10	SMP	<10	53B	0.23B	105	<3.0	26.6	4.8	1.2B,M	<0.98	NS	NS
C-14A	02/23/11	SMP	<10	49.2B	0.46B	120	<15	21.3	3.4B	<5.0	0.60J	NS	NS
C-14A	04/18/11	SMP	<10	35.8B	0.64B	82.5	<3.0	20.7	<5.0	<5.0	<1.0	NS	NS
C-14B	02/06/09	SMP	NS	NS	NS	NS	NS	NS	NS	NS	3.4	NS	NS
C-14B	09/14/09	SMP	NS	NS	NS	NS	NS	NS	NS	NS	2.4	NS	NS
C-14B	02/16/10	SMP	NS	NS	NS	NS	NS	NS	NS	NS	2.4	NS	NS
C-14B	06/21/10	SMP	<10	251	<5.0	1.7B	1.7B	0.059B,M	<5.0	<5.0	<1.0	<0.005	1.7
C-14B	07/07/10	SMP	NS	NS	NS	NS	NS	NS	NS	NS	NS	<0.005	2.8
C-14B	07/14/10	SMP	<10	239	<5.0	<5.0	2.6B	<0.20	4.0B	<5.0	1.8	<0.005	2.7
C-14B	07/14/10	DUP	<10	239	<5.0	<5.0	<3.0	<0.20	<5.0	<5.0	2.2	NS	NS
C-14B	09/08/10	DUP	2.8B	242	<5.0	0.67B	<3.0	<0.20	<5.0	<5.0	2.1	NS	NS
C-14B	08/11/10	SMP	<10	245	.78B	2B	2.5B	<0.20	<5.0	<5.0	<0.97	<0.005	3.4
C-14B	09/08/10	SMP	<10	236	0.18B	<5.0	<3.0	<0.20	<5.0	<5.0	1.9	NS	NS
C-14B	12/29/10	SMP	<10	242	<5.0	<5.0	<3.0	<0.20	<5.0	<5.0	1.3	NS	NS
C-14B	02/23/11	SMP	<10	252	1.1B	4.5B	1.4B	<0.2	<5.0	<5.0	2.6	NS	NS
C-14B	02/23/11	DUP	<10	250	0.52B	2.2B	2.8B	<0.20	<5.0	<5.0	2.8	NS	NS
C-14B	04/18/11	SMP	2.8B	231	<5.0	0.72B	<3.0	<0.20	5.1	<5.0	0.18J	NS	NS
C-29B	02/06/09	SMP	NS	NS	NS	NS	NS	NS	NS	NS	7.8	NS	NS
C-29B	02/06/09	DUP	NS	NS	NS	NS	NS	NS	NS	NS	7.0	NS	NS
C-29B	09/14/09	SMP	NS	NS	NS	NS	NS	NS	NS	NS	8.1	NS	NS
C-29B	09/14/09	DUP	NS	NS	NS	NS	NS	NS	NS	NS	9.9	NS	NS
C-29B	02/16/10	SMP	NS	NS	NS	NS	NS	NS	NS	NS	11	NS	NS
C-29B	02/16/10	DUP	NS	NS	NS	NS	NS	NS	NS	NS	11	NS	NS
C-29B	06/21/10	SMP	<10	162B	<5.0	1.8B	<3.0	0.045B,M	<5.0	<5.0	<0.98	<0.005	3.8
C-29B	06/21/10	DUP	NS	NS	NS	NS	NS	NS	NS	NS	NS	<0.005	5
C-29B	07/14/10	SMP	<10	164B	<5.0	2.0B	2.9B	<0.20	<5.0	<5.0	<0.95	NS	NS
C-29B	08/11/10	SMP	<10	119B	0.65B	2.9B	1.4B	<0.20	6.5	<5.0	3.4	0.2	805
C-29B	09/08/10	SMP	<10	73.2B	<5.0	<5.0	<3.0	<0.20	5.4	<5.0	8.2	NS	NS
C-29B	12/29/10	SMP	<10	88.7B	<5.0	1.4B	<3.0	<0.20	4.6B	<5.0	<0.95	NS	NS
C-29B	02/23/11	SMP	<10	94.8B	1.8B	11.8	2.2B	<0.20	<5.0	<5.0	5.8	NS	NS
C-29B	04/18/11	SMP	<10	76.5B	<5.0	0.57B	<3.0	<0.20	3.7B	<5.0	<0.99	NS	NS

Table 2
Groundwater Sample Results
Former Koppers Company Site
Morrisville, North Carolina

Well	Date Sampled	Sample Type	Arsenic - Total (µg/L)	Barium - Total (µg/L)	Cadmium - Total (µg/L)	Chromium - Total (µg/L)	Lead - Total (µg/L)	Mercury - Total (µg/L)	Selenium - Total (µg/L)	Silver - Total (µg/L)	Pentachlorophenol (µg/L)	Sodium Persulfate (g/L)	Sulfate (mg/L)
USEPA Primary MCL			10	2000	5	100	15	2	50	100 (S)	1	No MCL	500,000
PW-1	02/06/09	SMP	NS	NS	NS	NS	NS	NS	NS	NS	9.5	NS	NS
PW-1	09/15/09	SMP	NS	NS	NS	NS	NS	NS	NS	NS	29	NS	NS
PW-1	09/15/09	DUP	NS	NS	NS	NS	NS	NS	NS	NS	26	NS	NS
PW-1	02/16/10	SMP	NS	NS	NS	NS	NS	NS	NS	NS	38	NS	NS
PW-1	06/21/10	SMP	5.1B	255	<5.0	0.69B	7.8	0.18B,M	<5.0	<5.0	2.5	<0.005	5
PW-1	07/07/10	SMP	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.042	72.2
PW-1	07/14/10	SMP	<10	186B	1.9B	2.9B	10.4	1.3	7.4	<5.0	1.1	4.1	1403
PW-1	08/11/10	SMP	15.1	240	0.13B	27.7	46	6.8	14.9	1.1B	0.77J	2.4	617
PW-1	08/11/10	DUP	11.6	233	0.14B	34.1	45.2	7.1	15.1	<5.0	0.73J	NS	NS
PW-1	09/08/10	SMP	<10	134B	<5.0	4.4B	<3.0	2.6	<5.0	<5.0	1.8	NS	NS
PW-1	12/29/10	SMP	<10	151B	0.35B	<5.0	31.9	<0.20	<5.0	0.72B,M	1.7	NS	NS
PW-1	12/29/10	DUP	2.8B	150B	0.47B	<5.0	31	0.04B	NS	0.82B,M	1.4	NS	NS
PW-1	02/23/11	SMP	<10	116B	<5.0	3.8B	2.7B	0.52	<5.0	<5.0	3.4	NS	NS
PW-1	04/18/11	SMP	<10	130B	<5.0	6.2	<3.0	0.92	<5.0	<5.0	3.2	NS	NS
PW-1	04/18/11	DUP	3.6B	129B	4.1B	6.7	<3.0	0.91	9.9	<5.0	3.7	NS	NS

B= Estimated result. Result is less than RL.
J= Estimated result. Result is less than RL.
M= Method blank contamination. The associated method blank contains the target analyte at a reportable level.
NS= Not Sampled
S= Secondary MCL
SMP= Primary Sample
DUP= Duplicate Sample

Table 3
Field Parameters
Former Koppers Company Site
Morrisville, North Carolina

Well	Date	Dissolved Oxygen (mg/L)	ORP (mV)	pH	Specific Conductance (ms/cm)	Temperature (°C)	Turbidity (NTU)
C-14A	06/21/10	0.76	138.7	5.98	1.302	16.96	59.3
C-14A	07/07/10	0.15	241.7	6.05	46.759	NR	NR
C-14A	07/14/10	0.527	503.5	7.85	41.780	21.39	0.8
C-14A	08/11/10	7.2	543.0	7.17	19.764	17.36	NR
C-14A	09/08/10	4.09	482.0	6.67	18.370	20.40	124
C-14A	12/29/10	1.6	175.4	6.69	13.799	14.64	1
C-14A	04/18/11	1.79	356.8	6.64	5.813	20.69	8.7
C-14B	06/21/10	2.9	194.6	7.85	0.705	16.38	1.77
C-14B	07/07/10	1.35	-288.0	7.88	0.585	17.93	NR
C-14B	07/14/10	0.64	-85.6	7.96	0.625	18.42	0.5
C-14B	08/11/10	3.13	390.6	8.20	0.655	17.14	5.1
C-14B	09/08/10	1.00	78.2	7.92	0.687	18.93	2.1
C-14B	12/29/10	1.27	-37.8	7.95	0.65	15.83	1
C-14B	04/18/11	1.35	275.4	7.97	0.547	17.69	2.47
C-29B	06/21/10	0.58	136.9	7.22	0.594	17.24	6.61
C-29B	07/07/10	NR	181.1	7.86	0.616	17.03	NR
C-29B	07/14/10	1.24	314.6	7.84	0.588	17.65	0.9
C-29B	08/11/10	2.08	273.1	7.09	1.474	16.50	4
C-29B	09/08/10	0.65	120.8	7.21	1.061	17.52	0.8
C-29B	12/29/10	1.19	119.1	7.58	0.771	13.92	1
C-29B	04/18/11	1.81	360.5	7.72	0.794	18.43	2.97
PW-01	06/21/10	0.39	-38.9	11.05	0.997	17.09	3
PW-01	07/07/10	0.49	-87.0	7.40	0.788	18.32	NR
PW-01	07/14/10	1.27	293.1	6.33	4.950	19.79	1.4
PW-01	08/11/10	1.30	438.8	6.80	3.722	17.21	6.9
PW-01	09/08/10	0.62	332.3	6.74	2.846	16.84	1.4
PW-01	12/29/10	1.21	-34.0	6.84	2.326	12.62	4
PW-01	04/18/11	0.19	347.5	7.29	1.718	16.41	1.69

Notes:
NR = Not Recorded
Sodium Persulfate Injection occurred from June 28 through July 2, 2010

APPENDIX A

State of North Carolina Concurrence Letter

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Waste Management

Beverly Eaves Perdue
Governor

Dexter R. Matthews
Director

Dee Freeman
Secretary

February 21, 2012

Ms. Beverly Stepter
Remedial Project Manager
Superfund Remedial & Site Evaluation Branch
U. S. Environmental Protection Agency, Region 4
Sam Nunn - Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, GA 30303

RE: State Concurrence with the Explanation of Significant Differences
Koppers Company NPL Site
Morrisville, Wake County, North Carolina
NCD 003 200 383

Dear Ms. Stepter:

The State of North Carolina has reviewed the attached *Explanation of Significant Differences* at the Koppers Company National Priority List Site ("Site"). The State of North Carolina concurs with the *Explanation of Significant Difference*, subject to the following conditions:

1. State concurrence on the *Explanation of Significant Difference* ("ESD") and the selected remedy for the Site is based solely on the information contained in the subject ESD. Should the State receive new or additional information that significantly affects the conclusions or remedy selection contained in the ESD, it may modify or withdraw this concurrence with written notice to the United States Environmental Protection Agency (US EPA) Region IV.

2. State concurrence on this ESD in no way binds the State to concur in future decisions or commits the State to participate, financially or otherwise, in the cleanup of the Site. The State reserves the right to review, overview, comment, and make independent assessment of all future work relating to this Site.

3. If, after remediation is complete, the total residual risk level exceeds 10^{-6}, the State may require deed recordation/restriction to document the presence of residual contamination and possibly limit future use of the property as specified in North Carolina General Statute (NCGS) 130A-310.8.

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone: 919-707-8200 \ Internet: http://portal.ncdenr.org/web/wm/

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The State of North Carolina appreciates the opportunity to comment on the *Explanation of Significant Difference* for the Koppers Company National Priority List Site and looks forward to working with the US EPA on the final remedy. If you have any questions or comments, please feel free to contact David Mattison at (919) 707-8336 or at david.mattison@ncdenr.gov.

Sincerely,

Dexter R. Matthews
Division Director
NC DENR Division of Waste Management

Attachment

ATTACHMENT A

EPA Region 4 Office of CERCLA Legal Support
Input on ARARs Tables
for the Explanation of Significant Differences (ESD)
Koppers Superfund Site, Morrisville, Wake County, North Carolina

The following suggested Supplements to Tables 8.1, 8.4, and 8.5 are provided to identify Federal and State Action- and Location-Specific Applicable or Relevant and Appropriate Requirements (ARARs), respectively, to supplement ARARs for the remedy selected in the Koppers Superfund Site December 23, 1992 Record of Decision (ROD).

In the event that the existing remedies are further revised or new remedies are added in subsequent drafts of the ESD (such as Institutional Controls), then the ARARs will need to be re-evaluated.

Supplement to ROD Table 8.1 Action-Specific Applicable and Relevant and Appropriate Requirements and To-Be-Considered Guidance (Federal) Koppers Superfund Site Morrisville, Wake County, North Carolina			
Action	**Requirements**	**Prerequisite**	**Citation**
Class 5I Injection Well Installation, Operation, and Abandonment			
Abandonment of Class V injection wells	Shall close the well in a manner that prevents the movement of fluid containing any contaminant into an underground source of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 C.F.R. Part 141 or may otherwise adversely affect the health of persons.	Construction, use or operation of Class V injection wells for in-situ groundwater remediation – **relevant and appropriate**	40 C.F.R. § 146.10(c)(1)
	Shall dispose of or otherwise manage any soil, gravel, sludge, liquids, or other materials removed from or adjacent to the well in accordance with all applicable Federal, State, and local regulations and requirements.		40 C.F.R. § 146.10(c)(2)

Supplement to ROD Table 8.4 Action-Specific Applicable and Relevant and Appropriate Requirements and To-Be-Considered Guidance (North Carolina) Koppers Superfund Site Morrisville, Wake County, North Carolina			
Action	**Requirements**	**Prerequisite**	**Citation**
Class 5I Injection Well Installation, Operation, and Abandonment			
Activity associated with Class 5I injection wells (*e.g.*, persulfate injections)	Injection material may not contain any waste or any substance of a composition and concentration such that, if it were discharged to the land or waters of the state, would create a threat to human health or would otherwise render those waters unsuitable for their intended best usage.	Construction, use or operation of Class 5I injection wells for in-situ groundwater remediation – **relevant and appropriate**	15A NCAC 02C.0209(5)(b)
	Drilling fluids and additives shall contain only potable water and may be comprised of one or more of the following: the formational material encountered during drilling; materials manufactured specifically for the purpose of borehole construction or well construction; or materials approved by the Director [of DWQ] based on a demonstration of not adversely affecting human health or groundwater quality.		15A NCAC 02C.0225(g)(7)
Drilling, casing, screening and testing of Class 5I injection wells	A casing shall be installed which extends from at least 12 inches above land surface to the top of the injection zone. Casing extending less than 12 inches above land surface may be approved when site-specific conditions would endanger the physical integrity of the well or if it is not operatinally feasible due to engineering design requirements of the system.	Construction, use or operation of Class 5I injection wells for in-situ groundwater remediation – **relevant and appropriate**	15A NCAC 02C.0225(g)(15-16)
	The methods used in construction shall not threaten the physical and mechanical integrity of the well during its lifetime and shall be compatible with the proposed injection activities.		15A NCAC 02C..0225(g)(3)
	The borehole shall not penetrate to a depth greater than the depth at which injection will occur unless the purpose of the borehole is the investigation of the geophysical and geochemical characteristics of the aquifer. Following completion of the investigation, the borehole beneath the zone of injection shall be grouted completely to prevent the vertical migration of any contaminants downward.		15A NCAC 02C.0225(g)(5)

Supplement to ROD Table 8.4 Action-Specific Applicable and Relevant and Appropriate Requirements and To-Be-Considered Guidance (North Carolina) Koppers Superfund Site Morrisville, Wake County, North Carolina			
Action	**Requirements**	**Prerequisite**	**Citation**
Grouting and sand-gravel packing of Class 5I injection wells	The annular space between the casing and the borehole shall be grouted: • With an allowable grout specified in 15A NCAC 02C .0107; • By a method such that the physical and mechanical integrity of the well(s) is not threatened during its life expectancy; • From the top of the gravel pack to land surface in such a way that there is no interconnection of aquifers; and • So that the grout shall extend outward from the casing wall to a minimum thickness equal to either one-third of the diameter of the outside dimension of the casing or two inches, whichever is greater.	Construction, use or operation of Class 5I injection wells for in-situ groundwater remediation – **relevant and appropriate**	15A NCAC 02C.0225(g)(3,8,9)
	All grout mixtures shall be prepared prior to emplacement.		15A NCAC 02C.0225(g)(11)
	No additives which will accelerate the process of hydration shall be used in grout for thermoplastic well casing.		15A NCAC 02C.0225(g)(14)
	Packing materials shall: • Be composed of quartz, granite, or similar rock material and shall be clean, of uniform size, water-washed and free from clay, silt, or other deleterious material; • Be disinfected prior to subsurface emplacement; • Be emplaced such that it shall not connect aquifers or zones which have differences in water quality that would result in the deterioration of the water qualities in any aquifer or zone; and • Be evenly distributed around the screen and shall extend to a depth at least one foot above the top of the screen. A one-foot-thick seal, comprised of bentonitic clay or other sealing material that does not adversely affect human health or the environment, shall be emplaced directly above and in contact with the packing material.		15A NCAC 02C.0225(g)(19)
Abandonment of Class 5I injection wells	Shall abandon the well in such a manner that will prevent the movement of fluids into or between underground sources of drinking water.	Construction, use or operation of Class 5I injection wells for in-situ groundwater remediation – **relevant and appropriate**	15A NCAC 02C.0240(a)(4)
	The entire depth of the well shall be sounded before it is sealed to insure freedom from obstructions that may interfere with sealing operations.		15A NCAC 02C.0113(b)(2)

Supplement to ROD Table 8.4 Action-Specific Applicable and Relevant and Appropriate Requirements and To-Be-Considered Guidance (North Carolina) Koppers Superfund Site Morrisville, Wake County, North Carolina			
Action	**Requirements**	**Prerequisite**	**Citation**
	Drilled wells shall be completely filled with cement grout, which shall be introduced into the well through a pipe which extends to the bottom of the well and is raised as the well is filled.		15A NCAC 02C.0113(d)
	In the case of gravel-packed wells in which the casing and screens have not been removed, neat-cement shall be injected into the well completely filling it from the bottom of the casing to the top.		15A NCAC 02C.0113(b)(4)

Supplement to ROD Table 8.5 Location-Specific Applicable and Relevant and Appropriate Requirements and To-Be-Considered Guidance (North Carolina) Koppers Superfund Site Morrisville, Wake County, North Carolina			
Action	**Requirements**	**Prerequisite**	**Citation**
Class 5I Injection Well Installation, Operation, and Abandonment			
Activity associated with Class 5I injection wells (*e.g.*, persulfate injections)			
	The well shall be located in an area which does not require a person to enter confined spaces to perform sampling and inspection activities.		15A NCAC 02C.0225(g)(1)(B)
	The wells shall not be located where injectants or formation fluids would migrate outside othe approved injection zone as determined in accordance with 15A NCAC 02C .0225(e)(2) .		15A NCAC 02C.0225(g)(1)(C)
	The injection well shall not be located in an area generally subject to flooding.		15A NCAC 02C.0225(g)(1)(A)

ARAR = applicable or relevant and appropriate requirement
C.F.R. = *Code of Federal Regulations*
EPA = U.S. Environmental Protection Agency
NCAC = North Carolina Administrative Code
TBC = To Be Considered
> = greater than
< = less than
≥ = greater than or equal to
≤ = less than or equal to