UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103

SEP 25 2006

VIA FEDERAL EXPRESS

William Giarla, Esquire
Beazer East, Inc.
One Oxford Center
Suite 3000
Pittsburgh, PA 15219

Re: **Koppers (Newport) Superfund Site, Newport, New Castle County, Delaware: Administrative Order for Remedial Design/ Remedial Action (EPA Docket No. CERC-03-2006-0266DC)**

Dear Mr. Giarla:

Enclosed please find a true and correct copy of the Administrative Order for Remedial Design/Remedial Action captioned above ("Order"). The Order, issued pursuant to Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. § 9606(a), directs Beazer East, Inc. (Respondent) to conduct certain response action at and in connection with the Koppers (Newport) Superfund Site in Newport, New Castle County, Delaware.

Pursuant to Section XXIV of the Order, the Order is deemed issued on the date it is signed by EPA. The Order becomes effective thirty (30) calendar following the date on which it is issued. No later than twenty (20) calendar days from the date the Order is issued, Respondent may confer with EPA as provided in Section XXIV.B of the Order.

Please refer to the Order for the specific actions Respondent is required to undertake. Failure to comply with the Order may subject Respondent to civil penalties of up to $32,500 per day and/or punitive damages in an amount up to three times the amount of any costs incurred by the United States as a result of Respondent's failure to comply with the Order.

We look forward to working with you on this project. If you have any questions, please contact EPA Sr. Assistant Regional Counsel Andrew S. Goldman at (215) 814-2487.

Sincerely,

Abraham Ferdas, Director
Hazardous Site Cleanup Division
EPA Region 3

Enclosure

cc: Lindsay P. Howard, Esquire

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

IN THE MATTER OF: KOPPERS CO., INC. (NEWPORT PLANT) SUPERFUND SITE Beazer East, Inc., Respondent Proceeding Under Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. § 9606(a)	Docket No. CERC-03-2006-0266DC

ADMINISTRATIVE ORDER FOR REMEDIAL DESIGN/REMEDIAL ACTION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

IN THE MATTER OF: **KOPPERS CO., INC. (NEWPORT PLANT) SUPERFUND SITE** **Beazer East, Inc.,** **Respondent** **Proceeding Under Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. § 9606(a)**	**Docket No.** **CERC-03-2006-0266DC**

ADMINISTRATIVE ORDER FOR REMEDIAL DESIGN/REMEDIAL ACTION

Having determined the necessity for implementation of response activities at the Koppers Co., Inc. Superfund Site in Newport, New Castle County, Delaware ("Koppers Site" or "Site"), the United States Environmental Protection Agency ("EPA") hereby Orders as follows:

I. JURISDICTION

A. This Administrative Order ("Order") is issued to the Respondent by the United States Environmental Protection Agency ("EPA") under the authority vested in the President of the United States by Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, ("CERCLA"), 42 U.S.C. § 9606(a). This authority was delegated to the Administrator of EPA by Executive Order No. 12580 (52 Fed. Reg. 2923, January 29, 1987), delegated to the EPA Regional Administrators by EPA Delegation No.

14-14-B (May 11, 1994), and further delegated to the Director of the Hazardous Site Cleanup Division, EPA Region 3, by EPA Region 3 Delegation 14-14-B (November 7, 2003).

B. Prior notice of this Order has been given to the State of Delaware pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

II. PARTIES BOUND

A. This Order is issued to Beazer East, Inc. ("Respondent").

B. This Order shall apply to and be binding upon the Respondent and its agents, successors and assigns.

C. Neither a change in ownership of any property covered by this Order, nor a change in the ownership or corporate or partnership status of Respondent, shall in any way alter, diminish, or otherwise affect the Respondent's obligations and responsibilities under this Order.

D. In the event of any change in majority ownership or control of the Respondent, the Respondent shall notify EPA, in writing, no later than thirty (30) days after such change, of the nature and effective date of such change. The Respondent shall provide a copy of this Order to the prospective owner(s) or successor(s) of the Respondent before any change of ownership or control becomes irrevocable.

E. In the event that the Respondent files for bankruptcy or is placed involuntarily in bankruptcy proceedings, the Respondent shall notify EPA in writing within three (3) working days of such filing.

F. Respondent shall provide a copy of this Order to all contractors, subcontractors, laboratories, consultants, and other persons retained to conduct or monitor any portion of the Work performed pursuant to this Order prior to execution of any agreements or contracts with such persons. If the Respondent is under contract or agreement with any contractor, subcontractor, laboratory, consultant or other person retained to conduct or monitor any portion of the Work required pursuant to this Order at the time this Order is issued, Respondent shall provide a copy of this Order to all such persons within five (5) days of receipt of this Order. Respondent shall condition all contracts and agreements with such persons on compliance with the terms of this Order. Notwithstanding the terms of such contracts or agreements, Respondent remains responsible for complying with the terms of this Order and for ensuring that its contractors, subcontractors, laboratories, consultants, and other persons retained to conduct or monitor any portion of the Work required by this Order comply with the terms of this Order.

III. FINDINGS OF FACT

The following facts are a synopsis of information contained in the Administrative Record supporting issuance of this Order. That Administrative Record is incorporated by reference as if fully set forth herein:

A. Site Location and Historical Use

1. The Koppers Site consists of over 300 acres of land located in the northern part of New Castle County, Delaware, southwest of the town of Newport and northwest of the Route

I-95 and Route 141 interchange; is generally depicted as the "Former Koppers Company, Inc. Site" in Attachment 1 to this Order; and includes all places and property to which hazardous substances, pollutants or contaminants have migrated from the "Former Koppers Company, Inc. Site" in Attachment 1. The Site was the location of wood treatment operations from approximately the 1930s through 1971.

2. To the north, the Site is bordered by high-speed railroad lines. Beyond the rail lines are a former municipal sewage treatment facility, an industrial property, and a residential area. To the east, the Site is bordered by the former DuPont Holly Run Plant and the Christina River. To the south and west, the Site is bordered by White Clay Creek and Hershey Run, respectively. To the west of the Site, across Hershey Run, lies the Bread and Cheese Island property. The Site contains approximately 163 acres of upland areas 136 acres of wetlands, and three ponds.

3. In or around April 1929, Delaware Wood Preserving Company ("DelWood") acquired two parcels which comprise much of the Site and conducted wood treatment operations there until 1932. In 1932, DelWood sold the property to Century Wood Preserving Company, which continued to conduct wood treatment operations until it sold the property to the Wood Preserving Company ("WPC") in 1935. WPC continued wood treatment operations until 1941, when Koppers Company acquired the property. Koppers Company merged into Koppers Company, Inc. ("Koppers") in 1944 and continued to use the Site for wood treatment activities until 1971. In 1971, Koppers sold the property to E.I. duPont de Nemours & Company

("DuPont").

4. In 1974, the New Castle County Department of Public Works ("DPW") leased land in the northern portion of the Site where it built and operated a sewage/sludge treatment facility from 1974 until 1977. In 1977, DPW sold the building which currently exists on-Site to DuPont and discontinued wastewater treatment operations at the Site. In December 2004, DuPont transferred ownership of the Site to Respondent.

5. Wood treatment operations, conducted at various areas of the Site generally depicted in Attachment 2 to this Order, took place in the northern half of the Site. The Process Area contained various types of treatment equipment and storage for approximately 1,000,000 gallons of creosote and other process-related materials. Wood was treated in the Process Area using a creosote coal/tar solution, though pentachlorophenol ("PCP") with number 2 fuel oil was also used. The creosote treatment consisted of heating and pressurizing tanks filled with creosote and wood, forcing the creosote into the wood. After treatment, the freshly-treated wood products were temporarily allowed to cure and drip dry in the Drip Track Area prior to transfer to the large Wood Storage Area. Spills and leaks, including drips from drying wood, allowed treatment chemicals to seep into the soil.

6. The Potomac Formation, a major aquifer in the region of the Site and a source of potable water, lies beneath the Site. Several municipal water supply wells are located within approximately one mile of the Site.

7. Present on-Site is a building and sewer line constructed by DPW in or around 1974, a partial fence enclosure, and a blacktopped area. After purchasing the Site in 1971, Du Pont expanded its adjacent Holly Run Facility onto approximately 5 acres of the eastern portion of the Site, but subsequently dismantled the facility. Additional current Site features include two culverts, several drainage ditches, piles of old railroad ties, an "old foundation," a "fill or mounded area," an "old fire pond" and a former sump where effluent was treated or stored and is now covered with sediment/soil.

B. Environmental Investigations

1. The Site was first identified as a potential hazardous waste site in or around November 1979 following a review of responses to the Waste Disposal Site Survey of 1979 developed by the Subcommittee on Oversight and Investigation of the House Interstate and Foreign Commerce Committee (commonly known as the "Eckhardt Report").

2. EPA and the State conducted a Site Inspection on May 28, 1980, at which time several surface water samples were collected. Results showed that surface water on the Site appeared to be contaminated with phenolic compounds and PAHs. Additional samples were collected from the Site, as well as from nearby municipal drinking water supply wells, in October 1980 by an EPA contractor. On-site samples showed PAHs present in soil and leachate, but no contamination was detected in the supply wells.

3. EPA and the State conducted a Site Inspection in December 1984. Analytical results revealed the presence of, among other things, anthracene, benzo(a)anthracene,

benzo(b)fluoranthene, benzo(b)pyrene, 2-butanone, chrysene, fluoranthene, phenanthrene, pyrene, aluminum, barium, lead and magnesium in the on-site soil/sediment samples and stream sediment samples.

4. EPA proposed the Site for inclusion on the National Priorities List ("NPL") in 1989, and formally listed the Site on the NPL on August 30, 1990.

5. In 1991, Respondent agreed to perform a Remedial Investigation/Feasibility Study ("RI/FS") under the terms of an Administrative Consent Order signed by Respondent and EPA. Initial Remedial Investigation ("RI") field work was completed in 1996, with supplemental investigations conducted in 2002 and 2003. The RI, which EPA accepted as final in April 2003, revealed the presence of creosote non-aqueous phase liquid in both subsurface soils and wetland sediments at the Site. Shallow soils, subsurface soils, groundwater, and sediments were also found to be contaminated to varying degrees with polynuclear aromatic hydrocarbons. Contamination at the Site was found to be present in the Process and Drip Track, Wood Storage, Remaining Upland, Hershey Run Drainage, Fire Pond, South Ponds, and K Areas depicted in Attachment 2 to this Order.

6. A Human Health Risk Assessment ("HHRA"), conducted during the RI by Respondent to evaluate the human health risks that could result if no remedial action were taken at the Site, found that risks to a construction worker, industrial worker, adolescent trespasser, adolescent swimmer or angler exceed target risk levels for carcinogenic and non-carcinogenic risks.

7. In an Ecological Risk Assessment for the Site conducted in 1996-1997, EPA concluded that PAHs pose ecological risks to the upland, wetland and aquatic communities at the Site.

8. In September 1999, a draft Feasibility Study ("FS") report was submitted to EPA by Respondent. After receiving comments, extensive revisions were made and the draft FS was resubmitted in April 2003. Respondent submitted an addendum to the FS in September 2004. EPA accepted the FS, as modified by the FS Addendum, in 2005.

C. EPA's Record of Decision

1. EPA published a notice of its Proposed Remedial Action Plan for the Site on October 7, 2004. A period of public review and comment was held from October 7, 2004 through December 7, 2004.

2. On September 30, 2005, EPA issued a Record of Decision ("ROD") in which the Agency selected remedial action for implementation at the Koppers Site. The remedial action selected in the ROD generally consists of the following components:

a. Excavation and consolidation of all contaminated soils and sediments (soils with total PAHs greater than 600 mg/kg and sediments with total PAHs greater than 150 mg/kg) into one or two on-site landfills or containment areas ("Containment Area") to be located in the areas of the worst NAPL contamination;

b. Installation, operation, and maintenance of a ground water treatment system to prevent the migration of contaminated ground water, as well as to prevent the discharge of contaminated ground water from the recovery operation, and an oil-water separator to facilitate the recovery of free-phase NAPL as well as to prevent NAPL from reaching the ground water treatment system;

c. Treatment of ground water as necessary to meet discharge requirements;

d. Construction of ground water barrier walls and collection systems in the Containment Area to prevent further migration of ground water contamination, including NAPL;

e. Management of the hydraulic head of ground water and collection of NAPL contamination in the ground water through the use of the passive recovery trenches;

f. Separation of creosote from ground water and off-site disposal or recycling;

g. Movement of debris to a location on-Site where it can be placed under a cap;

h. Installation of a cap across the Containment Area;

i. Relocation of a portion of the existing channel of Hershey Run if the Containment Area extends into the Hershey Run wetlands;

j. Creation of wetlands to replace any wetlands that are filled in as part of the landfill construction;

k. Monitoring of ground water, surface water, sediments and wetlands to ensure the effectiveness of the remedy; and

l. Prevention of exposure to contamination inside the Containment Area or in ground water beneath the Site, and prevention of the drawdown of contamination into the deeper aquifer or elsewhere through land and ground water use restrictions for the Site and surrounding area.

D. Respondent

1. Respondent Beazer East, Inc. is a Delaware corporation.

2. In or around 1988, approximately 17 years after it ceased wood treatment operations at the Site, Koppers was acquired by BNS Acquisition, Inc.

3. In or around 1989, BNS Acquisition, Inc. merged into Koppers, and Beazer East, Inc. was established as the new holding company. Also in 1989, Koppers changed its name to Beazer Materials and Services, Inc.

4. In or around 1990, Beazer Materials and Services, Inc. changed its name to Beazer East, Inc.

IV. CONCLUSIONS OF LAW AND DETERMINATIONS

A. The Koppers Site is a "facility" as defined in Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

B. "Hazardous substances," as that term is defined in Section 101(14) of CERCLA, 42 U.S.C. § 9601(14), and 40 C.F.R. § 300.5, have been disposed of, deposited, stored, placed, or have otherwise come to be located on, and remain at, the Site.

C. The hazardous substances at the Site are being released, and/or threaten to be released, from the Site into the environment within the meaning of Section 101(8) and (22) of CERCLA, 42 U.S.C. § 9601(8) and (22).

D. Respondent is a "person" within the meaning of Section 101(21) of CERCLA, 42 U.S.C. § 9601(21).

E. Respondent is an "owner or operator," as defined in Section 101(20) of CERCLA, 42 U.S.C. § 9601(20), of the Site and is "the owner and operator of . . . a facility" within the meaning of Section 107(a)(1), 42 U.S.C. § 9607(a)(1). In addition, Respondent is "a person who at the time of disposal of any hazardous substance owned or operated any facility at which such hazardous substances were disposed of" within the meaning of section 107(a)(2) of CERCLA, 42 U.S.C. § 9607(a)(2).

F. The actual or threatened releases of hazardous substances from this Site may present an imminent and substantial endangerment to the public health or welfare or the environment.

G. The actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response actions selected in the ROD and by achieving and maintaining Performance Standards (as defined herein), may present an imminent and substantial endangerment to the public health or welfare or the environment.

H. EPA has determined that in order to implement the response actions selected in the ROD, the Work required by this Order must be performed.

V. DEFINITIONS

Unless otherwise expressly provided herein, terms used in this Order that are defined in CERCLA or in regulations promulgated pursuant to CERCLA shall have the meaning assigned to them in the statute or its implementing regulations. Whenever terms listed below are used in this Order or in the documents attached to this Order or incorporated by reference into this Order, the following definitions shall apply:

A. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601-9657.

B. "Day" shall mean a calendar day unless expressly stated to be a working day. "Working day" shall mean a day other than a Saturday, Sunday, or Federal holiday. In computing any period of time under this Order, where the last day would fall on a Saturday, Sunday, or Federal holiday, the period shall run until the end of the next working day.

C. "DQOs" or "Data Quality Objectives" are qualitative and quantitative statements which specify the quality of the data required to support EPA decisions during the remedial response actions. DQOs are determined based on the end uses of the data to be collected.

D. "Duly Authorized Representative" shall mean a person designated in accordance with the procedures set forth in 40 C.F.R. § 270.11(b) and approved as a Duly Authorized Representative by EPA.

E. "EPA" shall mean the United States Environmental Protection Agency and any successor departments or agencies of the United States.

F. "National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan, codified at 40 C.F.R. Part 300, including any amendments thereto.

G. "Operation and Maintenance" or "O&M" shall mean all activities that are required under the Operation and Maintenance Plan developed pursuant to this Order and the ROD, and approved by EPA.

H. "Order" shall mean this Administrative Order and all attachments appended hereto. In the event of conflict between the Order and any attachment, this Order shall control.

I. "Performance Standards" shall mean the cleanup standards and other measures of achievement of the goals of the Remedial Action, set forth in Section 11.2 of the ROD and those that are developed by the Respondent and approved by EPA during Remedial Design.

J. "ROD" shall mean, unless otherwise stated, the EPA Record of Decision for the Site signed on September 30, 2005, by the Director of the EPA Region 3 Hazardous Site Cleanup Division, and all attachments thereto. The ROD is appended hereto as Attachment 3 and is incorporated herein.

K. Remedial Action" or "RA" shall mean those activities, except for Operation and Maintenance ("O&M"), to be undertaken by Respondent to implement the final plans and specifications that are submitted by Respondent pursuant to the Remedial Design Work Plan and subsequently approved by EPA, including any additional activities required under Section VI (Performance of the Work) and Section XIII (Plans and Reports Requiring EPA Approval) of this

Order.

L. "Remedial Action Work Plan" or "RA Work Plan" shall mean a plan for Remedial Action, including a schedule for implementation of Remedial Action, submitted by Respondent pursuant to Paragraph VI.C.3 of this Order and approved by EPA.

M. "Remedial Design" shall mean those activities to be undertaken by Respondent to develop the final plans and specifications for the Remedial Action pursuant to the Remedial Design Work Plan.

N. "Remedial Design Work Plan" or "RD Work Plan" shall mean a plan for Remedial Design, including a schedule for remedial design work, submitted by Respondent pursuant to Paragraph VI.C.1 of this Order and approved by EPA.

O. "Respondent" shall mean Beazer East, Inc.

P. "Site" shall mean the Koppers Co., Inc. (Newport Plant) Superfund Site described in Section III.A.1 of this Order and for which EPA selected remedial action in the ROD.

Q. "State" shall mean the State of Delaware.

R. "Work" shall mean all activities Respondent is required to perform under this Order, including Remedial Design, Remedial Action, O&M, tasks to be performed in accordance with any EPA-approved Work Plan required by this Order, and any other activities required to be undertaken pursuant to this Order.

VI. PERFORMANCE OF THE WORK

A. Compliance with the ROD and the Law

1. Based on the foregoing, and the Administrative Record supporting issuance of this Order, it is hereby ordered that Respondent implement the remedy selected in Section 11.0 of the ROD for the Site. This work shall be conducted in accordance with CERCLA, the NCP, and the requirements and schedules specified in this Order and any future written modifications to this Order including, but not limited to, achieving and maintaining the applicable Performance Standards as defined in Section V (Definitions) of this Order.

2. Nothing in this Order, the ROD, or EPA's approval of the Remedial Design Work Plan or the Remedial Action Work Plan constitutes a warranty or representation of any kind by EPA that compliance with this Order, the ROD, or the EPA-approved Remedial Design Work Plan or the EPA-approved Remedial Action Work Plan will achieve or maintain the Performance Standards, or that such compliance will foreclose EPA from seeking compliance with all terms and conditions of this Order including, but not limited to, the Performance Standards.

3. All actions and activities carried out by Respondent pursuant to this Order shall be performed in accordance with all applicable Federal, State, and local laws and regulations. Respondent shall also comply with all applicable or relevant and appropriate requirements of Federal and State environmental laws and regulations and relevant guidance documents.

4. Respondent shall obtain all permits and authorizations necessary for off-Site Work and shall submit timely and complete applications and requests for any such permits or authorizations.

5. This Order is not, and shall not be construed to be, a permit issued pursuant to any Federal, State, or local statute or regulation.

6. In the event EPA determines that Respondent has failed to implement any provision(s) of the Work in an adequate or timely manner, or has otherwise violated this Order, EPA may exercise any and all rights it may have including but not limited to, those expressly reserved in Section XXII (Enforcement and EPA's Reservation of Rights) of this Order.

B. Selection of Contractor(s)

1. Supervising Contractor

a. All aspects of the Work to be performed by Respondent pursuant to this Order shall be under the direction and supervision of the Supervising Contractor, the selection of which shall be subject to acceptance or disapproval by EPA. Within five (5) days after the effective date of this Order, Respondent shall notify EPA in writing of the name, title, and qualifications of any contractor proposed to be the Supervising Contractor. EPA will issue a notice of disapproval or acceptance of the selection of such Supervising Contractor. If at any time thereafter, Respondent proposes to change a Supervising Contractor, Respondent shall give such notice to EPA and must obtain a notice of acceptance of such change from EPA, before the new Supervising Contractor performs, directs, or supervises any Work under this Order.

b. If EPA disapproves the selection of a proposed Supervising Contractor, EPA will notify Respondent in writing. Respondent shall submit to EPA a list of at least three contractors, including the qualifications of each contractor, that would be acceptable to Respondent within fourteen (14) days of receipt of EPA's notice. EPA will provide written notice of the names of any contractor(s) whose selection it would accept. Respondent may select any contractor from that list and shall notify EPA of the name of the contractor selected within twenty-one (21) days of EPA's written notice. In the event EPA does not accept the selection of any of the contractors proposed in the Respondent's list, EPA may direct the Respondent to submit to EPA the names and qualifications of at least three (3) additional contractors whose selection would be acceptable to the Respondent within fourteen (14) days of receipt of EPA's disapproval.

2. Remedial Design Contractor

a. Within five (5) days after the effective date of this Order, the Respondent shall: (1) notify EPA and the State in writing of the name, title, and qualifications of all contractor(s) and subcontractor(s) to be used in carrying out all Remedial Design activities required by this Order; and (2) identify the personnel that will be used during construction to ensure that the Work is performed in accordance with the approved Remedial Design submittal(s). For purposes of this Paragraph, the term "contractors" shall be deemed to include contractors and subcontractors.

b. EPA will notify Respondent in writing of its acceptance or disapproval of the selection of the Remedial Design contractor(s), including subcontractor(s). If EPA disapproves of the selection of the Respondent's proposed Remedial Design contractor(s), the Respondent shall submit to EPA the names, titles, and qualification of at least three (3) contractors that would be acceptable to the Respondent within fourteen (14) days of receipt of EPA's disapproval. Except as provided below, EPA will provide written notice of the name of the contractor(s) whose selection EPA accepts. The Respondent may select any contractor(s) from that list and shall notify EPA and the State in writing of the name(s) of the contractor(s) selected within fourteen (14) days of EPA's designation. The Respondent shall notify EPA and the State of the date the Respondent enters into an agreement or contract with such contractor(s) to perform the Work for which the selection of such contractor(s) were accepted by EPA. In the event EPA does not accept the selection of any of the contractors proposed in the Respondent's list, EPA may direct the Respondent to submit to EPA the names and qualifications of at least three (3) additional contractors whose selection would be acceptable to the Respondent within fourteen (14) days of receipt of EPA's disapproval.

c. If at any time during the pendency of this Order a decision is made by the Respondent to retain an additional or substitute Remedial Design contractor or subcontractor, the Respondent shall give written notification to EPA and shall obtain acceptance from EPA in accordance with the procedures described in Paragraphs VI.B.2.a and VI.B.2.b, above, before the new contractor(s) or subcontractor(s) perform(s), direct(s), or supervise(s) any Work pursuant to this Order.

3. Remedial Action Contractor(s)

a. Within thirty (30) days after EPA approves the Remedial Action Work Plan submitted by the Respondent pursuant to Paragraph VI.C.3 of this Order, and prior to the commencement of any Work thereunder, the Respondent shall notify EPA in writing of the name(s), title(s) and qualifications of all contractor(s) and subcontractor(s) and the personnel of such contractor(s) and subcontractor(s) proposed to be used in carrying out Work required by such approved Remedial Action Work Plan. For purposes of this Paragraph, the term "contractors" shall be deemed to include contractors and subcontractors.

b. EPA will accept or disapprove the selection of the Remedial Action contractor(s) and subcontractor(s) proposed by the Respondent in accordance with the procedures described for the acceptance or disapproval of Remedial Design contractor(s) and subcontractor(s) in Paragraph VI.B.2.b, above.

c. If at any time during the pendency of this Order a decision is made by the Respondent to retain an additional or substitute Remedial Action contractor or subcontractor, the Respondent shall give written notification to EPA and shall obtain acceptance of the selection from EPA in accordance with the procedures described in Paragraphs VI.B.2.a and VI.B.2.b, above, before the new contractor(s) or subcontractor(s) perform(s), direct(s), or supervise(s) any Work pursuant to this Order.

4. EPA retains the right to disapprove at any time the selection of contractor(s), including subcontractor(s); supervisory personnel; or other persons retained to conduct any of the Work required by this Order. In such event, the Respondent shall propose replacements in accordance with the requirements of this Section VI.

C. **Respondent Shall Perform the Work as Follows**

1. The Remedial Design Work Plan

a. Within forty-five (45) days after receiving notice of EPA's acceptance of the selection of the Remedial Design Contractor(s) in accordance with Paragraph VI.B.2.b., Respondent shall submit to EPA for review and approval a work plan for the design of the Remedial Action at the Site ("Remedial Design Work Plan" or "RD Work Plan"). The RD Work Plan shall include a step-by-step plan for completing the Remedial Design for the remedy identified in the ROD and for achieving and maintaining all requirements, including the Performance Standards, identified in the ROD. The RD Work Plan shall describe in detail the tasks that the Respondent will complete and the deliverables the Respondent will submit during the Remedial Design phase, and contain an expeditious schedule for completing the tasks and submitting the deliverables described in the RD Work Plan. The major tasks and deliverables described in the RD Work Plan shall include, but not be limited to the following: (1) a Preliminary Design for the remedy; (2) a Pre-Final Design for the remedy; (3) a Final Design for the remedy; (4) a Report of the Findings of any pre-design sampling; (5) a Site Monitoring Plan; (6) a Design Sampling and Analysis Plan, which shall include a Field Sampling Plan and a Quality Assurance Project Plan; (7) a Site Health and Safety Plan for design activities; (8) a

Contingency Plan; (9) a Construction Quality Assurance Plan ("CQAP"); (10) a plan for gathering additional data or information, or performing additional studies; (11) other appropriate components including a Permitting Plan and an Institutional Controls Plan; a Site Management Plan; and (12) a Remedial Design Schedule. At a minimum, the Institutional Controls Plan shall include the requirements of this Order set forth in Sections VIII (Access to and Use of the Site) and XVI (Notice of Obligations and Transfer of Interests), below.

b. The RD Work Plan shall be consistent with, and shall provide for, achievement and maintenance of the Performance Standards for the remedy. The RD Work Plan shall comport with EPA's "Superfund Remedial Design and Remedial Action Guidance," OSWER Directive 9355.0-4A, and any amendments to such Guidance.

c. Upon approval by EPA, the RD Work Plan shall be deemed to be incorporated into this Order and made an enforceable part hereof.

d. Upon approval of the RD Work Plan by EPA, Respondent shall implement the RD Work Plan in accordance with the schedules and methodologies contained therein. The Respondent shall submit all plans, submittals, and other deliverables required in accordance with the approved schedule therein for review and approval pursuant to Section XIII (Plans and Reports Requiring EPA Approval) of this Order. Unless otherwise directed by EPA, the Respondent shall not commence Remedial Design activities at the Site prior to approval of the Remedial Design Work Plan.

2. Remedial Design

a. Within sixty (60) days after EPA approves the RD Work Plan, Respondent shall submit a Preliminary Design for the remedy to EPA for review and approval. The preliminary design submittal begins with the initial design of the remedy and ends with the completion of approximately thirty (30) percent of the design effort. The Preliminary Design shall include, at a minimum, the following; (1) a design criteria report; (2) results of additional field sampling; (3) project delivery strategy; (4) preliminary plans, drawings, and sketches; (5) required specifications in outline form; (6) a preliminary construction schedule; and (7) a basis of design report.

b. Within ninety (90) days after EPA approves the Preliminary Design, Respondent shall submit to EPA for review and approval a Pre-Final Design for the remedy. This submittal shall represent approximately ninety (90) percent of the design effort. The Pre-final Design shall address all of EPA's comments on the Preliminary Design and shall include, at a minimum, the following: (1) Pre-final Plans, Specifications and Schedules; (2) an Operation and Maintenance Plan; (3) the Construction Quality Assurance Plan ("CQAP"); (4) the Field Sampling Plan including a Quality Assurance Project Plan, directed at measuring progress towards meeting the remedy Performance Standards; (5) the Site RA Health and Safety Plan which conforms to applicable Occupational Safety and Health Administration and EPA requirements including, but not limited to, 29 C.F.R. § 1910.120 and guidance entitled "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," dated October 1985, as amended; (6) a RA Contingency Plan which includes an air monitoring plan to protect the public during any soil excavation activities and a Spill Control and Countermeasure Plan; (7) an Institutional Controls Plan, which, at a minimum, shall include the requirements of this Order set forth in Sections VIII (Access to and Use of the Site) and XVI (Notice of Obligations and Transfer of Interests), below, and which will ensure that the structures, devices, and other components of the Work along with the naturally occurring hydrogeologic conditions at the Site are not interfered with or disturbed by future use of the property; (8) a Permitting Requirements Plan for any Work that may require permits; (9) RA Schedule; and (10) Waste Management Plan. The CQAP shall detail the approach to quality assurance during construction activities at the Site, and shall specify an Independent Quality Assurance Team ("IQAT") to conduct the quality assurance program during the construction phase of the project. The IQAT shall be a separate contractor, submitted for EPA acceptance or disapproval pursuant to Paragraph VI.B, above, who is not involved in any other aspects of the Remedial Design and Remedial Action and shall be responsible for examining and testing various materials, procedures, and equipment during implementation of the construction activities. The IQAT shall perform on-Site inspections of the Work to assess compliance with project standards, verify that the CQAP is implemented, and report to the Respondent and EPA the results of all inspections.

c. Within thirty (30) days after EPA approves the Pre-final Design, Respondent shall submit a Final Design for the remedy to EPA for review and approval. The Final Design, which shall address all of EPA's comments on the Pre-final design, shall include, at a minimum; (1) final Plans, Specifications, and Schedules; (2) the final Operation and Maintenance Plan; (3) the final CQAP; (4) the final Field Sampling Plan (directed at measuring progress towards meeting Performance Standards); (5) the final Site RA Health and Safety Plan; (6) a final RA Contingency Plan; (7) a final Institutional Controls Plan; (8) a final Permitting Requirements Plan; (9) RA Schedule; (10) Waste Management Plan ; and (11) a Design Analysis Report that contains all of the Design calculations.

d. Upon EPA approval, the Final Design shall be deemed to be incorporated into this Order and made an enforceable part hereof.

3. Remedial Action Work Plan

a. Not later than thirty (30) days after EPA approves all deliverables required as part of the Final Design, Respondent shall submit a Remedial Action Work Plan for the remedy ("RA Work Plan") to EPA for review and approval. The RA Work Plan shall be developed in accordance with the ROD; any amendments to the ROD and any Explanations of Significant Differences issued by EPA pursuant to Section 117 of CERCLA, 42 U.S.C. § 9617; and shall be consistent with the Final Design for the remedy approved by EPA. The RA Work Plan shall include methodologies, plans and schedules for completion of, at a minimum, the following: (1) selection of the Remedial Action Contractor; (2) implementation of the Remedial Design; (3) implementation of the CQAP; (4) development and submission of the ground water monitoring plan; (5) identification of and satisfactory compliance with applicable permitting requirements; (6) implementation of the Operations and Maintenance ("O&M") Plan; (7) implementation of the Contingency Plan; (8) implementation of the Institutional Controls Plan; and (9) development and submission of the Performance Standards assessment plan. The RA Work Plan shall also include an expeditious schedule for implementing all Remedial Action tasks identified in the ROD for the remedy and shall tentatively identify the members of Respondent's Remedial Action Project Team.

b. Respondent shall submit for EPA acceptance the RA Work Plan and the Health and Safety Plans for Remedial Action activities. Upon acceptance by EPA, the Health and Safety Plan for Remedial Action shall be deemed to be incorporated into and made an enforceable part of the Remedial Action Work Plan. The Respondent shall ensure that the Health and Safety Plan for Remedial Action, as accepted by EPA, is met by Respondent's contractor(s).

c. Upon approval by EPA, the RA Work Plan shall be deemed to be incorporated into this Order and made an enforceable part hereof.

4. Remedial Action

a. Upon approval of the RA Work Plan by EPA, Respondent shall implement the RA Work Plan according to the schedules and methodologies in the RA Work Plan. Unless otherwise directed by EPA in writing, Respondent shall not commence Remedial Action at the Site prior to approval of the RA Work Plan.

b. If Respondent seeks to retain a construction contractor to assist in the performance of the Remedial Action, then Respondent shall submit a copy of the solicitation documents including, but not limited to, the Request For Proposals, to EPA not later than five (5) days after publishing the solicitation documents.

c. Within thirty (30) days after EPA approves the RA Work Plan, Respondent shall notify EPA in writing of the name, title, and qualifications of any construction contractor(s) proposed to be used in carrying out Work under this Order.

d. Not later than twenty-one (21) days after EPA's acceptance of the Remedial Action contractor(s) in accordance with Paragraph VI.B.3 of this Order, Respondent shall submit to EPA, for approval by EPA, a Construction Management Plan. The Construction Management Plan shall identify key personnel, their experience, their qualifications, and their responsibilities for construction activities, and shall include a detailed schedule for completing all construction activities. Upon approval by EPA, the Construction Management Plan shall be deemed to be incorporated into this Order and made an enforceable part hereof.

e. Within thirty (30) days after EPA approves the Construction Management Plan, Respondent shall begin on-Site implementation of the Remedial Action for the remedy. Upon approval by EPA of the Construction Management Plan, Respondent shall implement and comply with the schedules and terms of all deliverables relating to Remedial Action including the RA Work Plan and the Construction Management Plan.

f. The Work performed by the Respondent pursuant to this Order shall, at a minimum, achieve and maintain the Performance Standards and shall be consistent with CERCLA and the NCP.

g. Notwithstanding any action by EPA, Respondent remains fully responsible for achieving and maintaining the Performance Standards. Nothing in this Order, or in the Remedial Design or Remedial Action Work Plan, or approval of any other submission, shall be deemed to constitute a warranty or representation of any kind by EPA that full performance of the Remedial Design will achieve and maintain the applicable Performance Standards. Respondent's compliance with such approved documents shall not foreclose EPA from requiring additional response actions to achieve and maintain the applicable Performance Standards.

D. **Reporting Requirements/Progress Reports**

1. In addition to any other requirement of this Order, Respondent shall submit to EPA five (5) copies, and to the State two (2) copies, of written monthly progress reports that provide a summary of actions and activities undertaken pursuant to this Order. The progress reports shall be submitted on or before the fifth day of each calendar month following the effective date of this Order. Respondent's obligation to submit progress reports continues until EPA gives written notice that Respondent has demonstrated, to EPA's satisfaction, that all Work required pursuant to this Order has been fully performed and that all Performance Standards have been met. The monthly progress reports shall: (a) describe the actions which have been taken toward achieving compliance with this Order during the previous month; (b) include all results of sampling and tests and all other data pertaining to the Work received or generated by Respondent or its contractors or agents (and not previously submitted to EPA) in the previous month; (c) identify all Work plans, plans, and other deliverables required by this Order which were completed and submitted during the previous month; (d) describe all actions including, but not limited to, data collection and implementation of work plans, which are scheduled for the next month; and provide other information relating to the progress of construction including, but not limited to, critical path diagrams, Gantt charts, and Pert charts; (e) include information regarding the percentage of completion of the Work, delays encountered or anticipated that may affect the future schedule for implementation of the Work, and a description of efforts made to mitigate

those delays or anticipated delays; (f) describe any modifications to the work plans or other schedules that Respondent has proposed to EPA or that have been approved by EPA; and (g) describe all activities, as approved by EPA under Section XIX (Community Relations) undertaken in support of the Community Relations Plan during the previous month and those to be undertaken in the next month. If requested by EPA, Respondent shall also provide briefings for EPA and the State to discuss the progress of the Work.

2. Except as otherwise provided in the next sentence, Respondent shall notify EPA of any anticipated change to the EPA-approved schedule for performance of any activity including, but not limited to, implementation of work plans, no later than seven (7) days prior to the scheduled performance of the activity. Notwithstanding the foregoing, Respondent shall notify EPA of any anticipated change to the EPA-approved schedule for the performance of data collection no later than thirty (30) days prior to the performance of such activity, unless otherwise directed by EPA. All modifications to the EPA-approved schedule must be approved by EPA in writing.

3. In addition to the reporting required by Section 103 of CERCLA, 42 U.S.C. § 9603, and Section 304 of the Emergency Planning and Community Right-to-Know Act ("EPCRA"), 42 U.S.C. § 11004, upon the occurrence of any event during performance of the Work that Respondent is required to report pursuant to Section 103 of CERCLA, 42 U.S.C. § 9603, or Section 304 of EPCRA, 42 U.S.C. § 11004, Respondent shall, within twenty-four (24) hours of the onset of such event, orally notify the EPA Remedial Project Manager or the Chief of the DE, VA, WV Remedial Branch within the Office of Superfund Site Remediation, Hazardous

Site Cleanup Division, EPA Region III ("Branch Chief") (in the event of the unavailability of the EPA Remedial Project Manager), or, in the event that neither the EPA Remedial Project Manager nor the Branch Chief is available, the EPA Region III Hotline at (215) 814-9016. Within ten (10) days of the onset of such an event, Respondent shall furnish to EPA and the State a written report, signed by the Respondent's Project Coordinator, setting forth the events which occurred and the measures taken, and to be taken, in response thereto. Within thirty (30) days of the conclusion of such an event, Respondent shall submit a report setting forth all actions taken in response thereto.

4. Respondent shall submit to EPA five (5) copies, and to the State two (2) copies, each year within thirty (30) days of the anniversary of the effective date of this Order, a report setting forth the status of the Work, which shall at a minimum include a statement of major milestones accomplished in the preceding year, a statement of tasks remaining to be accomplished, and a schedule for implementation of the remaining Work.

5. Failure to submit written reports in accordance with the requirements of this Order shall constitute a violation of this Order.

E. <u>Off-Site Shipments</u>

1. Respondent shall, at least twenty-one (21) days prior to any off-Site shipment of hazardous substances which are generated as part of the Remedial Design or Remedial Action activities from the Site to any waste management facility, provide written notification to the appropriate state environmental official in the receiving facility's state and to the EPA Remedial Project Manager of such shipment of hazardous substances. However, the requirement to notify

EPA shall not apply to any off-Site shipment when the total volume of all shipments from the Site to each receiving facility will not exceed ten (10) cubic yards.

2. Respondent shall include in the written notification the following information: (a) the name and location of the facility to which the hazardous substances are to be shipped; (b) the type and quantity of the hazardous substances to be shipped; (c) the expected schedule for the shipment of the hazardous substances; and (d) the method of transportation. Respondent shall notify the state in which the planned receiving facility is located of major changes in the shipment plan, such as a decision to ship the hazardous substances to another facility within the same state, or to a facility in another state.

3. The identity of the receiving facility and the State will be determined by the Respondent. Respondent shall provide written notification required by this Paragraph, including the information required by Paragraph VI.E.2, above, as soon as practicable, but in no case no less than fourteen (14) days before the hazardous substances are actually shipped.

4. All hazardous substances which Respondent removes from the Site shall be disposed of or treated at a facility in accordance with Section 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3), the EPA "Revised Procedures for Planning and Implementing Off-Site Response Actions" (September 22, 1993), Section 300.440 of the NCP (40 C.F.R. § 300.440), and all other applicable Federal, State and local laws and regulations.

F. <u>Operation and Maintenance ("O&M")</u>

Respondent shall perform the activities during O&M in accordance with the applicable Performance Standards, the EPA-approved RD and RA Work Plans, and the EPA-approved O&M Plan to be submitted pursuant to this Order. Notification requirements for off-Site shipments of hazardous substances described in Paragraph VI.E above shall also be met during the O&M.

G. **Additional Response Actions**

1. In the event that EPA determines that additional response actions are necessary to meet applicable Performance Standards or EPA determines, in accordance with Section XI (EPA Periodic Review), below, that the Remedial Action required by this Order is not protective of human health and the environment, EPA may notify Respondent that additional response actions are necessary.

2. Unless otherwise stated by EPA, within thirty (30) days of receipt of notice from EPA that additional response actions are necessary to meet applicable Performance Standards or, pursuant to Section XI, below, are necessary to protect human health and the environment, Respondent shall submit to EPA for approval a work plan for the additional response actions. The work plan shall conform to the applicable requirements to this Order.

3. Upon EPA's approval of the work plan for additional response actions, the work plan shall become an enforceable part hereof and Respondent shall implement that work plan in accordance with the provisions and schedule contained therein. Unless otherwise directed by EPA, Respondent shall not commence physical on-Site implementation of the work plan for additional response actions prior to the date for commencement set forth in the EPA-approved work plan.

4. Any additional response actions that Respondent proposes are necessary to carry out the requirements of the ROD, the requirements of this Order, or to achieve and maintain applicable Performance Standards shall be subject to approval by EPA and, if authorized by EPA, shall be completed by Respondent in accordance with plans, specifications, and schedules approved by EPA.

5. If required by Sections 113(k)(2) or 117 of CERCLA, 42 U.S.C. §§ 9613(k)(2) or 9617, or the NCP, Respondent and the public will be provided with an opportunity to comment on any additional response actions proposed pursuant to this Paragraph VI.G and to submit written comments for the record during the public comment period.

VII. SAMPLING AND QUALITY ASSURANCE

A. Respondent shall consult with EPA in planning for, and prior to, all sampling and analysis required by this Order, and by any plan which EPA approves pursuant to this Order. Unless otherwise directed by the EPA Remedial Project Manager, Respondent shall not commence sampling until EPA approves the Remedial Design Work Plan and the Sampling and Analysis Plan ("SAP").

B. Respondent shall prepare a SAP, consisting of a Quality Assurance Project Plan ("QAPP") and a Field Sampling Plan ("FSP"), for sample collection, transportation, analysis, validation and reporting to be conducted pursuant to this Order. The SAP shall be submitted as part of the Remedial Design Work Plan to the EPA Remedial Project Manager for review and approval prior to commencing sampling and analysis or field investigation. Each plan shall specify, for the phase of activity addressed, the Data Quality Objectives ("DQOs"), sample collection and transportation procedures, data analysis methods, data reduction, data review, and reporting procedures. The FSP shall also include the types, locations, analytical parameters, and frequency of samples. Selection of analytical methods shall be justified in conjunction with the DQOs. The guidelines referenced in Paragraph VII.C, below, and any additional guidance provided to the Respondent by EPA shall be followed in the preparation of the SAP.

C. While conducting all sample collection and analysis activities required by this Order, the Respondent shall implement quality assurance, quality control, and chain of custody procedures in accordance with "EPA Requirements for Quality Assurance Project Plans," External Review Draft (EPA QA/R-5) (October 1998); "EPA NEIC Policies and Procedures Manual," (Revised 1991) (EPA 330/978-001-R); EPA Region III Modifications to the National Functional Guidelines for Inorganic Data Review (EPA Region III: April 1993); EPA Region III Modifications to the National Functional Guidelines for Organic Data Review (EPA Region III: September 1994); "EPA Region III Innovative Approaches to Data Validation," (EPA Region III: June 1995); "Data Quality Objectives Process for Superfund," (EPA 540/R-93/071: September 1994); and subsequent amendments to such guidelines upon notification by EPA to Respondent of such amendment. Prior to the commencement of any monitoring project under this Order, Respondent shall submit to EPA for approval a Quality Assurance Project Plan ("QAPP") for the Work that is consistent with the NCP and the guidance documents cited above. Respondent shall ensure that EPA and State personnel and their authorized representatives are allowed access at reasonable times to all laboratories utilized by Respondent in implementing this Order. In addition, Respondent shall ensure that such laboratories shall analyze all samples submitted by EPA pursuant to the QAPP for quality assurance monitoring. Respondent shall ensure that the laboratories they utilize for the analysis of samples taken pursuant to this Order perform all analyses according to accepted EPA methods. Respondent shall submit to EPA the selected laboratory's(ies') Quality Assurance Program Plan and their qualifications, which shall include, at a minimum, previous certifications, Performance Evaluation results, equipment lists and personnel resumes. Respondent shall ensure that all field methodologies utilized in collecting samples for subsequent analysis pursuant to this Order will be conducted in accordance with the procedures set forth in the QAPP approved by EPA. At the request of EPA, Respondent shall conduct one or more audits of the selected laboratory(ies) to verify analytical capability and compliance with the QAPP. Auditors shall conduct lab audits during the time the laboratory(ies) is(are) analyzing samples collected pursuant to this Order. The lab audit shall be conducted according to procedures available from the Analytical Services and Quality Assurance Branch, Environmental Assessment and Innovation Division, EPA Region 3. Audit reports shall be submitted to the EPA Remedial Project Manager within fifteen (15) days of completion of the audit. The Respondent shall report serious deficiencies, including all those which adversely impact data quality, reliability or accuracy, and take action to correct such deficiencies within twenty-four (24) hours of the time the Respondent knew or should have known of the deficiency.

D. Upon request, the Respondent shall allow split or duplicate samples to be taken by EPA and the State or their authorized representatives. Respondent shall notify EPA and the State not less than thirty (30) days in advance of any sample collection activity unless shorter notice is agreed to by EPA. In addition, EPA and the State shall have the right to take any additional samples that EPA or the State deem necessary. Upon request, EPA and the State shall allow the Respondent to take split or duplicate samples of any samples they take as part of EPA's oversight of the Respondent's implementation of the Work.

E. Respondent shall submit to EPA and the State two (2) copies each of the results of all sampling and/or tests or other data obtained or generated by or on behalf of Respondent with respect to the Site and/or the implementation of this Order unless EPA agrees otherwise.

F. Notwithstanding any provision of this Order, EPA hereby retains all of its information gathering and inspection authorities and rights, including enforcement actions related thereto, under CERCLA, RCRA, and any other applicable statutes or regulations.

VIII. ACCESS TO AND USE OF THE SITE

A. If the Site, or any other property where access and/or land use restrictions are needed to implement any part of the ROD or this Order, is owned or controlled by the Respondent, Respondent shall:

1. Commencing on the effective date of this Order and thereafter, provide access to EPA and the State and their respective authorized representatives, employees, agents, consultants, or contractors for the purpose of conducting any activity related to this Order including, but not limited to, the following activities:

a. Performing and Monitoring the Work;

b. Verifying any data or information submitted by the Respondent to EPA or the State;

c. Conducting investigations relating to contamination at or near the Site;

d. Obtaining samples;

e. Assessing the need for, planning, or implementing additional response actions at or near the Site;

f. Inspecting and copying records, operating logs, contracts, or other documents maintained or generated by Respondent or its agents, consistent with Section XVIII (Access to Information);

g. Assessing Respondent's compliance with this Order; and

h. Determining whether the Site or other property is being used in a manner that is prohibited or restricted, or that may need to be prohibited or restricted.

2. Commencing on the effective date of this Order and thereafter, refrain from using the Site, or such other property, in any manner that would interfere with or adversely affect the integrity or protectiveness of the response actions to be implemented pursuant to this Order. In addition, Respondent shall refrain from using the Site, or such other property, for any purpose which might interfere with, obstruct, or disturb the performance, support, or supervision of the Work, including any Operation and Maintenance activities, taken pursuant to this Order. Unless otherwise required for implementation of the Work under this Order or otherwise determined to be necessary by EPA, such restrictions include, but are not limited to, the land and ground water use restrictions identified in Section 11.2.12 of the ROD.

B. If the Site, or any other property where access and/or land use restrictions are needed to implement this Order, is owned or controlled by persons other than the Respondent, Respondent shall use best efforts to secure from such persons:

1. An agreement to provide access thereto for EPA, the Respondent, and their respective authorized representatives, employees, agents, consultants, or contractors, for the purpose of conducting any activity related to this Order including, but not limited to, those activities listed in Paragraph VIII.A.1 of this Order;

2. An agreement to abide by the obligations and restrictions established by Paragraph VIII.A.2 of this Order, or that are otherwise necessary to implement, ensure non-interference with, or ensure the protectiveness of the response actions to be performed pursuant to this Order.

C. If, within forty-five (45) days of the effective date of this Order, Respondent has not submitted access and/or land use restriction agreements required by Paragraph VIII.B of this Order, Respondent shall promptly notify EPA in writing and shall include in that notification a summary of the steps that Respondent has taken to attempt to comply with Paragraph VIII.B of this Order. EPA may, as it deems appropriate, assist Respondent in obtaining access or land use restrictions. As used in this Section, "best efforts" shall include, at a minimum, but shall not be limited to, a certified letter from the Respondent to the owners of property not owned or controlled by the Respondent but to which access and/or land use restrictions are needed to implement this Order requesting:

1. the agreement required to be obtained pursuant to Paragraph VIII.B.1 of this Order; and

2. the agreement required to be obtained pursuant to Paragraph VIII.B.2 of this Order.

D. If EPA determines that land use restrictions in the form of State or local laws, regulations, ordinances or other governmental controls beyond those set forth in the ROD are needed to implement the remedy selected in the ROD, ensure the integrity and protectiveness thereof, or ensure non-interference therewith, Respondent shall cooperate with EPA's efforts to secure such governmental controls.

E. Notwithstanding any provision of this Order, EPA retains all of its access authorities and rights, as well as all of its rights to require land use restrictions, including enforcement authorities related thereto, under CERCLA, RCRA and any other applicable statutes or regulations.

IX. FAILURE TO PERFORM

A. In the event of an inability or anticipated inability on the part of Respondent to perform any of the actions required by this Order in the time and/or manner required herein, the Respondent's Project Coordinator, as defined in Section XII (Designated Project Coordinators), below, shall notify EPA orally within forty-eight (48) hours of such event and in writing as soon as possible, but in no event more than ten (10) days after Respondent knew or should have known about such event. Such notice shall set forth the reason(s) for, and the expected duration of, the inability to perform; the actions taken and to be taken by Respondent to avoid and mitigate the impact of such inability to perform; and the proposed schedule for completing such actions. Such notification shall not relieve Respondent of any obligation under this Order.

B. Any delay in performance of this Order that, in EPA's judgment, is not properly justified by Respondent under the terms of this Section shall be considered a violation of this Order.

C. Any delay in performance of this Order or inability to perform any action required by this Order shall not affect Respondent's obligation to fully perform all activities required under the terms and conditions of this Order.

D. Failure of Respondent to carry out any requirement of this Order in accordance with the terms and conditions specified herein may result in the unilateral performance of the required actions by EPA pursuant to applicable authorities, an action to recover penalties and/or treble damages pursuant to CERCLA, and/or the initiation of an enforcement action against Respondent to require Respondent to perform such actions, in addition to any other relief that may be available to EPA pursuant to applicable law.

E. Nothing in this Section or any other provision of this Order shall be construed to limit any powers EPA may have under CERCLA, the NCP, or any other law or regulation.

F. Increased costs or expenses associated with implementation of the activities called for in this Order are not justification for any delay in performance or failure to perform.

X. ENDANGERMENT AND EMERGENCY RESPONSE

A. In the event of any action, occurrence, or situation during the performance of the Work which causes or threatens to cause a release of a hazardous substance that constitutes an emergency situation or that may present an immediate threat to the public health or welfare or the environment, Respondent shall, subject to Paragraph B of this Section, immediately take all appropriate action to prevent, abate, or minimize such release or threat of release or endangerment, and shall immediately notify the EPA Remedial Project Manager, or, if the EPA Remedial Project Manager is unavailable, the Chief of the DE, VA, WV Remedial Branch within the Office of Superfund Site Remediation, Hazardous Site Cleanup Division, EPA Region III. If neither of these persons is available, Respondent shall notify the EPA Region III Hotline at (215) 814-9016. Respondent shall take such actions in consultation with the EPA Remedial Project Manager or other available authorized EPA officer and in accordance with all applicable provisions of the Health and Safety Plans, the Contingency Plans, any other applicable plans or documents developed and approved pursuant to this Order, and all other applicable Federal, State, and local laws and regulations.

B. Nothing in the preceding paragraph or in this Order shall be deemed to limit any authority of the EPA to take, direct, or order all appropriate action or to seek an order from the Court to protect public health or welfare or the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances on, at, or from the Site.

XI. EPA PERIODIC REVIEW

A. Under Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), and any applicable regulations, EPA must review the Remedial Action required by this Order at least every five (5) years after initiation of the Remedial Action if hazardous substances remain on the Site, to assure that the Work performed pursuant to this Order adequately protects human health and the environment. Until such time as EPA certifies completion of the Work, Respondent shall conduct the requisite studies, investigations, or other response actions as determined necessary by EPA in order to permit EPA to conduct the reviews under Section 121(c) of CERCLA, 42 U.S.C. § 9621(c). As a result of any reviews performed under this Section, Respondent may be required to perform additional Work in accordance with Paragraph C of this Section or to modify Work previously performed.

B. If required by Sections 113(k)(2) or 117 of CERCLA, 42 U.S.C. §§ 9613(k)(2) or 9617, or the NCP, Respondent and the public will be provided with an opportunity to comment on any additional response actions proposed by EPA as a result of the review conducted pursuant to Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), and to submit written comments for the record during the public comment period.

C. If the Director of the Hazardous Site Cleanup Division, EPA Region III, or his/her delegate determines that information received, in whole or in part, during the review conducted pursuant to Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), indicates that the Remedial Action required by this Order is not protective of human health and the environment, or that additional response actions are necessary to meet the applicable Performance Standards, Respondent shall undertake any additional response actions EPA has determined are appropriate in accordance with Paragraph VI.G of this Order.

XII. DESIGNATED PROJECT COORDINATORS

A. EPA's Project Coordinator shall be the EPA Remedial Project Manager. EPA's Remedial Project Manager is:

Matthew T. Mellon (3HS23)
U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103
Telephone: (215) 814-3168
Fax: (215) 814-3002

B. EPA has the discretionary, non-reviewable right to change its Remedial Project Manager. If EPA changes its Remedial Project Manager, EPA will inform Respondent in writing of the name, address and telephone number of the new Remedial Project Manager.

C. The EPA Remedial Project Manager shall have the authority lawfully vested in a Remedial Project Manager by the NCP. In addition, the EPA Remedial Project Manager shall have authority, consistent with the NCP, to halt or redirect any Work required by this Order and to take any necessary response action when s/he determines that conditions at the Site may present an imminent and substantial endangerment to public health or welfare or the environment.

D. Within five (5) days after the effective date of this Order, Respondent shall designate a Project Coordinator and shall submit the name and qualifications of the Project Coordinator, including any support entities and staff, to EPA for review and acceptance. Respondent's Project Coordinator shall have the technical expertise sufficient to adequately oversee all aspects of the Work and shall not be acting as an attorney for Respondent in this matter. If Respondent wishes to change its Project Coordinator, Respondent shall provide written notice to EPA of the name and qualifications of the new Project Coordinator at least five (5) days prior to changing the Project Coordinator.

E. Respondent's selection of a Project Coordinator or replacement Project Coordinator shall be subject to EPA acceptance. If EPA does not accept the selection of the Project Coordinator, Respondent shall submit to EPA a list of the names and qualifications of proposed Project Coordinators that would be acceptable to them, within fourteen (14) days after receipt of EPA's notice not to accept the Project Coordinator previously selected. EPA will then provide Respondent with written notice identifying each proposed Project Coordinator on the list whose designation would be acceptable to EPA. Within ten (10) days of receipt of EPA's notice identifying acceptable replacement Project Coordinators, Respondent shall select any acceptable Project Coordinator from the list and notify EPA of such selection.

F. Each Project Coordinator will be responsible for overseeing the implementation of this Order.

G. Unless otherwise directed by the EPA Remedial Project Manager, all communications, whether written or oral, from Respondent to EPA shall be directed to the EPA

Remedial Project Manager.

H. No informal advice or guidance from the EPA Remedial Project Manager shall relieve Respondent of any obligation under this Order.

XIII. PLANS AND REPORTS REQUIRING EPA APPROVAL

A. Unless otherwise specified in this Order or by the EPA Remedial Project Manager, five (5) copies of all documents, including plans, reports, and other items required to be submitted to EPA for approval pursuant to this Order, shall be submitted to the EPA Remedial Project Manager in accordance with the requirements of this Section. Two (2) copies of each such document shall simultaneously be submitted to the State at the following address:

Stephen Johnson
State of Delaware
Division of Air & Waste Management
Dept. of Natural Resources and Environmental Control
391 Lukens Drive
New Castle, DE 19720-2774
Telephone: (302) 395-2604

To the maximum extent possible, communications from Respondent to EPA and all documents, including reports and other correspondence, concerning the activities performed pursuant to this Order, will be directed to the EPA and State Project Coordinators by overnight mail or equivalent delivery.

B. Plans, design documents, proposals, reports or other documents shall be signed by a Duly Authorized Representative (as defined in Section V (Definitions) of this Order) of

Respondent. The Remedial Design Work Plan, Remedial Action Work Plan, and any other work plan submitted to EPA for approval pursuant to this Order shall contain the following certification:

"Except as provided below, I certify that the information contained in or accompanying this [type of submission] is true, accurate, and complete."

"As to [the/those] portion(s) of this [type of submission] for which I cannot personally verify [its/their] accuracy, I certify under penalty of law that this [type of submission] and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature:

Name: ______________________
Title: ______________________

C. After review of any plan, report, or other item which is required to be submitted for approval by EPA pursuant to this Order, EPA shall, (1) approve, in whole or in part, the submission; (2) approve the submission upon specified conditions; (3) modify the submission to cure the deficiencies; (4) direct that the Respondent modify the submission; (5) disapprove, in whole or in part, the submission, notifying Respondent of deficiencies; or (6) any combination of the above.

D. If EPA disapproves a plan, report, or item because EPA determines that it is deficient, Respondent shall be deemed to be in violation of the provision of this Order requiring

Respondent to submit such plan, report, or item, and EPA may assume responsibility for performing all or any portion of the Work. Such EPA performance shall not release Respondent from its obligation to comply with the requirements of this Order.

E. In the event of approval, approval upon conditions, or modification by EPA, Respondent shall proceed to take any action required by the plan, report, or other item, as approved or modified by EPA with respect to the modifications or conditions made by EPA. In the event the preliminary, pre-final, or final design is approved upon specified conditions by EPA, Respondent shall incorporate all of the requirements contained in EPA's notice of approval upon conditions in the subsequent design submittal. Such subsequent design submittal shall be submitted in accordance with the schedule set forth in the Remedial Design Work Plan, unless otherwise directed by the EPA Remedial Project Manager.

F. Upon receipt of a notice of disapproval or a notice requiring modification of the submission, Respondent shall, within twenty-one (21) days or such other time as specified by EPA in such notice, correct the deficiencies and resubmit the plan, report, or other item for approval. Notwithstanding the notice of disapproval or a notice requiring modification of the submission, Respondent shall proceed, at the direction of EPA, to take any action required by any non-deficient portion of the submission.

G. In the event that a resubmitted plan, report or other item, or portion thereof, is again disapproved by EPA, EPA may require Respondent to correct the deficiencies, in accordance with Paragraph XIII.F, above. EPA also retains the right to amend or develop the plan, report or other item. Respondent shall implement any such plan, report, or item as amended or developed by EPA.

H. All plans, reports, and other items required to be submitted to EPA under this Order shall, upon modification and/or approval by EPA, be deemed to be incorporated into and enforceable as part of this Order. In the event that EPA approves a portion of a plan, report, or other item required to be submitted to EPA under this Order, the approved portion shall be deemed to be incorporated into and enforceable as part of this Order.

I. Notwithstanding any action by EPA, Respondent remain fully responsible for achieving and maintaining applicable Performance Standards. Nothing in this Order, or in EPA's approval of any submission shall be deemed to constitute a warranty or representation of any kind by EPA that performance of the Remedial Design or the Remedial Action will achieve and maintain the applicable Performance Standards. Respondent's compliance with EPA-approved documents does not foreclose EPA from seeking to require that Respondent perform additional actions to achieve and maintain the applicable Performance Standards.

J. No failure by EPA to approve, disapprove, or otherwise respond to a document submitted to EPA for approval shall be construed as an approval of such document.

XIV. ASSURANCE OF ABILITY TO COMPLETE WORK

A. Within thirty (30) days of the effective date of this Order, Respondent shall demonstrate its ability to complete the Work required by this Order and to pay all claims which may arise from performance of the Work required by this Order by obtaining, and presenting to EPA for approval, financial assurance in the amount of $51,756,239 in one of the following forms:

1. A surety bond or performance bond guaranteeing performance of the Work;
2. One or more letters of credit;
3. A trust fund;
4. A guarantee to perform the Work by one or more parent corporations or subsidiaries, or by one or more unrelated corporations that have a substantial business relationship with the Respondent; or
5. A demonstration that the Respondent satisfies the requirements of 40 C.F.R. § 264.143(f).

B. If Respondent seeks to demonstrate its ability to complete the Work through a guarantee by a third party pursuant to Paragraph A.4 of this Section, Respondent shall demonstrate that the guarantor satisfies the requirements of 40 C.F.R. § 264.143(f). If Respondent seeks to demonstrate its ability to complete the Work by means of the financial test or the corporate guarantee, Respondent shall resubmit sworn statements conveying the information required by 40 C.F.R. § 264.143(f) annually, on the anniversary of the effective date of this Order. In the event that EPA determines at any time that the financial assurances provided pursuant to this Section are inadequate, Respondent shall, within thirty (30) days of receipt of notice of EPA's determination, obtain and present to EPA for approval one of the other forms of financial assurance identified in Paragraph A of this Section. Respondent's inability to demonstrate financial ability to complete the Work shall not excuse performance of any activities required under this Order.

C. Subject to this Paragraph, such financial assurance shall be maintained by the Respondent until EPA determines in accordance with Section XX of this Order (Certification of Completion of the Work) that all Work required pursuant to this Order has been fully performed and all applicable Performance Standards have been met. If Respondent can show that the estimated cost to complete the remaining Work has diminished below the amount set forth in Section XIV.A of this Order, Respondent may request, in writing, a reduction in the amount of the financial security provided under this Section to the estimated cost of the remaining work to be performed. Respondent may reduce the financial assurance only in accordance with EPA's written approval of such request.

XV. INSURANCE

A. During the pendency of this Order, Respondent shall satisfy, and shall ensure that its contractor(s) and subcontractor(s) satisfy, all applicable laws and regulations regarding the provision of worker's compensation insurance for all persons retained to perform Work pursuant to this Order.

B. No later than fifteen (15) days before commencing any on-Site Work, Respondent shall secure and maintain, or shall ensure that its contractor(s) and subcontractor(s) secure and maintain, until the first anniversary of EPA's certification of completion of the Work pursuant to Section XX (Certification of Completion of the Work) of this Order, comprehensive general liability insurance with limits of at least five million dollars ($5,000,000), combined single limit, naming as additional insured the EPA.

C. No later than fifteen (15) days after the effective date of this Order, Respondent shall secure automobile liability insurance with limits of five hundred thousand dollars ($500,000) and shall maintain such insurance until the first anniversary of EPA's certification of completion of the Work pursuant to Section XX of this Order.

D. No less than fourteen (14) days prior to commencement of on-Site Work under this Order, Respondent shall provide to EPA certificates of comprehensive general liability and automobile insurance and a copy of each insurance policy. Respondent shall resubmit such certificates and copies of policies each year on the anniversary date of the policies.

E. If Respondent demonstrates by evidence satisfactory to EPA that any contractor or subcontractor retained to perform Work pursuant to this Order maintains insurance equivalent to that described above, or insurance covering the same risks but in a lesser amount, then, with respect to matters so insured by that contractor or subcontractor, Respondent need provide only that portion of the insurance described above which is not maintained by the contractor or subcontractor.

F. Respondent may satisfy the provisions of this Section XV (Insurance) if Respondent submits to EPA for approval one of the financial assurance mechanisms of Section XIV of this Order (Assurance of Ability to Complete Work) in at least the amounts stated in Paragraphs B and C of this Section (Insurance), thereby demonstrating that Respondent is able to pay any claims arising out of Respondent's performance of its obligations under this Order. Such financial assurance mechanism shall meet all of the requirements of Section XIV (Assurance of Ability to Complete Work) of this Order. If Respondent seeks to utilize one of the financial assurance mechanisms set forth in Section XIV (Assurance of Ability to Complete Work) to satisfy the provisions of this Section (Insurance), Respondent must demonstrate an ability to pay the amounts required under this Section (Insurance) above and beyond that required by the obligations of Section XIV (Assurance of Ability to Complete Work).

XVI. NOTICE OF OBLIGATIONS AND TRANSFER OF INTERESTS

A. With respect to any property owned or controlled by the Respondent that is located within the Site, within fifteen (15) days after the effective date of this Order, the Respondent shall submit to EPA for review and approval a notice to be filed with the Recorder Of Deeds Office, New Castle County, Delaware ("Title Notice"), which shall provide notice to all successors-in-title that the property is part of the Site, that EPA selected a remedy for the Site on September 30, 2005, and that EPA has issued the Respondent this Order requiring the Respondent to implement the requirements of the ROD. Each such Title Notice shall identify the administrative docket number of this Order and the effective date of this Order. Each such Title Notice shall recite the Respondent's specific obligations to provide access to and restrict use of the Site pursuant to Section VIII of this Order. Respondent shall record the Title Notice within ten (10) days of EPA's approval of the Title Notice. The Respondent shall not modify or release such Title Notice without prior written approval of EPA. The Respondent shall provide EPA with a certified copy of the recorded Title Notice within ten (10) days of recording of such Title Notice.

B. Within fifteen (15) days after the effective date of this Order, the Respondent shall record a certified copy of this Order with the Recorder of Deeds Office for New Castle County, Delaware, in such manner as shall be effective to bring this Order to the attention of any person examining or researching the Site and/or quality of the title to any real property constituting the Site or searching for any encumbrances, covenants, easements, liens, restrictions, or other limitations relating to said property. At a minimum, such recording shall be made in the Grantor/Grantee and Lot/Block indices of the Land Records for the Site. Thereafter, each deed, title, or other instrument of conveyance for property included in the Site executed by Respondent shall contain a notice stating that the property is subject to this Order and any lien held by EPA pursuant to Section 107(1) of CERCLA, 42 U.S.C. § 9607(1), and shall reference the recorded locations of this Order, the Title Notice, and any restrictions applicable to the property under this Order.

C. At least thirty (30) days prior to the conveyance by Respondent of any interest in property located within the Site including, but not limited to, fee interests, leasehold interests, and mortgage interests, the Respondent shall give the grantee or transferee-in-interest written notice of (I) this Order and (ii) any Site access and use restriction requirements set forth in Section VIII (Access to and Use of the Site). At least thirty (30) days prior to such conveyance, Respondent shall also give written notice to EPA and the State of the proposed conveyance, including the name, address, and telephone number of the grantee or transferee-in-interest, and the date on which notice of this Order and Site access and use restriction requirements was given to the grantee.

D. In the event of any such conveyance, Respondent's obligations under this Order including, but not limited to, its obligation to provide access to and restrict use of the Site pursuant to Section VIII (Access to and Use of the Site), shall continue to be met by Respondent. In no event shall the conveyance release or otherwise affect Respondent's obligation to comply with all provisions of this Order, absent the prior written consent of EPA.

XVII. RECORD RETENTION

A. Respondent shall preserve and retain all records and documents now in its possession or control or which come into its possession or control that relate in any manner to the performance of the Work, implementation of this Order, or liability of any person, including Respondent, for the response actions conducted and to be conducted at the Site, regardless of any document retention policy to the contrary, for a minimum of ten (10) years after the Respondent's receipt of EPA's notification pursuant to Section XX (Certification of Completion of the Work) of this Order.

B. Respondent shall use its best efforts to obtain copies of all documents relating in any way to the Site and which are in the possession of its employees, agents, accountants, contractors, subcontractors, consultants, or attorneys. Respondent shall ensure that any agreement between Respondent and any agent, contractor, subcontractor, consultant, or other person retained to perform or oversee Work pursuant to this Order shall explicitly require said agent, contractor, subcontractor, consultant, or other person to maintain and preserve, during the pendency of this Order and for a minimum of ten (10) years after Respondent's receipt of EPA's notification pursuant to Paragraph XX (Certification of Completion of the Work), all data, records, and documents within their respective possession or control which relate in any way to this Order or to hazardous substance management and/or disposal at the Site.

C. Upon conclusion of this document retention period, Respondent shall notify EPA at least ninety (90) days prior to the destruction of any such records, documents or information, and, upon request of EPA and subject to Paragraphs B, C and of Section XVIII (Access to Information) of this Order, Respondent shall deliver all such records, documents and information to EPA. In no event shall Respondent destroy such records, documents or information until EPA responds in writing approving such destruction.

XVIII. ACCESS TO INFORMATION

A. Subject to the limitations contained in Paragraphs B, C and D of this Section, Respondent shall provide to EPA, within thirty (30) days of receipt of a request by EPA, copies of all documents and information within its possession or control or that of its contractors, subcontractors, or agents relating to activities at the Site or to the implementation of this Order including, but not limited to, sampling data, analyses of samples, field notes, contractual documents, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information related to the Work. Respondent shall also make available to EPA for purposes of investigation, information gathering, or testimony, its employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work. Upon reasonable notice, Respondent and/or its contractors or subcontractors shall make themselves available for such meetings, conferences, and/or inspections with EPA, or its representatives, as may be necessary for EPA to oversee the performance of Work required by this Order.

B. Respondent may assert business confidentiality claims covering all or part of the documents or information submitted to EPA under this Order to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and 40 C.F.R. § 2.203(b). Such assertion shall be made in the manner described in 40 C.F.R. § 2.203(b) and substantiated in accordance with 40 C.F.R. § 2.204(e)(4) at the time the assertion is made. Documents or information determined to be confidential by EPA (hereinafter referred to as "CBI") will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B. If no claim of confidentiality accompanies documents or information when they are submitted to EPA, or if EPA has notified Respondent that the documents or information are not confidential under the standards of Section 104(e)(7) of CERCLA or 40 C.F.R. Part 2, the public may be given access to such documents or information without further notice to Respondent. No claim of confidentiality shall be made with respect to any data including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, or engineering data, or any other documents or information evidencing conditions at or around the Site.

C. Respondent shall maintain, for the period during which this Order is in effect, an index of documents, if any, that Respondent is claiming as CBI and has substantiated as such. The index shall contain, for each document, the date, author, addressee and subject of the document. Upon written request by EPA, Respondent shall submit a copy of the index to EPA.

D. Respondent's obligation to disclose information requested by EPA pursuant to this Order is subject to applicable privileges recognized by Federal Courts under Federal law, provided that no sample results or analytical data shall be claimed as privileged. If the Respondent asserts such a privilege, it shall provide EPA with the following: (1) the title of the document, record, or information; (2) the date of the document, record, or information; (3) the name and title of the author of the document, record, or information; (4) the name and title of each addressee and recipient; (5) a description of the contents of the document, record, or information; and (6) the nature and basis of the privilege asserted by Respondent.

E. Respondent shall cooperate with EPA to ensure that all data generated as part of the Work to be performed under this Order is maintained in a computerized system that is compatible with EPA's system. The means of storing and manipulating data generated as part of the Work shall be described in a Data Management Plan, as a component of the SAP. Upon request by EPA, Respondent's computerized data bases shall be provided to EPA within sixty (60) days of said request.

XIX. COMMUNITY RELATIONS

Respondent shall cooperate with EPA and the State in providing information regarding the Work to the public. As requested by EPA, Respondent shall participate in the preparation of such information for dissemination to the public and in public meetings which may be held or sponsored by EPA to explain activities taking place at or concerning the Site.

XX. CERTIFICATION OF COMPLETION OF THE WORK

A. Completion of the Remedial Action

1. Within thirty (30) days after Respondent concludes that the Remedial Action has been fully performed in accordance with this Order and any modifications or amendments made hereto, and the applicable Performance Standards have been attained, Respondent shall so certify to EPA in writing and shall schedule and conduct a pre-certification inspection to be attended by the EPA Remedial Project Manager, a Registered Professional Engineer, and Respondent's Project Coordinator. Respondent shall also provide written notice to the State at least ten (10) days prior to the scheduled date of the inspection, and invite the State to such pre-certification inspection. If, after the pre-certification inspection, Respondent still believes that the Remedial Action has been fully performed in accordance with this Order and the applicable Performance Standards have been attained, Respondent shall submit a written report to EPA for approval pursuant to Section XIII (Plans and Reports Requiring EPA Approval) within thirty (30) days of the inspection. In the report, the Registered Professional Engineer ("RPE") and a Duly Authorized Representative of the Respondent shall certify pursuant to Paragraph XIII.B. that the Remedial Action has been completed in full satisfaction of the requirements of this Order. The written report shall include as-built drawings signed and stamped by the RPE and certified as required by Paragraph XIII.B. of this Order. If, after completion of the pre-certification inspection and receipt and review of the written report or any subsequent notification of completion by Respondent, EPA determines that the Remedial Action or any portion thereof has not been completed in accordance with this Order or that the applicable Performance Standards

have not been achieved, EPA will notify Respondent in writing of the activities that must be undertaken to complete the Remedial Action and/or achieve the applicable Performance Standards. EPA will set forth in the notice a schedule for performance of such activities consistent with the Order or require the Respondent to submit a schedule to EPA for approval pursuant to Section XIII (Plans and Reports Requiring EPA Approval). Respondent shall perform all activities described in the notice in accordance with the specifications and schedules established pursuant to this Paragraph.

2. If EPA concludes, based on the initial or any subsequent Certification of Completion by Respondent, that the Remedial Action has been fully performed in accordance with this Order and that the applicable Performance Standards have been achieved, EPA will so certify in writing to Respondent. This certification shall constitute the Certification of Completion of the Remedial Action for purposes of this Order. Certification of Completion of the Remedial Action shall not affect Respondent's obligations under this Order that continue beyond the Certification of Completion including, but not limited to, access, land use restrictions and institutional controls, O&M, record retention, indemnification, insurance, payment of fines, and any work to be conducted under Section VI.G. (Additional Response Activities), Section VI.D. (Reporting Requirements/ Progress Reports), Section XI (EPA Periodic Review), Section XVII (Record Retention), Section XVIII (Access to Information), and Section XIX (Community Relations). This certification shall not limit EPA's right to perform periodic reviews pursuant to Section 121(c) of CERCLA, 42 U.S.C. § 9621(c).

B. Completion of the Work

1. Within thirty (30) days after Respondent concludes that all phases of the Work required by this Order (including O&M) have been fully performed and that all Performance Standards required by this Order have been attained, Respondent shall so notify EPA's Remedial Project Manager by submitting a written report by an RPE certifying that the Work has been completed in full satisfaction of the requirements of this Order. The report shall also contain a sworn certification from a Duly Authorized Representative of Respondent in the form required by Paragraph XIII.B. of this Order. If, after review of the written report, EPA determines that any portion of the Work has not been completed in accordance with this Order and/or that the applicable Performance Standards have not been achieved, EPA will notify Respondent in writing of the activities that must be undertaken to complete the Work. EPA will set forth in the notice a schedule for performance of such activities consistent with the Order or require the Respondent to submit a schedule to EPA for approval pursuant to Section XIII (Plans and Reports Requiring EPA Approval). Respondent shall perform all activities described in the notice in accordance with the specifications and schedules established therein.

2. If EPA concludes, based on the initial or any subsequent Certification of Completion by Respondent, that the Work has been fully performed in accordance with this Order and that the applicable Performance Standards have been achieved, EPA will so notify the Respondent in writing.

XXI. NON-LIABILITY OF EPA

By issuing this Order, EPA assumes no liability for any injuries or damages to persons or property resulting from acts or omissions of Respondent or its directors, officers, employees, agents, representatives, successors, assigns, contractors, subcontractors, or consultants in carrying out any action or activity pursuant to this Order. Neither EPA nor the United States may be deemed to be a party to any contract entered into by Respondent or its directors, officers, employees, agents, successors, assigns, contractors, subcontractors, or consultants in carrying out any action or activity pursuant to this Order.

XXII. ENFORCEMENT AND EPA'S RESERVATION OF RIGHTS

A. EPA reserves all rights, claims, interests, and defenses it has under CERCLA or any other law or in equity.

B. Nothing herein shall be construed to prevent EPA from seeking legal or equitable relief to enforce the terms of this Order, to seek injunctive relief, and/or to seek the imposition of statutory penalties or punitive damages.

C. EPA reserves all rights, including the right to institute legal action against the Respondent in connection with the performance of any response actions not addressed by this Order.

D. EPA reserves the right to disapprove of Work performed by Respondent pursuant to this Order, to require that Respondent correct and/or re-perform any and all Work disapproved by EPA, and to require that Respondent perform response actions in addition to those required by this Order.

E. EPA reserves the right to take enforcement actions, including actions for monetary penalties, for any violation of law, regulation, or of this Order. Failure to comply with this Order subjects Respondent to the assessment of civil penalties of up to $32,500/day and/or punitive damages in an amount up to three times the amount of any costs incurred by the United States as a result of such failure pursuant to Sections 106(b) and 107(c) of CERCLA, 42 U.S.C. §§ 9606(b) and 9607(c). EPA may also undertake other actions as it may deem necessary or appropriate for any purpose including, but not limited to, actions pursuant to Sections 104 and/or 106 of CERCLA, 42 U.S.C. §§ 9604 and/or 9606.

F. EPA reserves the right to undertake removal and/or remedial actions, including all actions required by this Order, at any time such actions are appropriate under CERCLA and the NCP, and to seek reimbursement from Respondent for any costs incurred.

G. EPA reserves the right to bring an action against Respondent pursuant to Section 107 of CERCLA, 42 U.S.C. § 9607, for recovery of all response costs incurred by the United States in connection with this Order and not reimbursed by Respondent, as well as any other costs incurred by the United States in connection with response actions conducted pursuant to CERCLA at or in connection with the Site. The response costs included in this reservation include, but are not limited to, past costs, direct costs, indirect costs, the costs of oversight, the costs of analyzing the cost documentation to support oversight cost demand, as well as accrued interest as provided in Section 107(a) of CERCLA, 42 U.S.C. § 9607(a).

H. Without limitation of any other provision in this Order, EPA reserves the right to bring actions against, and/or issue orders to, Respondent pursuant to applicable authorities for any purpose including, but not limited to, performance of response actions other than those performed by Respondent pursuant to this Order. EPA also reserves the right to amend this Order and require any and all additional Work EPA deems necessary to implement the ROD.

XXIII. EFFECT OF ORDER/INVALIDATION OF A PROVISION

A. Nothing herein shall constitute or be construed as a satisfaction or release from liability of Respondent or any other person.

B. Nothing in this Order shall constitute or be construed as a release from any claim, cause of action, or demand in law or equity against any person, firm, partnership, or corporation not bound by this Order for any liability it may have arising out of or relating in any way to the generation, storage, treatment, handling, transportation, release, or disposal of any hazardous substances found at, taken to, or taken from the Site.

C. This Order does not constitute any decision on pre-authorization of funds under Section 111(a)(2) of CERCLA, 42 U.S.C. § 9611(a)(2).

D. Invalidation of any provision or requirement of this Order shall not affect the validity of any other provision or requirement of this Order.

XXIV. EFFECTIVE DATE AND OPPORTUNITY TO CONFER

A. This Order is deemed issued on the date it is signed by EPA. This Order shall become effective thirty (30) days following the date on which it is issued.

B. Not later than twenty (20) days from the date of issuance of this Order, Respondent may confer with EPA to discuss the scope and applicability of this Order, the findings upon which this Order is based, the appropriateness of any action or activity required to be undertaken hereby, or other issues directly relevant to issuance of this Order. Such a conference is not, and shall not be deemed to be, an adversarial hearing or part of a proceeding to challenge this Order, and no official stenographic record of such proceeding shall be kept. Any request for a conference within the prescribed time frame shall be made to:

Andrew S. Goldman (3RC42)
Sr Assistant Regional Counsel
U.S. Environmental Protection Agency
1650 Arch Street
Philadelphia, PA 19103
Telephone: (215) 814-2487
Fax:(215) 814-2602

XXV. NOTICE OF INTENT TO COMPLY

A. No later than two (2) days after the effective date of this Order, Respondent shall provide notice in writing to EPA's Remedial Project Manager stating whether Respondent will comply with the terms of this Order. If Respondent does not unequivocally and unqualifiedly commit to perform all the Work required by this Order in such notice, EPA will assume that Respondent has decided not to comply with the terms of the Order and Respondent will be deemed to be in violation of this Order. Respondent shall describe, using facts that exist, on or prior to the effective date of this Order, any "sufficient cause" defenses asserted by Respondent within the meaning of Sections 106(b) and 107(c)(3) of CERCLA, 42 U.S.C. §§ 9606(b) and 9607(c)(3). The absence of a response by EPA to the notice required by this Section shall not be deemed to be acceptance of Respondent's assertions nor as a position taken by the Agency with regard to those assertions.

B. Failure of Respondent to provide such notice shall be a violation of this Order and deemed to be a decision by Respondent not to comply with the terms of this Order. Said failure to comply may trigger an Agency decision to file a judicial action or to initiate a Superfund response action at the Site.

XXVI. ADMINISTRATIVE RECORD

The Administrative Record compiled in support of issuance of this Order may be reviewed at the EPA Region III offices by contacting the EPA Remedial Project Manager. A copy of the index to the Administrative Record is appended to this Order as Attachment 4.

XXVII. MODIFICATIONS

A. Modification to any document submitted to and approved or accepted by EPA pursuant to this Order may be made in writing by EPA. The effective date of such modification shall be the date on which the Respondent receives notice of such modification.

B. Except as otherwise provided in Paragraph A of this Section XXVII, the provisions of this Order may be modified at any time, in writing, solely by the Director of the EPA Region III Hazardous Site Cleanup Division.

IT IS SO ORDERED.

ABRAHAM FERDAS
Director, Hazardous Site Cleanup Division
EPA Region III

9/25/06
Date

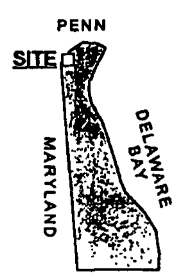
EPA Docket No. CERC-03-2006-0266DC

ATTACHMENT 1

MAP SOURCE:
UNITED STATES GEOLOGICAL SURVEY
7.5 MINUTE TOPOGRAPHIC QUADRANGLE
SERIES "NEWARK EAST, DE" (1993) AND
"WILMINGTON SOUTH, DE-NJ" (1993)

2000 0 2000

APPROXIMATE SCALE IN FEET



FORMER KOPPERS COMPANY, INC. NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION

SITE LOCATION MAP

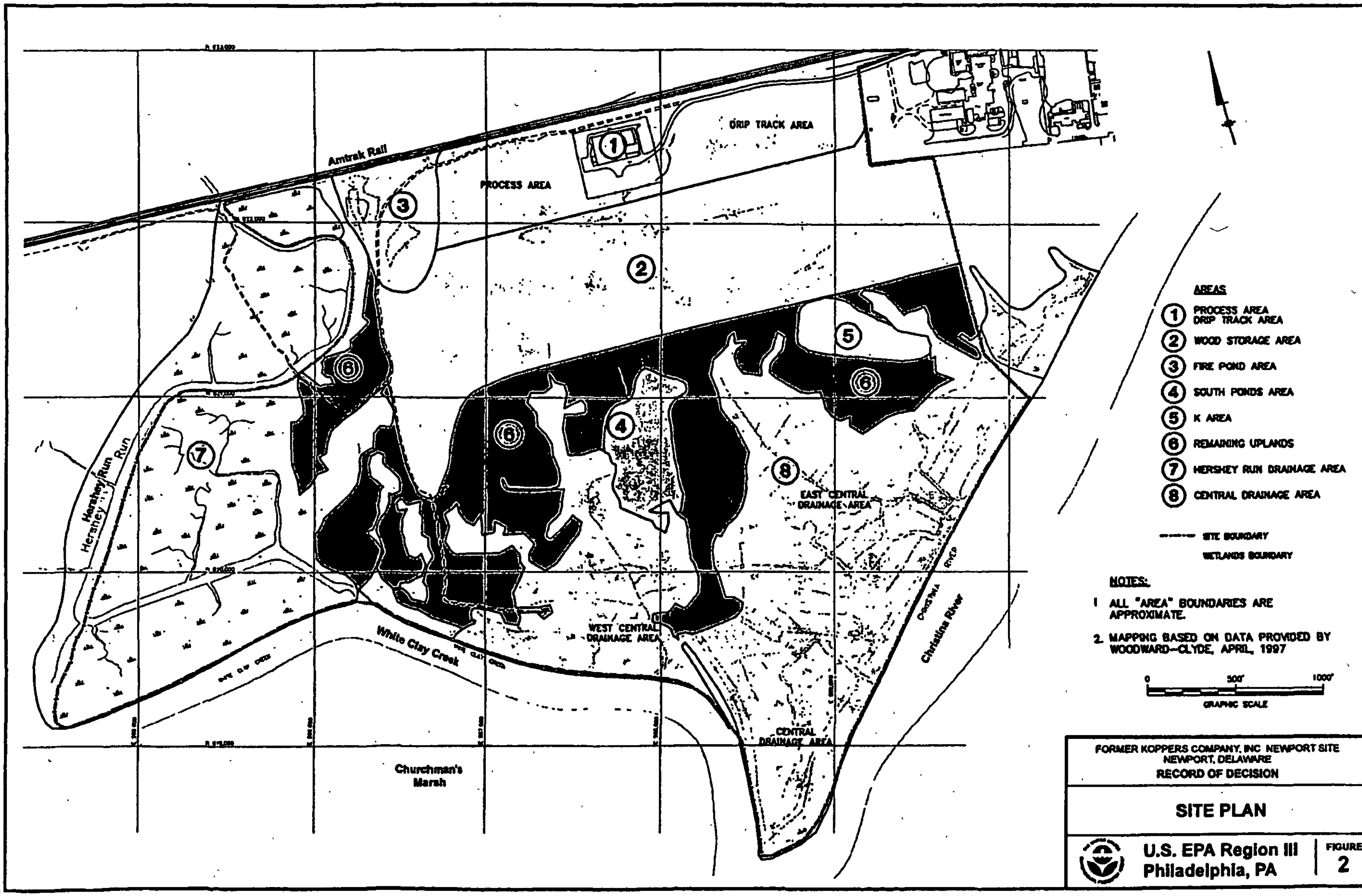
U.S. EPA Region III
Philadelphia, PA

FIGURE
1

AR316111

EPA Docket No. CERC-03-2006-0266DC

ATTACHMENT 2


Amtrak Rail
DRIP TRACK AREA
PROCESS AREA
Hershey Run
White Clay Creek
Churchman's Marsh
EAST CENTRAL DRAINAGE AREA
WEST CENTRAL DRAINAGE AREA
CENTRAL DRAINAGE AREA
Christina River
AREAS
1 PROCESS AREA DRIP TRACK AREA
2 WOOD STORAGE AREA
3 FIRE POND AREA
4 SOUTH PONDS AREA
5 K AREA
6 REMAINING UPLANDS
7 HERSHEY RUN DRAINAGE AREA
8 CENTRAL DRAINAGE AREA
SITE BOUNDARY
WETLANDS BOUNDARY
NOTES:
1 ALL "AREA" BOUNDARIES ARE APPROXIMATE.
2. MAPPING BASED ON DATA PROVIDED BY WOODWARD-CLYDE, APRIL, 1997
0 500' 1000'
GRAPHIC SCALE
FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION
SITE PLAN
U.S. EPA Region III
Philadelphia, PA
FIGURE 2

AR316112

EPA Docket No. CERC-03-2006-0266DC

ATTACHMENT 3

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IV. TABLES

AR315902

V. FIGURES

Note: Base Figures 1-6 and 8-12 were prepared by BBL, Inc, provided by Beazer East, and were modified by EPA

RECORD OF DECISION
KOPPERS CO , INC (NEWPORT PLANT)
SUPERFUND SITE

DECLARATION

Site Name and Location

Koppers Co , Inc (Newport Plant) Superfund Site
Newport / New Castle County, Delaware
CERCLIS ID Number DED980552244

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Koppers Co , Inc Superfund Site ("Site" or "Koppers") located just outside of Newport, in New Castle County, Delaware, (see Figure 1) which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA"), as amended, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C F R Part 300 This decision document explains the factual and legal basis for selecting the remedial action for this Site The information supporting this decision is contained in the Administrative Record for this Site

The Delaware Department of Natural Resources and Environment Control ("DNREC") concurs with the selected remedy

Assessment of the Site

Pursuant to duly delegated authority, I hereby determine, pursuant to Section 106 of CERCLA, 42 U S C. § 9606, that actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision ("ROD"), may present an imminent and substantial endangerment to public health, welfare, or the environment

Description of the Remedy

The remedial action described here comprises a comprehensive remedy for the Site Wood-treating operations conducted at the Site have resulted in residual contamination, mainly of creosote constituents (primarily quantified as total polycyclic aromatic hyrdocarbons, or "total PAHs"), in soils, sediments and ground water, with some areas having very high levels of contamination, including liquid creosote, a non-aqueous phase liquid ("NAPL") with a density only slightly greater than water This contamination is considered to be a principal threat waste since it is a continuous source for ground water contamination The remedial action addresses contaminated soils in upland areas of the Site (including the "Process Area", "Drip Track", and "Wood Storage Yard"), contaminated sediments in wetland areas of the Site (including the "Fire

Pond", "South Ponds", "K Area", "Hershey Run", "Hershey Run Marsh", and the "Western Central Marsh"), and contaminated ground water throughout the Site

The selected remedy includes

1. Excavating and consolidating all contaminated soils and sediments (soils with total PAHs greater than 600 mg/kg and sediments with total PAHs greater than 150 mg/kg) into one or two on-site landfills or containment areas, herein referred to collectively as "the Containment Area," to be located in the areas of the worst NAPL contamination,

1 Installing, operating and maintaining a ground water treatment system (e g , liquid carbon filtration) to prevent the migration of contaminated ground water, as well as to prevent the discharge of contaminated ground water from the recovery operation, and an oil-water separator (e g , belt skimmer or baffle tank) to facilitate the recovery of free-phase NAPL, as well as to prevent NAPL from reaching the ground water treatment system,

2 Treating ground water as necessary to meet discharge requirements,

3 Constructing ground water barrier walls and collection systems (e g , passive recovery trenches) in the Containment Area to prevent further migration of ground water contamination, including NAPL,

4 Managing the hydraulic head of ground water and collecting NAPL contamination in the ground water through the use of the passive recovery trenches,

5 Separating creosote from ground water and transporting creosote off-site for disposal or recycling in accordance with Section 121(d)(3) of CERCLA,

6 Moving debris to a location on-site where they can be placed under the RCRA (Resource Conservation and Recovery Act) modified cap,

7 Installing a RCRA modified cap across the Containment Area,

8 Relocating a portion of the existing channel of Hershey Run, if the Containment Area shall extend into the Hershey Run wetlands,

9. Creating wetlands to replace any that are filled in as part of the landfill construction,

10 Monitoring ground water, surface water, sediments and wetlands to ensure the effectiveness of the remedy,

11 Prevent exposure to contamination inside the Containment Area or in ground water beneath the Site, and prevent the drawdown of contamination into the deeper aquifer or elsewhere, through land and ground water use restrictions for the Site and surrounding area (as appropriate)

Data Certification Checklist

The following information is included in the Decision Summary of this ROD Additional information can be found in the Administrative Record for this Site.

ROD CERTIFICATION CHECKLIST	
Information	Location/Page Number
Chemicals of concern and respective concentrations	Section 7 1 1, Page 8 Tables 1, 2, 3, 4, 5
Baseline risk	Section 7 1, Page 7 Tables 7, 8
Clean-up levels and the basis for these levels	Section 8, Page 18 Section 11 2, Page 35
How source materials constituting principal threat are addressed	Section 2, Page 1 Section 4, Page 3 Section 8, Page 18 Section 11 1, Page 34 Figures 4 – 7, 11
Current and reasonably anticipated future land use assumptions and potential future beneficial uses of ground water	Section 6, Page 6 Section 11 4, Page 44
Potential future land and ground water use that will be available at the Site as a result of the selected remedy	Section 6, Page 6 Section 11 4, Page 44
Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected	Section 12 3, Page 46 Table 10
Key factors that led to selecting the remedy	Section 10, Page 27 Section 11 1, Page 34

Statutory Determinations

The selected remedial action is protective of human health and the environment, complies with federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e , reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment)

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment Such reviews will be conducted every five years thereafter, until EPA determines that hazardous substances remaining at the Site do not prevent unlimited use and unrestricted exposure at the Site.

Abraham Ferdas, Director
Hazardous Site Cleanup Division
EPA Region III

9/30/05
Date

II. DECISION SUMMARY

KOPPERS CO., INC. (NEWPORT PLANT) SUPERFUND SITE

NEWPORT / NEW CASTLE COUNTY, DELAWARE

1.0 SITE NAME, LOCATION AND DESCRIPTION

The Koppers Co , Inc. (Newport Plant) Superfund Site ("Site" or "Koppers") is comprised of approximately 300 acres and is located in the northern part of New Castle County, in the State of Delaware, southwest of the town of Newport and northwest of the Route I-95 and Route 141 interchange (see Figures 1 and 2), and includes the areal extent of contamination from the property To the north, the Site is bordered by high-speed railroad lines Beyond the rail lines are a former municipal sewage treatment facility, an industrial property, and a residential area To the east, the Site is bordered by the former DuPont Holly Run Plant and the Christina River To the south and west, the Site is bordered by White Clay Creek and Hershey Run, respectively To the west of the Site, across Hershey Run, lies the Bread and Cheese Island property The Site previously contained a wood-treatment facility The Site consists of 163 acres of upland areas, 136 acres of wetlands, and three ponds Soil and ground water at the Site are contaminated as a result of past wood-treatment activities. Contamination at the Site is present in the following areas 1) upland soils, 2) Hershey Run, 3) the Fire Pond, 4) the South Pond area (the non-tidal South Pond itself and the tidal West Central Drainage area), 5) the K Pond area and 6) ground water (see Figure 2) Only the East Central and Central Drainage Areas (the marshes bordering the Christina River) and the wooded uplands to the south of the former facilities are generally free of site-related contaminants The Comprehensive Environmental Response, Compensation, and Liability Information System ("CERCLIS") identification number for this Site is DED980552244

The U S Environmental Protection Agency ("EPA") is the lead agency for Site activities and the Delaware Department of Natural Resources and Environment Control ("DNREC") is the support agency EPA has reached prior settlements with potentially responsible parties ("PRPs") under which the PRPs have performed a Remedial Investigation and Feasibility Study and maintained the Site

This action addresses contamination in the sediments, soils and ground water at the Site in the areas designated by Figures 4-6 This action comprises a comprehensive remedy for the Site, and no further actions are anticipated

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

In 1929, a group of parcels comprising the Site was conveyed by Lynam and Wright to the Delaware Wood Preserving Company, which began conducting wood-treatment operations on the property In 1931, the Site was sold to Century Wood Preserving Company (Century) Four years later in 1935, the Wood Preserving Company acquired the property and all associated stock from Century Through liquidation of the Wood Preserving Company, Koppers Company acquired the Site in 1940 and reorganized in 1944 into Koppers Company, Inc (Koppers) Koppers then continued wood-treatment operations at the Site until 1971, when the property was sold to DuPont The Site has remained largely inactive since wood-treating operations ceased in 1971

From 1974 to 1977, the New Castle County Department of Public Works leased the northern part of the Site, and then built and operated a wastewater treatment facility to temporarily maintain the County's wastewater treatment capabilities until permanent facilities were built In 1977, the County sold the building to DuPont and discontinued wastewater treatment operations at the Site

The primary material used in the wood-treatment processes was a creosote/coal tar solution, which was used to preserve railroad ties, telephone poles, and other wood products (this is typical of the type of wood-treatment used today for railroad ties and telephone poles) Pentachlorophenol (PCP) was also used to treat the wood, although to a much smaller degree Throughout a large area of the Site (approximately two-thirds of the operations area), an array of railroad tracks provided for the movement of wood and materials to and from the Site Based on available records, former Site areas where creosote handling occurred included the Process Area and Drip Track Area (Figure 2)

Located in the northwestern portion of the Site, the Process Area was utilized for the application of wood preservatives and contained various types of wood-treatment equipment and associated structures This area also provided storage for approximately 1,000,000 gallons of creosote and other process-related materials The treatment consisted of heating and pressurizing tanks filled with creosote and wood, forcing the creosote into the wood After treatment, the freshly-treated wood products were temporarily allowed to cure and drip dry in the Drip Track Area prior to transfer to the Wood Storage Area The Fire Pond was created as a source of water for fire-fighting purposes

Sloppy operations, including spills and leaks, allowed contaminants to seep into the soil It is likely that the contaminants escaped into Hershey Run by flowing as a separate phase with the shallow ground water, or by being washed toward Hershey Run during storm events.

The Site was identified as a potential hazardous waste site in 1979 Following multiple subsequent investigations, the Site was proposed to the NPL in 1989, and formally listed on August 30, 1990 In 1991, Beazer East ("Beazer," the successor corporation to Koppers) and DuPont (the land owner at that time, Beazer has since acquired the property from DuPont) signed an agreement with EPA to conduct the Remedial Investigation/Feasibility Study (RI/FS)

In 1991, an Administrative Order on Consent was signed by EPA and the PRPs, requiring the PRPs to conduct a Remedial Investigation and Feasibility Study ("RI/FS") at the Site These reports and other documentation provided in the Administrative Record provide the basis for the determinations found in this Record of Decision

3.0 COMMUNITY PARTICIPATION

The Koppers Remedial Investigation, Feasibility Study, and Baseline Risk Assessment, and other Administrative Record documents relating to the Site, were made available to the public They are located in the Administrative Record, which can be viewed at http //www epa gov/arweb, or at the Administrative Record link on the sidebar of the U.S EPA Region 3 Hazardous Site Cleanup Division Homepage at http //www epa gov/reg3hwmd In addition, the detailed Administrative Record can be examined at the following locations

Kirkwood Public Library	Delaware Department of Natural Resources & Environmental Control	Admin Records Room
6000 Kirkwood Highway	Superfund Branch	US EPA Region III
Wilmington, DE 19808	391 Lukens Drive	1650 Arch Street
(302) 995-7663	New Castle, DE 19720	Philadelphia, PA 19103
	(302) 395-2600	(215) 814-3157
		(Please call ahead)

The notice of availability of these documents was published in the *Wilmington News Journal* on October 7, 2004 In addition, EPA sent a fact sheet summarizing the Agency's preferred remedial alternative for the Site to residences and businesses within an approximately one-mile radius of the Site in October 2004

From October 7, 2004 to December 7, 2004, EPA held a 60-day public comment period to accept public comments on the remedial alternatives presented in the *Feasibility Study* and the Proposed Plan and the other documents contained within the Administrative Record for the Site On October 21, 2004, EPA held a public meeting to discuss the Proposed Plan and accept comments. A transcript of this meeting is included in the Administrative Record The summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary, which is a part of this Record of Decision

4.0 SCOPE AND ROLE

The actions proposed by EPA in this document constitute a comprehensive approach for addressing all of the environmental problems at the Site The actions proposed at this time are expected to be the final actions that will be necessary to completely address the risks from the contamination at the Site There have been no previous cleanup efforts at the Site by EPA or the State

5.0 SITE CHARACTERISTICS

5.1 Surface Features, Soil and Geology, and Hydrogeology

Surface Features and Resources. The Site is located in the Coastal Plain Physiographic Province in New Castle County, Delaware (see Figure 1), near the fall line with the Piedmont Physiographic Province.

Existing facilities/structures and other physical features at the Site include one warehouse building (constructed by the New Castle Department of Public Works), a paved access road, and secondary roads providing access to overhead power lines that traverse the Site Generally, the railroad lines once present throughout the Site no longer exist.

Access to the Site is restricted through the use of 24-hour security-guarded gates at the CibaSC facility, fencing, and posting Natural barriers, such as the Christina River, White Clay Creek, and Hershey Run, and the surrounding marshes and wetlands also limit access to the Site, as does the high-speed Amtrak rail line to the north (see Figure 2) However, signs of trespass, including spent shotgun shells, numerous hunting blinds and well-worn foot paths, have been found

The Site consists of 163 acres of upland areas, 136 acres of wetlands and three ponds Wetlands cover approximately 45 percent of the Site and dominate the southern and western portions The wetland cover types include freshwater tidal marsh (115 acres), non-tidal emergent wetlands (11 acres), non-tidal forested wetlands (9 acres), and non-tidal scrub/shrub wetlands (1 acre) Tidal wetlands at the Site individually drain into Hershey Run, White Clay Creek and the Christina River Non-tidal wetlands occur in the South Ponds Area, K Area, Fire Pond Area, and approximately 15 smaller disjunct non-tidal wetlands occupy low-lying areas in the uplands of the Process and Wood Storage Areas

White Clay Creek is Delaware's only "National Wild and Scenic River," a designation that is administered by the National Park Service (NPS) under the authority of the Wild and Scenic Rivers Act of 1968 The final reach of White Clay Creek, from the southern boundary of United Water Delaware Corporation's property (where the Amtrak lines cross the Creek) to the confluence with the Christina River, is the nearest and adjacent section of the Creek to hold this designation Work at the Site will be conducted in consultation with the NPS in order to ensure that cleanup work at the Site does not negatively affect this reach

Several plants that occur on Delaware's Rare Native Vascular Plant List exist at the Site These plants include the swamp white oak, sessile leaved tick-trefoil, swamp milkweed, and closed gentian While it is not expected that these plants will be impacted by the remedy, this will be evaluated in further detail during design work

The Site may contain suitable habitat for the bog turtle, a federally endangered species A survey to determine whether or not it is present will be conducted during the Remedial Design The State has recently reported that a bald eagle was observed nesting on Bread and Cheese Island, adjacent to the Site

Soil and Geology. Figure 3 shows a geological cross-section of the Site Fill is the uppermost unit encountered in the uplands area, and varies in thickness from 0 to approximately 9 ft with greater thicknesses observed in the Process Area and Fire Pond Area The fill is composed primarily of silts with lesser amounts of sands, gravels, and clays In addition, the fill contains various anthropogenic materials including stone fill, brick and concrete fragments, asphalt pavement, railroad tie pieces, coal and ash debris, and wood, steel, and iron debris In the former production areas of the Site, creosote is present within the fill, primarily in a dry, weathered form

Fluvial Quaternary (Recent) sediments overlie much, if not all, of the unconsolidated Columbia Formation (Pleistocene). The Quaternary (Recent) sediments are generally comprised of silts with lesser amounts of sand, gravel, and clay as well as organic matter in the form of roots, peat, reeds, and other organic debris These deposits range in thickness from 0 to upwards of approximately 10 to 15 ft and generally decrease in thickness near drainage areas Holocene deposits are present in drainageways and marsh areas and consist of silty clay with lesser amounts of fine sand and thicknesses ranging from 0 to 6 ft. In the marsh areas a gray clay is present which is described as a drier and firmer clay at depth. This clay unit ranges in depth from 1 to 4 ft below ground surface (bgs), and its thickness ranges from 1 to 5 ft This "marsh clay" is present in over 95 percent of the borings which were advanced below 2 ft or more in depth in the marsh areas For the probes that penetrated through the gray clay layer, the thickness ranged from approximately 1 to 3 ft with an average thickness of approximately 2 ft The marsh clay is apparently absent below sections of Hershey Run, or may be present at depths greater than that to which probes were advanced

The Columbia Formation is composed of primarily silty sands and gravels with seams and thin beds (up to 2 ft in thickness) of silts The Columbia Formation was encountered in thicknesses ranging from 0 ft to approximately 20 to 25 ft, and is generally thicker near the Process Area and Drip Track Area

The Potomac Formation is composed of silts and clays interlayered with medium to fine sands At the Site, a lower-permeability layer is typically observed at the top of this unit and can vary from clay to a clayey silt or clayey sand There are no known areas of direct recharge from the Columbia to the lower Potomac at the Site, although the two aquifers are referred to in the literature as "leaky" and "interconnected " The Potomac Formation is distinguished from the Columbia Formation by smaller grain sizes and the usual presence of the lower-permeability clayey layer at the contact with the Columbia Formation. The maximum thickness of the fine-grained layers at the top of the Potomac, where encountered at the Site, ranged from 1 3 to 5 ft (in seven borings). Where present, the fine-grained unit may act as a lower-permeability capillary barrier, potentially retarding the downward movement of NAPL between the Columbia and Potomac Formation

Hydrogeology. During high tides, ground water in the upper aquifer (which occurs in the Columbia and Fill geologic units) appears to be recharged by surface water in the West Central Drainageway and Hershey Run, during low tides the upper aquifer appears to discharge ground water to the West Central Drainageway and Hershey Run Horizontal hydraulic conductivities measured in the upper aquifer ranged from 2 x 10^{-1} to 4 x 10^{-4} cm/sec

Using the highest horizontal hydraulic gradient observed in the upper aquifer (0 013 ft/ft), the mean hydraulic conductivity (3.2 x 10^{-2} cm/sec), and an assumed effective porosity of 0 3, an average linear ground water flow velocity of approximately 4 ft/day was calculated

No drinking water wells are located within the Site boundaries. Local sources of drinking water include surface water from White Clay Creek (approximately one mile upstream) and municipal supply wells located within a few miles of the Site and screened in the Potomac aquifer

5.2 Nature and Extent of Contamination

The nature and extent of contamination in certain areas and environmental media at the Site were evaluated during the Remedial Investigation This information is documented in the Administrative Record and is only briefly summarized in this section of the ROD More than 100,000 data were obtained for surface soil, sediment, ground water, surface water, air, tissue and other media from the Site and surrounding area

As a result of the former wood-treatment operations conducted at this Site, creosote NAPL has been released to the subsurface These highly concentrated contaminant liquids do not dissolve readily in water, are usually slightly heavier than water and, therefore, move downward with gravity to sink in and through the soil and ground water until they run into a less permeable clay layer NAPLs behave as continuing sources of contamination, as upgradient clean ground water flows through the Site and comes into contact with the NAPL Contamination slowly dissolves from the NAPL into the ground water, which eventually flows to surface water bodies, or migrates downward through the lower aquifer Creosote NAPL was observed in both subsurface soils and in wetland sediments at the Site In addition, creosote NAPL sheens have been observed in the surface waters of Hershey Run. Shallow soils, subsurface soils, ground water and sediments at the Site have been contaminated to varying degrees with PAHs, the primary chemical of concern (COC) identified at this Site (see Figures 4 – 6) For more information, refer to Section 4 of the Remedial Investigation Report for the Site (May 2003) and EPA's comments regarding the report, which are available in the Administrative Record

5.3 Conceptual Site Model

A Conceptual Site Model ("CSM") diagrams contaminant sources, contaminant release mechanisms and migration routes, exposure pathways, and potential human and ecological receptors It documents what is known about human and environmental exposure under current and potential future Site conditions The risk assessment and final response action for this Site are based on the CSM

The CSM for this Site (see Figure 7) illustrates residual NAPL in the shallow soil being released from past wood-treatment activities at the Site Contamination at the Site was released into the soil and migrated into the subsurface, adjacent wetlands and wetland sediments Once NAPLs enter the ground water, they act as a major source of ground water contamination (via dissolution), and surface water contamination (due to discharge of contaminated ground water and/or movement of NAPLs) Site receptors include individuals and ecological receptors that may be exposed to the contaminants in the soil, sediments, and ground water

6.0 CURRENT AND POTENTIAL FUTURE LAND USES

Land use within the surrounding area includes a mix of industrial, commercial and residential activities The Site (see Figure 2) is zoned for industrial use, according to the zoning board of New Castle County, Delaware, and the properties in use immediately adjacent to the Site are used for residential or industrial purposes. U.S Census Bureau data indicates that New Castle County has experienced significant growth in recent years. Because of the very limited access to the Site and because it is zoned for industrial use, EPA's assumed future use for the Site was for industrial purposes However, based on more recent discussions between EPA, DNREC and the property owner of the Site, EPA has also considered the possible future use of the Site as a wetlands bank

7.0 SUMMARY OF SITE RISKS

A baseline human health risk assessment was conducted in order to estimate the probability and magnitude of potential adverse human health effects from exposure to contaminants in on-site soil, sediments and ground water, assuming no further response actions are undertaken Both a human health and an ecological risk assessment were conducted for this Site The risk assessments provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action at the Site

This section of the ROD summarizes the results of the baseline human health and the ecological risk assessments

7.1 Summary of Human Health Risk Assessment

The Baseline Risk Assessment ("BLRA") for the Site is comprised of the *Human Health Risk Assessment for the Former Koppers Company, Inc Site, Newport, Delaware* submitted by DuPont and Beazer, and prepared by Environmental Standards, Inc The Human Health Risk Assessment was accepted by EPA on September 20, 2001 The BLRA was prepared in order to determine the current and potential future effects of contaminants in soil and ground water in the absence of further cleanup actions at the Site The BLRA considered the effects of exposure to soil and ground water The BLRA consisted of a four step process (1) the identification of chemicals of potential concern ("COPCs"), i e , those that have the potential to cause adverse health effects, (2) an exposure assessment, which identified actual and potential exposure pathways, potentially exposed populations, and the magnitude of possible exposure, (3) a toxicity assessment, which identified the adverse health effects associated with exposure to each COPC and the relationship between the extent of exposure and the likelihood or severity of adverse effects; and (4) a risk characterization, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks A summary of those aspects of the human health risk assessment, which support the need for remedial action, is discussed below

7.1.1 Contaminants of Potential Concern

During the Remedial Investigation, a number of organic and inorganic chemicals were detected in Site soils, sediments and ground water Chemicals with maximum concentrations and/or analytical method detection limits of less than Risk-Based Concentrations ("RBCs")[1] were eliminated from further consideration in the risk assessment Risk calculations were based on either the upper 95th percentile confidence limit on the mean ("UCL95") or the maximum detected concentration for each chemical The lower of these two values (designated the "medium-specific concentration" or "MSC") was used in the risk calculations as the exposure point concentration for that chemical in that medium Table 1 lists Summary Statistics and COPC Selection for Site soil, sediment and ground water PAHs are the primary COC at this Site, with the respective exposure point concentrations used in the risk assessment presented in each scenario's individual risk calculation (presented in Table 6) Please note that the tables and risk assessment, generated during the Remedial Investigation, included dioxin (specifically 2,3,7,8-TCDD) as a COC, it has since been determined that this was in error, and that dioxin was only detected due to a lab spike error As a result, dioxin is not a COC at the Koppers Site

7.1.2 Exposure Assessment

Potential human health effects associated with exposure to the COPCs were estimated quantitatively or qualitatively through the evaluation of several actual or potential exposure pathways These pathways were developed to reflect the potential for exposure to hazardous substances at the Site Demographics and land use were evaluated to assess present and potential future populations working or otherwise spending time at the Site The exposure scenarios evaluated in the *Baseline Risk Assessment* are presented below

The *Baseline Risk Assessment* considered the effects of ingestion of, and dermal contact with, soils, sediments, surface water and ground water at the Site The BLRA also considered the inhalation of chemical volatilization from ground water and dermal contact while showering

Five different current or future exposure scenarios were developed in order to estimate risks for the following populations: (1) on-site construction worker; (2) on-site industrial worker, (3) adolescent trespasser, (4) adolescent swimmer, and (5) angler

A number of assumptions were used in the risk assessment process to calculate the dose for each exposure pathway since it is seldom possible to measure a specific dose The following assumptions were used to estimate reasonable maximum exposure for each of the five populations identified above (see Table 3 for complete exposure parameters)

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[1] The identification of chemicals of potential concern was performed utilizing the EPA guidance, "Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening" (EPA Region III, 1992)

On-site construction worker (Future)

- The on-site construction worker was assumed to have a body weight of 70 kilograms ("kg")
- The exposure duration was 1 year
- The frequency of exposure to soil, NAPL and air emissions was assumed to be 120 days per year ("days/yr").
- The soil ingestion rate was assumed to be 50 milligrams per day ("mg/day")
- The skin surface area for dermal contact was assumed to be 1,820 square centimeters per day ("cm^2/day")
- A soil-to-skin adherence factor of 0 11 milligrams per square centimeter ("mg/cm^2") was used
- The inhalation rate was assumed to be 20 cubic meters per day ("m^3/day")

On-site industrial worker (Future)

- The on-site industrial worker was assumed to have a body weight of 70 kg
- The exposure duration was 25 years
- The frequency of exposure to soil and NAPL was assumed to be 134 days/yr
- The frequency of contact with ground water (via ingestion or while showering) was assumed to be 250 days/yr (1 shower/day at 15 minutes/shower)
- Ground water ingestion rate was 1L/day
- The soil ingestion rate was assumed to be 50 mg/day.
- The skin surface area for dermal contact was assumed to be 1,820 cm^2 (or 20,000 cm^2 while showering)
- A soil-to-skin adherence factor of 0 11 mg/cm^2 was used

Adolescent trespasser (Current and Future)

- The adolescent trespasser was assumed to have a body weight of 56 kg
- The exposure duration was 6 years (ages 12-18)
- The frequency of exposure to soil, NAPL and surface water was assumed to be 24 events/yr, and 10 events/yr for exposure to sediment
- The soil ingestion rate was assumed to be 100 mg/event
- The skin surface area for dermal contact was assumed to be 4,381 cm^2, based on area of face, upper extremities, and lower legs (and 207 cm^2 for legs wading in non-river surface water at 1 hour/event).
- A soil/sediment-to-skin adherence factor of 0 025 mg/cm^2 was used

Adolescent swimmer (Current and Future)

- The body weight of the adolescent swimmer was assumed to be 56 kg
- The exposure duration was 6 years
- The frequency of exposure to river surface water and sediment was assumed to be 24 events/yr at 1 hour/event
- The ingestion rate was assumed to be 50 mL/hr.
- The skin surface area for dermal contact with water was assumed to be 15,758 cm^2 (or 1,103 cm^2 for feet exposed to sediment)
- A sediment-to-skin adherence factor of 0 063 mg/cm^2 was used

Angler (Current and Future)

- The angler was assumed to have a body weight of 70 kg
- The exposure duration was 25 years
- The frequency of exposure was assumed to be 365 days/yr
- The ingestion rate was assumed to be 25 g/day

7.1.3 Toxicity Assessment

Excess lifetime cancer risks were determined for each exposure pathway by incorporating the chemical-specific cancer slope factor. Cancer slope factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic substances The resulting risk estimates are expressed in scientific notation as a probability (e g , 1×10^{-6} or 1/1,000,000) and indicate (using this example) that an average individual is not likely to have greater than a one in a million chance of developing cancer over 70 years as a result of site-related exposure to the compound at the stated concentrations. All risks estimated represent an "excess lifetime cancer risk," or the additional cancer risk on top of that which we all face from other causes such as cigarette smoke or exposure to ultraviolet radiation from the sun EPA's generally acceptable risk range for site-related exposure is 10^{-4} to 10^{-6}. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to multiple hazardous substances or exposure via multiple pathways

In assessing the potential for exposure to a chemical to cause adverse health effects other than cancer, a hazard quotient ("HQ") is calculated by dividing the daily intake level by the reference dose ("RfD") or other suitable benchmark EPA has developed reference doses for many chemicals which represent a level of exposure that is expected to result in no adverse health effects. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that the potential for adverse health effects will not be underestimated An HQ $\leq$ 1 indicates that a receptor's dose of a single contaminant is less than the RfD and that harmful non-cancer effects from that chemical are unlikely. The Hazard Index ("HI") is generated by adding the HQs for all COPCs that affect the same target organ (e g , liver) within or across those pathways by which the same individual may reasonably be exposed An HI $\leq$ 1 indicates that harmful non-cancer health effects are not expected as a result of exposure to all of the COPCs within a single or multiple exposure pathway(s)

A summary of the cancer and non-cancer toxicity data relevant to the COPCs in the *Baseline Risk Assessment* is presented in Table 4

7.1.4 Risk Characterization

The Baseline Risk Assessment was conducted in order to determine the current and potential future effects (if no cleanup actions were taken at the Site) of contaminants in sediments, soils and ground water on human health and the environment The current and potential future land use plays a key role when EPA determines the exposure scenarios to be evaluated in the Baseline Risk Assessment Although historically used for industrial purposes and currently zoned as industrial, the Site is currently not in use other than as wildlife habitat The adjacent properties (the former DuPont Holly Run plant and the existing CibaSC facility) have both been used for industrial purposes throughout the history of the Site Therefore, with regard to human health, EPA evaluated the potential risks associated with industrial use of the Site, construction workers, anglers, adolescent swimmers and adolescent trespassers EPA does not believe the Site could reasonably be used for residential purposes because of the difficulty of access (through an active chemical plant) and the isolation of the property (surrounded by railroad tracks [Amtrak's Northeast Corridor line], water, and the active facility)

The Baseline Risk Assessment considered the hazards from potential exposure to contamination if an industrial facility were to be built at the Site Potential effects were evaluated from the incidental ingestion of sediments and soils, ingestion of ground water contaminated with creosote constituents, dermal contact with Site sediments, soils and ground water, and the inhalation of vapors emitted from ground water were it to be used (i e , for showering) The future industrial worker scenario resulted in the greatest calculated risks, for details of the other scenarios evaluated, please refer to the Human Health Risk Assessment (HHRA) in the AR, and to the risk summary tables in this ROD.

For soils, the Human Health Risk Assessment found that the carcinogenic risk for an industrial worker from ingestion and dermal exposure 2 4 x 10^{-4}. The majority of the risk was caused by the incidental ingestion of soil (1.8 x 10^{-4}) The contaminant that contributed the most to the risk was benzo(a)pyrene, with other PAHs (including benzo(a)anthracene, benzo(b)fluoranthene, and dibenz(a,h)anthracene) also contributing

For groundwater, the carcinogenic risk from dermal exposure for a future industrial worker was 1.3 x 10^{-3} and the carcinogenic risk from ingestion was 4 6 x 10^{-1} Scenarios evaluating exposure to ground water without NAPL present did not result in carcinogenic risk outside of the acceptable range.

The non-carcinogenic risks from groundwater to a future industrial worker resulted in a Hazard Index (HI) of 115 (or 115 times greater than EPA's threshold) from dermal exposure and an HI of 170 (170 times greater than EPA's threshold) from the ingestion scenario The risk to a future industrial worker where NAPL was not present in the ground water produced an HI of 1 3 when the dermal, ingestion, and inhalation pathways were combined The HI exceedance of 1 was largely caused by high background levels of metals that occur in Columbia Aquifer ground water, which contributed to the ingestion pathway

There were no site-related contaminants found in the Potomac Aquifer wells at the Site, but these wells were intentionally not located in the vicinity of the worst areas of contamination to avoid creating a pathway for contamination A summary of the risk calculations for all of the scenarios evaluated is presented in Table 5

EPA believes the risk from exposure to soil and sediment may be underestimated due to the presence of creosote NAPL, at the surface, in both soils and sediments at the Site The presence of surficial creosote NAPL has the potential to cause acute toxicity if a trespasser were to be exposed to that material, as PAHs are dermal irritants on direct contact

In summary, unacceptable risks exist to human health from groundwater at the Site In addition, there exists the potential risk of exposure to creosote material in soils and sediments for any person traversing the Site

7.1.5 Uncertainty in Risk Characterization

Risk assessment provides a systematic means of organizing, analyzing and presenting information on the nature and magnitude of risks posed by chemical exposures Uncertainties are present in all risk assessments because of the quality of available data and the need to make assumptions and develop inferences based on incomplete information about existing conditions and future circumstances Below is a brief discussion of the major uncertainties associated with the *Baseline Risk Assessment*.

- Dermal Contact Pathway - The use of adjusted toxicity values for the assessment of dermal risks is a source of uncertainty in the risk assessment Adjusted oral toxicity values were generated based on currently available oral absorption factors Adjustment factors ranging from less than 1 percent (inorganic) to 100 percent (VOCs) were applied to toxicity values to account for absorbed doses.

- Risk Characterization - Constituent-specific risks are generally assumed to be additive This oversimplifies the fact that some constituents are thought to act synergistically (1 + 1 > 2) while others act antagonistically (1 + 1 < 2) The overall effect of these mechanisms on multi-constituent, multi-media risk estimates is difficult to determine but the effects are usually assumed to balance

- There is inherent variability in environmental sampling results, given the spatial distribution of contamination and composition of the matrix sampled Small numbers of analytical samples for a given area may not completely characterize the numbers and concentrations of constituents actually present.

- Exposure parameters for the Site risk assessment were obtained from EPA guidance or peer review literature Most of these assumptions are considered average or reasonable maximum exposure estimates that would not likely underestimate exposure While there are situations where the parameters used may produce underestimates, it is unlikely that the cumulative effect of all exposure parameter estimates will lead to underestimates of risk

7.1.6 Principal Threat Waste

EPA characterizes waste on-site as either principal threat waste or low-level threat waste The concept of principal threat waste and low-level threat waste, as developed by EPA in the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), is applied on a site-specific basis when characterizing source material "Source material" is defined as material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to ground water, to surface water, to air, or that act as a source for direct exposure Principal threat wastes are those source materials considered to be highly toxic or highly mobile, which would present a significant risk to human health or the environment should exposure occur

The proposed cleanup addresses areas where contamination is just above the cleanup criteria to areas where contamination is so high and prevalent that it is visible and flows freely as a separate phase From the results of the RI/FS for the Koppers Site, EPA considers the NAPL in the shallow and subsurface soils and sediments to be principal threat waste because it is source material that contains hazardous substances, pollutants, or contaminants that act as a reservoir for the migration of contamination to surface water and/or ground water

Section 300 430(a)(1)(iii) of the NCP states that "EPA expects to use treatment to address the principal threats posed by a site, wherever practicable," that "EPA expects to use engineering controls, such as containment, for waste that poses a relatively low, long-term threat or where treatment is impracticable," and that "EPA expects to use a combination of methods, as appropriate, to achieve protection of human health and the environment " It also states that "EPA expects to use institutional controls .to supplement engineering controls as appropriate ," and that institutional controls may be used "where necessary, as a component of the completed remedy " However, the NCP also states that institutional controls "shall not substitute for active response measures . as the sole remedy unless such active measures are determined not to be practicable . " After giving careful consideration to the expectations in the NCP regarding principal threat waste and to the nine criteria in the NCP, which EPA is required to use to evaluate various possible remedial alternatives, EPA is proposing an alternative that uses containment rather than treatment to address principal threat waste The range of alternatives includes a treatment alternative EPA's rationale for proposing a containment remedy is discussed in detail in later sections of this Record of Decision

In regard to ground water, the NCP describes EPA's expectation to return contaminated ground water to its beneficial use, which in this case would be to a condition that would allow human consumption. While EPA's experience is that is difficult to clean up ground water that contains NAPL to such a degree as to allow drinking, EPA believes that at this Site, by isolating the worst NAPL *in the containment areas, ground water outside the containment areas can be returned to* its beneficial use In addition, because this contaminated ground water represents an ongoing source as described above, this will prevent the future recontamination of surface waters and sediments

7.2 Summary of Ecological Risk Assessment

Like a Human Health Risk Assessment, an Ecological Risk Assessment (ERA) serves to evaluate the potential for risks due to exposure to site contaminants specific to ecological receptors (such as wildlife, fish, and plants) Since the ERA evaluates many species that have drastically different exposure pathways, the ERA can appear complicated Numerous environmental processes and ecological receptor groups (part of what is referred to as "assessment endpoints") are evaluated, and there are differences in contaminant exposures and sensitivity to contaminants between groups For example, wildlife are mainly exposed through their diet, while soil organisms are exposed through direct contact with the soil in which they live The complexity of the ERA arises from the need to evaluate the important exposure pathways to the relevant receptors The toxicology varies between the different ecological groups In addition, some contaminants are effectively transferred up the food chain, concentrating and thereby posing risks, while other contaminants are not transferred because they are either metabolized, biologically regulated or simply not absorbed Some compounds may be metabolized into more or less toxic daughter compounds, which may be transferable

Superfund site-specific ERAs are conducted using an eight-step process which minimally consists of two tiers of evaluation a Screening Level ERA ("SLERA" - steps 1 and 2) and the full Baseline ERA ("BERA" - steps 3 through 7) Step 8 is a risk management step The function of the SLERA is to determine if a BERA is necessary, along with which contaminants should be evaluated further A SLERA uses published conservative toxicity benchmarks found in literature for water, sediment and soil, and compares site concentrations to these benchmarks

The BERA begins with the results of the SLERA and with problem formulation, which establishes the goals, breadth and focus of the investigation. It also establishes the assessment endpoints, which are the specific valued ecological communities to be protected The questions and issues to be addressed in the BERA are defined based on potentially complete exposure pathways and ecological effects A conceptual site model (CSM) is developed that includes questions about the assessment endpoints and the relationship between exposure and effects The CSM describes the approach, types of data and analytical tools to be used for the analysis phase of the BERA Information is generated through literature reviews and field studies, results are compiled and conclusions are reached Once it has been concluded that ecological risk exists, the information is used to meet other objectives, such as determining what exposure level may minimize any unacceptable risk.

A CSM relies on contaminant and habitat characteristics to identify critical exposure pathways to the selected measurement endpoints. A measurement endpoint is a measurable biological response to a stressor that can be related to the assessment endpoint. The CSM for the Koppers Site, for example, illustrates that contaminants were spilled onto the ground in the past and have migrated overland and/or through the subsurface into the adjacent wetlands (i e , Hershey Run and the Western Central Marsh adjacent to the South Ponds), where macroinvertebrates, insects, fish and other organisms may be exposed The potential for risk exists where organisms are exposed to contamination directly (e g , insect larvae living in contact with contaminated sediments, fish contacting contaminated sediments and/or earthworms and other burrowing organisms living in contact with soil), as well as when organisms higher in the food chain consume organisms lower in the food chain that have been in contact with contamination and have stored contamination in their bodies (e g , insects may store contaminants, then fish eat the insects, birds eat the fish, and so on) The SLERA identified PAHs and other contaminants exceeding benchmarks in sediment, soil and water

At the Koppers Site, a total of 12 assessment endpoints were evaluated, six related to direct exposure and six related to exposure to contamination through the food chain for non-aquatic receptors Only the six related to direct exposure (see Table 7) identified risks associated with the creosote contamination These conclusions are largely based upon the results of the site-specific toxicity tests conducted with Site sediment on the amphipod (a small shelled organism), *Hyalella azteca*, and the midge (a small fly), *Chironomus tentans*, and with Site soil on the earthworm, *Eisenia foetida*, as supplemented with plant community observations

For both the sediment and soil toxicity tests, the distribution of contaminants at the Site presented a dilemma in obtaining samples for testing and the determination of NOAEL (No Observed Adverse Effects Level) and LOAEL (Lowest Observed Adverse Effects Level) values The distribution of total PAH contamination can be characterized as having sharply defined highly contaminated areas and limited areas that have intermediate levels of contamination The result of these circumstances is that the toxicity results do not generate a gradient of toxicity responses; the results were either that the soil or sediment sample caused death or had no measured effect While this presented technical difficulties in the risk calculations, it clearly defines where severe ecological risks exist and do not exist In addition, the physical areas of uncertainty (the area and volume of intermediately contaminated soil and sediment) is a relatively small zone around areas of high contamination levels Therefore, the cleanup volumes are not very sensitive to changes in the cleanup goals.

The amphipod, *Hyallela azteca*, lives in close association with sediments, as does the larva of the midge, *Chironomus tentans* These two organisms were used under standardized solid-phase sediment testing procedures to determine if the contaminated sediments at the Site caused mortality (the test organisms died when exposed to sediment from the Site) or non-lethal adverse effects (such as reduced growth) Where adverse effects were determined, the concentrations of contaminants in test sediments were used to evaluate at what concentrations minimal or no adverse effects may occur (the NOAEL), and above what contaminant levels adverse effects would be expected (the LOAEL) In addition, the type of the adverse effect (e g , death or reduced growth) was taken into consideration in evaluating the certainty and the severity of risk The NOAEL was calculated to be 83 mg/kg, and the LOAEL was calculated to be 198 mg/kg for total PAHs [2]

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[2] Note that there appeared to be risk caused by zinc as well which is not a site-related contaminant

Fish that utilize the Site can be impacted by contaminants in two ways: (1) short-term toxicity and (2) long-term reproductive effects on organisms exposed as larvae or juveniles Short-term toxicity of Site contaminants to killifish (*Fundulus heteroclitus*) embryos was assessed in a 10-day solid-phase sediment toxicity test The bioaccumulation potential of each contaminant was assessed through a review of the fish tissue data collected at the Site Indirect effects on fish populations were inferred through the midge and amphipod toxicity tests, since benthic macroinvertebrates comprise a large percentage of predatory fish forage No significant correlations between fish survival and level of measured contaminants were found A NOAEL for total PAH concentration was calculated at 33 5 mg/kg based upon sublethal effects However, recent studies conducted by the USFWS and the State found an approximately 40% incidence of liver tumors, among other health effects, in fish in Hershey Run Follow-up studies have strongly suggested that this high incidence of liver tumors is unique to Hershey Run in the area (Copies of both studies are available in the Administrative Record)

To evaluate the potential effects of Site contaminants on the structure and function of the soil community, 7, 14, and 28-day solid-phase toxicity tests were conducted with the earthworm, *Eisenia foetida*. The toxicity tests provided information on the toxicity of soil contaminants to this species and potentially other soil invertebrate species found on-site In addition, the bioaccumulation potential of Site contaminants was assessed by analyzing all surviving earthworms for contaminants of concern potentially present in their tissues

Earthworm survival was reduced in PAH-contaminated samples from the upland area of the Site, with complete mortality occurring by day 7 of the 28 day test (none of the worms survived) Survival in all other soil samples was greater than 94 percent Growth was significantly lower in the PAH-contaminated samples from the upland wood storage yard From the toxicity data, PAHs were determined to be the compounds that were responsible for the observed toxicity The NOAEL for total PAH concentration for the tests conducted was determined to be 587 mg/kg and the LOAEL was 1,264 mg/kg.

Vegetation surveys conducted during the Remedial Investigation showed negative effects of contaminants on upland plants, particularly in areas of visible contamination

In summary, it is concluded that PAHs pose ecological risks to the upland, wetland and aquatic communities at the Site, specifically to organisms low in the food chain (i.e , earthworms, insects, shelled organisms, fish and frog embryos, and both upland and aquatic plants) [3] In

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[3] Zinc, which can be found at levels in the thousands of parts per million, poses an ecological risk at the Site as well Although EPA does not believe that the zinc is site-related, EPA's preferred alternative would address the vast majority of the elevated zinc in the areas where the elevated zinc is co-located with elevated levels of PAHs When the zinc is not co-located with PAHs, it exists at depth in sediments such that it does not pose a threat to ecological receptors EPA believes that the zinc most likely came from the adjacent DuPont-Newport Superfund site, where zinc was a major contaminant EPA notes that there are other zinc sources in the watershed, most notably the NVF Yorklyn site upstream on Red Clay Creek However, data evaluated during the DuPont-Newport remedy selection process showed that the zinc from

general the aquatic assessment endpoints were more sensitive than the terrestrial assessment endpoints with respect to the calculated NOAEL and LOAEL levels For the aquatic assessment endpoints the NOAEL was calculated to be 82 87 mg/kg total PAHs and the LOAEL was calculated to be 197 6 mg/kg For the terrestrial assessment endpoints the NOAEL was determined to be 587 mg/kg total PAHs, with a LOAEL of 1,264 mg/kg

Based on the results of the risk assessment, EPA has determined that for this Site, a sediment cleanup criteria of 150 mg/kg total PAHs (approximately the geometric mean between the sediment NOAEL of 83 and the LOAEL of 198) and a soil cleanup criteria of 600 mg/kg total PAHs (just above the NOAEL of 587)[4] are the appropriate levels to provide protection to the environment.

7.3 Conclusion of Risk Assessments

EPA has concluded that risks to a construction worker, industrial worker, adolescent trespasser, adolescent swimmer or angler exceed NCP target risk levels for carcinogenic and non-carcinogenic risks In addition, EPA has concluded that PAHs pose unacceptable ecological risks to the upland, wetland and aquatic communities at the Site By comparing maps of total PAH values to those of benzo(a)pyrene equivalences ("B(a)P equivalence"), EPA has determined that the cleanup criteria described above will be protective of both the environment and human health for potential future industrial workers and current and future trespassers

EPA has determined that the remedial action selected in this ROD is necessary to reduce the risks for these receptors to levels within or below EPA's risk range

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the NVF site was not causing sediment contamination in the vicinity of the Koppers and DuPont sites Since the time of the DuPont-Newport Record of Decision, work has been conducted to help control zinc discharges in the watershed, which will only further prevent recontamination In addition, the State has been developing a TMDL for zinc for both the Red Clay Creek and the Christina River, which should help minimize the potential for recontamination in the future

[4] EPA does not believe that using the geometric mean of the soil NOAEL and LOAEL to determine the soil cleanup criteria would be protective because the result would be much higher and could result in potential for contaminated soil to act as continuing source of contamination to the wetlands EPA believes that the 600 mg/kg soil cleanup criterion would provide adequate protection to the wetlands, since it is a "not-to-exceed" value that would result in average surface soil concentrations of total PAHs of a much lower value. Once vegetation has been reestablished after the cleanup, the possibility for recontamination is very remote. One hypothetical area where it could happen is if an area of soil was just below the 600 mg/kg soil cleanup criteria and located adjacent to a wetland that was just below the 150 mg/kg sediment cleanup criteria such that erosion could increase the wetland concentration to above 150 mg/kg, thus creating an unacceptable risk With the fact that the concentration gradients at the Site are steep (i e , the contamination goes from high to low in a short distance), any areas that would match this condition would be small and would not warrant a change in the soil cleanup criteria

8.0 REMEDIAL ACTION OBJECTIVES

Based on the information relating to the types of contaminants, environmental media of concern, and potential exposure pathways, Remedial Action Objectives ("RAOs") were developed to aid in the development and screening of alternatives EPA has established the following RAOs to mitigate and/or prevent existing and future potential threats to human health and the environment

1 Prevent current or future direct contact with contaminated soils and sediments that would result in unacceptable levels of risk to ecological receptors by reducing levels of total PAHs concentrations to below 150 mg/kg in sediment and 600 mg/kg in soil (150 mg/kg in soil that is to be converted to wetlands),

2 Prevent unacceptable human health risks due to exposure to contaminated ground water,

3 Minimize the on-going contamination of ground water from the presence of NAPL through removal and/or containment,

4 Prevent any direct contact threat to an adult or child trespasser and to an industrial worker,

5. Protect potential future residents from contact with contaminated soil and/or ground water, by preventing the construction of residential buildings on any part of the Site (which is currently prohibited by local zoning, a future zoning change and potential residential use of the Site would require a residential risk assessment scenario and an evaluation by EPA),

6 Restore ground water at the Site to its beneficial use.

9.0 SUMMARY OF REMEDIAL ALTERNATIVES

9.1 Remedial Alternatives Common Elements

During the **Feasibility Study**, various alternatives to cleanup contamination at the Site were developed EPA evaluated a number of alternatives, including the range of alternatives described in detail below, in order to determine which cleanup method would be best EPA's preferred alternative is Alternative 4 (see page 23) Further information may be obtained from the Administrative Record

The alternatives describe possible actions to address contamination in the following areas 1) upland soils, 2) Hershey Run, 3) the Fire Pond, 4) the South Pond area (the non-tidal South Pond itself and the tidal West Central Drainage area), 5) the K Pond area and 6) ground water (See Figure 2)

Each alternative, except the "no action" alternative, contains some common elements that were considered in the evaluation process The common elements include.

1 Ground Water Each alternative includes monitoring of dissolved phase contamination in both the Columbia and Potomac aquifers until such a time as contaminant levels fall below levels EPA determines are safe to drink (approximately 20 wells - 10 in the Columbia and 10 in the Potomac aquifer). Although no creosote contamination was found in the Potomac aquifer during the RI, monitoring is necessary to ensure that contamination does not spread into the Potomac, since mobile NAPL was found in the Columbia aquifer. Several new Potomac aquifer wells would be installed closer to the processing areas to aid in this monitoring. DNREC would create a ground water management zone (GMZ) that would include the Site and enough adjacent areas such that pumping wells could not draw contamination from the Site, either laterally or downward into the Potomac (There currently exists a GMZ encompassing much of the adjacent DuPont-Newport Superfund Site) The GMZ would have to remain in effect in perpetuity for Alternatives 2 and 3 because they do not fully address ground water contamination, and for Alternative 4 because of the waste remaining in the containment areas (although this could be smaller in size once EPA has determined that ground water outside the containment areas is safe to drink) Under Alternative 5, this GMZ could be lifted once MNA has succeeded in reducing contaminant concentrations to acceptable levels (presumably in 30 years, though possibly more). For those alternatives that include NAPL recovery, a characterization of any recovered NAPL would be conducted in order to determine an optimal method for disposal For the purposes of estimating costs, it was assumed that all recovered NAPL would be drummed, characterized and disposed of off-site at an appropriate permitted facility (in accordance with CERCLA 121(d)(3)), although it is possible that the creosote NAPL may be suitable for recycling (also in accordance with CERCLA 121(d)(3)) In addition to these measures, each alternative would include an evaluation to be conducted to verify the extent of NAPL at the Site, including along the ballast of the Amtrak railroad line along the northern boundary of the Site

2 Land-Use Restrictions Land-use restrictions or institutional controls would be used (1) to ensure that the land was not used for residential purposes or other purposes that would cause a risk to human health due to any contamination that would remain on-site after the cleanup was complete, and (2) to ensure that any activities that may take place on the Site after cleanup do not interfere with any components of the remedy and are conducted in a manner to protect the health of future construction workers For example, if any structures were to be constructed in the future on top of the containment area, they may be restricted to minimal intrusion into the subsurface in order to protect the cap (e g., foundations may be restricted to a minimum number of pilings with slab construction above, thereby potentially limiting the size of a structure). These institutional controls could include such things as restrictive covenants, and/or requirements that workers who might come into contact with any remaining contamination on-site be properly protected in accordance with the current Site Health and Safety Plan and/or Operations and Maintenance Manual The institutional controls may include restrictions that will operate as a covenant running with the land burdening the property such as. (a) activity restrictions (limitations on activities and use which may be conducted on the property, i e only those activities which do not interfere with the ongoing protectiveness and effectiveness of the Remedial Action), (b) restrictions on the disturbance of the soil (limitations on activities that could cause interference with or disturbance of the Remedial Action, disturbance of surface soils

or protective Site features, or a risk of soil erosion or exposure to remaining contamination, especially in the containment area), and (c) ground water restrictions (limitations on activities that would use ground water or cause a change in hydraulic conditions that could interfere with the ongoing protectiveness and effectiveness of the Remedial Action)

9.2 Remedial Alternatives

Note that the Total Present Worth Cost for each alternative was calculated using a 7% discount rate and an Operations and Maintenance ("O&M") period of 30 years (unless mentioned otherwise)

Alternative 1 *No Action*

Capital Cost	$ 0
Annual O&M Costs	$ 0
Total O&M Costs	$ 0
Total Present Worth Cost	$ 0

Under this alternative, no remedial measures would be implemented at the Site to prevent exposure to the sediments, soil, NAPL and ground water contamination The "no action" alternative is included because the National Contingency Plan (NCP) requires that a "no action" alternative be developed as a baseline for evaluating other remedial alternatives

Alternative 2 *Covering upland soils, Sediment cap in Fire Pond, South Pond and K Pond, Sheetpile and NAPL collection at Fire Pond and South Pond, Monitored Natural Recovery (MNR) in Hershey Run and tidal wetlands, Monitored Natural Attenuation of ground water contamination*

Capital Cost	$ 15,934,988
Annual O&M Costs	$ 125,500 *(for years 1-5)*
	$ 117,500 *(for years 6-30)*
Total O&M Costs	$ 1,490,864
Total Present Worth Cost	$ 17,425,852

In addition to the common elements described above, Alternative 2 includes the remedial measures detailed below, according to media See Figure 8 for the further details

Soils

In order to protect trespassers and ecological receptors from contaminated soils, this alternative includes the installation of a soil cover on top of the existing grade This cover would consist of a geotextile layer followed by a 2-foot (ft) soil cover, including a burrow-inhibiting layer of stone, installed over upland surficial soils (0-24 inch layer) containing visual NAPL or total PAH concentrations greater than 600 mg/kg Approximately 125,000 cy of cover materials would be brought in and placed over a total of 39 acres

Sediments

In order to protect trespassers and ecological receptors from contaminated sediments, this alternative includes the installation of a 2-ft reactive (sorbent) cap over sediments in the Fire Pond, South Ponds, and K Area (totaling approximately 0.7 acres) This cap will be constructed (from bottom to top) of geotextile, approximately 1 ft of sorbent material (e g., a mixture of clay, anthracite, and soil that significantly retards potential movement of contaminants through the cap), and 1 ft of sand This alternative also includes monitored natural recovery of sediments in Hershey Run, Hershey Run Marsh, and the West Central Marsh Drainage

Ground Water

To prevent future releases of NAPL to surface water and sediments that could cause risks to trespassers and ecological receptors, Alternative 2 includes the installation of approximately 1,000 and 1,100 ft of sealed steel sheetpile walls at the South Ponds and Fire Pond, respectively This sheetpile would be installed within the Columbia aquifer, keyed into the lower permeability, finer-grained layer underlying the Site at depths ranging from approximately 15 to 30 ft bgs (at the top of the Potomac aquifer) Shallow hydraulic gates would be incorporated into the top of the walls of the sheetpiling to allow ground water to flow through the upper portions of the Columbia aquifer (thus preventing buildup of hydraulic head behind the wall) while NAPL is retained below In addition, this alternative includes monitoring and passively removing NAPL from interceptor trenches installed behind these sheetpile walls, with the collected NAPL to be disposed of or recycled off-site in accordance with CERCLA 121(d)(3) NAPL would remain in the ground water outside the containment area, preventing the restoration of ground water to its beneficial use

Alternative 3 *Excavate, consolidate and cap shallow soils and shallow tidal sediments, Cap Fire, K and South Ponds, Sheetpile and NAPL collection at Fire Pond and South Ponds areas, Rechannelization of Hershey Run, Wetlands mitigation, Monitored Natural Attenuation of ground water contamination*

Capital Cost	$ 40,094,305
Annual O&M Costs	$ 261,937 *(for years 1-5)*
	$ 261,937 *(for years 6-30)*
Total O&M Costs	$ 3,250,383
Total Present Worth Cost	$ 43,344,688

In addition to the common elements described above, Alternative 3 includes the remedial measures detailed below, according to media. See Figures 9 and 10 for the further details

Soils

In order to protect trespassers and ecological receptors from contaminated soils, this alternative includes the excavation of upland surficial soils containing visual NAPL or total PAH concentrations greater than 600 mg/kg to a depth of 2 ft bgs, followed by consolidation in an on-site containment area (approximately 115,000 cy of surficial soils would be removed over an approximately 35-acre area into a 4-acre containment area in either the former Process area or Drip Track area) which would then be capped with a geomembrane (see Figure 9) The excavated areas would be filled with clean soil to restore the grade. In areas that the soil at 2 ft bgs still remained above the soil cleanup criteria of 600 ppm total PAHs, a geotextile layer would be placed to separate the contaminated soil from the clean soil

Sediments

In order to protect trespassers and ecological receptors from contaminated sediments, this alternative includes the installation of a cap over sediments in the Fire Pond, South Pond, and K Area as described in Alternative 2

In addition, Alternative 3 would include the relocation of the channel of the upper portion of Hershey Run, as depicted in Figure 10, so that the new channel would bypass the NAPL-impacted area to the west of the Fire Pond which would be contained using sheetpile (described below) To create the new channel (approximately 800 ft long and 0 8 acre in size), this alternative would require the removal of approximately 6,500 cy of marsh sediment which would be deposited behind the sheetpile to fill the currently existing channel. The new channel would be constructed in such a way as to maximize habitat and control erosion Additional clean fill would be required within the sheetpile area to bring the grade to the top of the sheetpile (set at approximately 6-ft elevation or high high tide) EPA expects that this area would remain a wetland, although non-tidal

While the added containment area would enclose the majority of the NAPL underneath Hershey Run and adjacent wetlands, it would not contain all of the NAPL Therefore, to prevent any NAPL migration to the surface in this area where it could present a risk to trespassers and ecological receptors, the portions of existing Hershey Run that would be outside the containment area yet, due to the geometry, not be part of the new channel, would be capped with 1 ft of reactive cap material and 1 ft of sediments

In the remainder of the Hershey Run channel (the lower portion) and marsh and the West Central Drainage Areas, surficial sediments (within the upper 1 ft bgs) containing total PAHs greater than 150 mg/kg would be excavated, thus providing protection for trespassers and ecological receptors This excavation of surficial sediments is expected to generate 23,000 cy over an area of 9 acres

Where contamination exists below 1 ft bgs, an additional 1 ft of sediment would be excavated and a cap installed Installation of a cap would inhibit the migration or erosion of PAH-contaminated materials which could recontaminate the wetlands or migrate off-site The cap constructed in the channel portion of the drainage areas would consist of 0 5 ft of reactive material, on top of which would be placed 1.5 ft of sand, geotextile, and 0 5 ft of armor stone, respectively The marsh area cap would be of similar construction, however, 0 5 ft of soil would be placed on top of the sand, instead of the geotextile and armor stone, as erosional forces are expected to be less outside the channel in the marsh areas The additional excavation needed to accommodate the cap is expected to generate 25,000 cy over an area of 6 2 acres Sediment monitoring would be conducted in wetlands with caps to verify that the contaminated materials remain isolated Monitoring would also take place where any wetlands were disturbed to ensure that restoration activities were successful

If any wetland acreage is lost within the containment area, this alternative would, to comply with EPA's Wetlands Policy, include creating replacement wetlands commensurate with the acreage of wetlands filled at the Site (at a minimum ratio of 1 1)

Overall, approximately 55,000 cy of sediments (including about 15% added volume due to stabilization to improve soil properties to support a cap) would be added to the landfill area created with consolidated upland surface soils

Ground Water

To prevent future releases of NAPL to surface water and sediments where it could cause risks to trespassers and ecological receptors, this alternative includes sheetpile wall installations at the Fire and South Ponds as described in Alternative 2 However, due to the rechannelization of Hershey Run, in Alternative 3 an additional 600 ft of sealed steel sheetpile would be installed in the Fire Pond area to contain subsurface NAPL extending from the Fire Pond underneath wetlands across Hershey Run from the pond (See Figure 10) The sheetpile in the marsh would be set at or above the high high-tide elevation to preclude consistent surface water inundation NAPL would remain in the ground water outside the containment area, preventing the restoration of ground water to its beneficial use

Alternative 4 *Excavate, consolidate and cap all contaminated soils and sediments, Subsurface ground water barrier wall around consolidation area(s) with passive NAPL recovery, Restoration of ground water through excavation of NAPL-contaminated aquifer material outside of consolidation areas, Rechannelization of Hershey Run, Wetlands mitigation, Monitoring of ground water contamination*

Capital Cost	$ 49,837,587
Annual O&M Costs	$ 227,267 *(for years 1-5)*
	$ 118,767 *(for years 6-30)*
Total O&M Costs	$ 1,918,652
Total Present Worth Cost	$ 51,756,239

In addition to the common elements described above, Alternative 4 includes the remedial measures detailed below, according to media See Figure 11 for the further details

Soils

In order to protect trespassers and ecological receptors from contaminated soils, soil would be excavated as in Alternative 3 (soil with visible NAPL or total PAHs above 600 mg/kg) In addition, excavation would continue in those areas where wetlands are to be created until the total PAH concentration was 150 mg/kg or below Excavation depths will potentially reach as deep as 30 ft bgs in a few locations, although the average excavation depth is expected to be 5 to 15 ft Instead of backfilling the excavated areas, the areas would be graded appropriately, and wetlands would be created, minimizing the increase in cost over a shallower excavation since no outside fill would be needed An estimated 113,000 cy of soil would be excavated and consolidated into two on-site landfills. The location of the landfills would coincide with the areas of upland that have the greatest amount of NAPL in soil and the ground water, thus reducing the amount of excavation required and allowing the landfills and the NAPL recovery areas (described below) to be located together The two landfills would cover approximately 38 acres and would be used to contain all contaminated material excavated as part of this alternative This alternative would allow for the cover material (over the geomembrane) to come from areas of the Site with clean soil This fits with one possible reuse of the Site - wetland creation - since extra excavation would be required to create the wetlands The cost estimate for this alternative assumes that the cover material is coming from an on-site source (borrow area)

Sediments

In order to protect trespassers and ecological receptors from contaminated sediments, this alternative would involve the complete excavation (and consolidation into on-site landfills) of contaminated sediments (containing total PAHs above 150 mg/kg) in the Fire Pond, South Pond, K Area, West Central Drainage Area, lower Hershey Run and the marsh adjacent to the upper portion of Hershey Run The depth of excavation ranges from 0 to 13 ft with an average of 2-4 ft Restoration activities would take place as appropriate to provide suitable ecological habitat Backfilling shall be required to restore the original stream profile, unless it can be otherwise shown, as determined by EPA, that an alternate design may be hydrodynamically stable and ecologically advantageous If that is the case, there would likely be a cost savings associated with the reduction in need for backfill The use of minor backfilling may be able to effectively increase the diversity of the wetland types at the Site

As in Alternative 3, this alternative would involve the rechannelization of upper Hershey Run to allow the installation of sheetpile and passive NAPL recovery (see below) Any wetland acreage that was lost would be replaced at the Site It is estimated that a total of approximately 75,000 cy of stabilized sediments would be added to the consolidation area (including a 15% increase in volume for stabilization to improve soil/sediment properties to support a cap)

Ground Water

In order to achieve the restoration of ground water, NAPL-contaminated aquifer material located outside of the containment areas would be excavated to depth (generally 5 to 15 ft deep, and occasionally to 30 ft) and isolated in the on-site landfills (as described above) To prevent future releases of NAPL to surface water and sediments that could cause risks to trespassers and ecological receptors, as well as to control the source of ground water contamination, this alternative includes the sheetpile and passive NAPL collection in the area of the Fire Pond as in Alternative 3, with the extensive addition of sheetpile or other low permeability ground water barrier[5] (and associated passive NAPL recovery) around the two landfills. The landfills would be located over the areas of most extensive NAPL contamination where NAPL, based on

[5]The cost estimate assumed 1,375 ft (25%) of sheetpile and 4,125 ft (75%) of slurry wall

observations during the RI, may still be mobile This alternative also includes the excavation of NAPL material from below the wetlands in the South Pond and adjacent West Central Drainage area, as well as from the K area By aggressively addressing these NAPL areas (i e , the sources of contamination), natural attenuation would restore the ground water outside of the containment area to its beneficial reuse, and no sediment caps would be required to prevent the recontamination of the wetlands The passive NAPL recovery trenches would also be used to manage the level of ground water inside of the barrier walls, draining ground water for surface discharge (following treatment via oil-water separation and carbon filtration, if necessary) Monitoring of ground water and sediments would be conducted to verify the effectiveness of containment and the continued attenuation of any dissolved phase contamination

Studies, including ground water modeling as appropriate, would be conducted during the Remedial Design to determine the optimal configuration for the passive NAPL recovery trenches and system, and would specifically seek to minimize the complexity of the system and, to the extent possible, minimize the need for ground water treatment prior to discharge Given the mobility of NAPL at the Site, as demonstrated by the extent to which NAPL has already migrated beneath and into the Hershey Run marsh, EPA believes that passive NAPL recovery would successfully and significantly reduce the volume of mobile NAPL at the Site At the same time, this NAPL recovery system would provide the opportunity for managing ground water (as described above) If monitoring shows that it is necessary to ensure compliance with the substantive requirements of the NPDES program and State Water Quality Standards, ground water drained through the recovery trenches would be treated using an oil-water separator and/or carbon filtration system in order to remove any contamination before it is discharged to surface water

Alternative 5 *In-situ steam-enhanced extraction of subsurface NAPL, excavation and off-site treatment of sediments and certain soils, Wetland restoration, Monitored Natural Attenuation of ground water contamination*

Capital Cost	$ 189,365,815
Annual O&M Costs	$ 169,000 *(for years 1-5)*
	$ 87,500 *(for years 6-30)*
Total O&M Costs	$ 1,419,957
Total Present Worth Cost	$ 190,785,772

In addition to the common elements described above, Alternative 5 includes the remedial measures detailed below, according to media See Figure 12 for the further details

Soils

Upland soils containing visual, weathered NAPL would be excavated and transported off-site for treatment via low temperature thermal desorption (LTTD) and then landfilled in accordance with Section 121(d)(3) of CERCLA and 40 C F.R §300 440 In addition, upland soils with total PAH concentrations greater than 600 mg/kg that are outside of the area undergoing *in-situ* steam-enhanced extraction (see description below for ground water) would be excavated to a depth of 2 ft bgs and treated off-site The excavated areas would be backfilled with clean fill and revegetated Approximately 106,000 cy of surficial soils would be removed and backfilled over a 33-acre area A staging area would be constructed in the former Process or Drip Track areas

Sediments

The sediments in the Fire Pond, South Ponds, and K Area would be addressed as part of the *in-situ* steam-enhanced extraction at the subsurface NAPL areas (see below)

As described in Alternative 3, the upper portion of Hershey Run would be rechannelized so that the new channel would bypass the NAPL-impacted area adjacent to the Fire Pond (which would be addressed through *in-situ* steam-enhanced extraction, as described below under for ground water) Although the NAPL would eventually be addressed by the *in-situ* steam-enhanced extraction, the rechannelization and sheetpile would be necessary to prevent Hershey Run from becoming an infinite heat sink, substantially increasing fuel costs and likely preventing the appropriate temperature increase

All surface and subsurface sediments containing total PAHs greater than 150 mg/kg would be excavated from the lower portion of Hershey Run, Hershey Run Marsh to the west of the proposed sheeting, and the West Central Drainage Area waterway and marsh, with removal depths up to 13 ft The excavated sediments would be treated and disposed of along with the soils, as described above

Ground Water

To prevent future releases of NAPL to surface water and sediments where it could cause risks to trespassers and ecological receptors, as well as to restore ground water to its beneficial use through source control and natural attenuation, NAPL contamination would be addressed through thermally-enhanced *in-situ* extraction. The particular thermal enhancement proposed is known as "steam injection" or dynamic underground stripping This technique would be used to remove subsurface NAPL at all upland areas and subsurface NAPL beneath the Fire Pond and South Ponds areas

In-situ steam-enhanced extraction would require steam to be generated at the surface and injected into arrays of injection wells in an effort to heat the subsurface NAPL zones and recover NAPL through multi-phase extraction wells During steam injection, some of the NAPL constituents would distill or volatilize, become more mobile, and could then be removed via extraction wells Due to the high heat and oxygen introduced in the steam, some NAPL would be destroyed through physical and chemical degradation. The injection and extraction wells would be spaced according to the depth of the impacted zones, which may range from approximately 5 to 15 ft bgs, and in some cases up to 30 ft bgs Because of the shallow depth of the target zone, the soil surface would have to be covered, potentially with asphalt, to prevent steam from venting at the surface Steam, liquid, and noncondensible gases would be removed from the ground and captured in a recovery system, where fluid separation and treatment technologies would be required Recovered NAPL would be retained in storage tanks prior to transport and off-site incineration Three-phase resistive heating may be used as a complement to *in-situ* steam injection in an effort to heat low-permeability soil zones within the target areas As part of the pre-design investigation, an extensive pilot study would first be required to develop process control parameters

Infrastructure would be constructed at the Site including an electrical supply grid, steam boilers, boiler fuel supply such as propane or natural gas, injection and extraction wells, steam conveyance piping, recovered fluids conveyance piping, and a network of roads to access all of the treatment areas The fluid separation system would separate vapors, liquids, and NAPL A vapor treatment system would be designed and constructed to treat recovered vapors prior to discharge to the atmosphere A water treatment system would be designed and constructed to treat recovered liquid prior to discharge

Once the steam injection and extraction is completed (over a period of several years), monitored natural attenuation would allow for the eventual restoration of ground water at the Site to a beneficial use (potentially in 30 years)

10.0 EVALUATION OF ALTERNATIVES

The five remedial alternatives described above were evaluated in detail to determine which would best meet the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, ("CERCLA") and the NCP, and achieve the remedial action objectives identified in section 8 0 of this ROD EPA uses the nine criteria set forth in the NCP, 40 C F R. §300 430(e)(9)(iii); to evaluate remedial alternatives The first two criteria (overall protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements ("ARARs")) are threshold criteria The selected remedy must meet both of these threshold criteria (except when an ARAR waiver is invoked) The next five criteria (long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment; short-term effectiveness, implementability, and cost) are the primary balancing criteria. The remaining two criteria (state and community acceptance) are referred to as modifying criteria and are taken into account after public comment is received on the Proposed Remedial Action Plan

The following discussion summarizes the evaluation of the five remedial alternatives developed for the Site against the nine evaluation criteria.

Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment A remedy is protective if it reduces, to acceptable levels, current and potential risks associated with each exposure pathway at a site

The "no action" alternative (Alternative 1) does not meet this threshold criterion for several reasons Without any active remediation at the Site, a number of risks (both current and potential) would remain, including (1) risks would remain for potential future industrial or construction workers from exposure to both soil and ground water, (2) current risks would remain to ecological receptors in aquatic areas such as the Fire and South Ponds, the K Area, Hershey Run and associated wetlands and in upland soil areas, (3) potential future risks to

ecological receptors could increase if the Site were developed to increase wetland acreage, and (4) while not readily quantifiable, risks to trespassers would remain from exposure to NAPL that can be released while wading in sediments in Hershey Run Since the "no action" alternative does not meet this threshold criterion, it will not be considered any further
Each of the other alternatives (Alternatives 2, 3, 4, and 5) would offer protection of human health from soil contamination through the use of institutional controls to prevent future use of the Site for residential purposes and to ensure that any industrial use was conducted in such a way as to ensure the protection of workers

For human health risks due to ground water, each alternative would initially address risks through the creation of a ground water management zone (GMZ) by the State of Delaware that would prevent any drinking water wells from being installed Each alternative would include monitoring until the ground water is restored to its beneficial use (which for Alternatives 2 and 3 could practically be forever) Alternatives 2, 3 and 4 would control NAPL to varying degrees with the use of ground water barrier walls, creating areas that would not be cleaned up and would rely solely on the GMZ Additionally, Alternative 4 would excavate NAPL found outside of the consolidation areas and provide for complete containment of NAPL through far more extensive barrier walls Alternative 4 is further augmented by extensive efforts to passively recover NAPL within the containment areas. Alternative 5 would aggressively address NAPL with *in-situ* steam-enhanced extraction followed by monitored natural attenuation to finish the cleanup Only Alternatives 4 and 5 provide overall protection to human health from ground water risks and restoration of ground water to its beneficial use (one of the RAOs), thus restoring the ground water to its beneficial use

In regard to protection of the environment, each of the alternatives would protect upland species Alternatives 2 and 3 would provide a clean "living layer" of soil by either covering soil contamination (soil with total PAH concentrations above 600 mg/kg) with clean soil (Alternative 2) or by removing and replacing the top layer of soil (Alternative 3) Alternative 4 would address risks from upland soil by removing all soil that is above the Site-specific soil cleanup criteria of 600 mg/kg with replacement (whole or partial) possibly occurring depending on the type of habitat desired Alternative 5 addresses these risks by removing contamination through a combination of excavation (when weathered NAPL is visible) and removal and/or destruction of contaminants through *in-situ* steam-enhanced extraction.

Alternative 2 would involve sediment caps in the Fire Pond, South Pond, and K Area to prevent receptors from coming into contact with contamination Sheetpile would be installed at the Fire Pond and the South Pond, along with passive NAPL collection, to prevent NAPL migration to water bodies However, Alternative 2 would not be protective in Hershey Run because, like the "no action" alternative, it would not address NAPL and PAHs in the sediments of lower Hershey Run except through natural recovery EPA does not believe that natural recovery could reduce the risks posed by the sediments in lower Hershey Run because of the amount of contamination present In addition, this material was used in the wood treating industry to prevent biodegradation of wood Any biodegradation that would take place would do so at a slow rate

Alternative 3 would also involve sediment caps in the Fire Pond, South Pond, and K Area to prevent receptors from coming into contact with contamination In addition, aquatic risk in

Hershey Run and the adjacent marsh and the West Central Drainage area would be addressed by excavating the top 2 ft with a reactive cap placed in areas where elevated levels of contamination remained below Sheetpile would also be installed at the Fire Pond (although over a greater area to enclose more NAPL, but resulting in the need to rechannelize Hershey Run) and the South Pond, along with passive NAPL collection, in order to prevent NAPL migration to water bodies and to mitigate an on-going source of contamination to the water bodies

Alternative 4 would address risks to aquatic receptors by aggressively excavating all sediment above the site-specific cleanup criteria of 150 mg/kg total PAHs in the South Pond, K Area, Hershey Run and adjacent marsh and the West Central drainage area Risks in the Fire Pond would be addressed by filling the Fire Pond as part of the consolidation of contaminated soils and sediments

Alternative 5 would address risks to aquatic receptors by removing and/or destroying subsurface contamination using *in-situ* steam-enhanced extraction, and by removing all contaminated sediments for treatment off-site

In terms of comparison, EPA believes Alternatives 4 and 5 provide the highest degree of overall protection of human health and the environment since they address all of the risks, provide the most aggressive cleanup and rely the least on institutional controls Alternative 3 provides a greater degree of protection compared to Alternative 2 since it provides for a greater degree of capture of NAPL at the Fire Pond/Hershey Run area and addresses contaminated sediments in lower Hershey Run and the West Central Drainage area

Compliance with ARARs

This criterion addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements ("ARARs") of federal and state environmental and facility siting laws and/or will provide grounds for invoking a waiver

Any cleanup alternative selected by EPA must comply with all applicable or relevant and appropriate federal and state environmental requirements or, under certain conditions, waive one or more ARARs Applicable requirements are those substantive environmental standards, requirements, criteria, or limitations promulgated under federal or state law that are legally applicable to the Remedial Action to be implemented at a site. Relevant and appropriate requirements, while not being directly applicable, address problems or situations sufficiently similar to those encountered at a site such that their use is well-suited to the particular site EPA is not waiving any ARARs for this Site.

Alternatives 2, 3, 4 and 5 each meet this threshold criterion Some of the major ARARs for the Site include

1 State and Federal water and air discharge requirements – Air emissions for any *excavation or on-site treatment; water discharge or re-injection for de-watering during* construction activities and for ground water collected in the recovery of NAPL

2 State Water Quality Standards – State water quality standards will be attained during any Remedial Action taken Any surface water discharge will meet the substantive requirements of the NPDES program and will be monitored to ensure compliance with these standards

3 National Historic Preservation Act – Due to the long industrial and prior history of this Site, additional cultural resources surveys must be conducted prior to the beginning of any Remedial Action If cultural resources are found that are on, or eligible for, the National Register of Historic Places and would be impacted by the cleanup, including being covered by a cap or disturbed by excavation, mitigation activities may be required

4 RCRA Hazardous Waste Disposal Regulations – Since creosote is a listed waste, off-site disposal costs would be high All creosote ultimately left on-site would be consolidated within an "area of contamination" without triggering RCRA's "land-ban" regulations

5. Ground Water Regulations (**Maximum Contaminant Levels or MCLs and non-zero Maximum Contaminant Level Goals or MCLGs**) – The ground water at the Site is a Class IIB aquifer, meaning that it is a potential source of drinking water As such, MCLs and MCLGs are relevant and appropriate requirements. Only Alternatives 4 and 5 would meet these ARARs because only these alternatives aggressively address the NAPL (the source of the ground water contamination) outside of any area of consolidation or waste management area Note that Section 300 430(f)(5)(iii)(A) of the NCP states that performance (for example, attainment of ARARs) shall be measured at appropriate locations in the ground water, surface water, etc The preamble to the NCP explains that for ground water, remediation levels should generally be attained throughout the contaminated plume or at and beyond the edge of a waste management area when waste is left in place (55 FR 8753) Alternatives 2 and 3 would require an ARAR waiver in order to be selected as the cleanup for the Site

6 Wetlands Regulations – Any activity at the Site which will permanently fill wetlands must include the creation of compensatory wetlands resulting in no net loss of wetlands acreage at the Site

A complete list of ARARs for the selected remedy for the Site is presented in Table 8

Long-term Effectiveness and Permanence

This criterion considers the ability of an alternative to maintain protection of human health and the environment over time The evaluation takes into account the residual risk remaining from untreated waste at the conclusion of remedial activities, as well as the adequacy and reliability of containment systems and institutional controls

Since any containment system requires on-going Operations and Maintenance (O&M), Alternative 5, which includes *in-situ* treatment and excavation and off-site disposal, offers the highest degree of long-term protection because it would permanently remove contamination from the Site The other alternatives that include containment on-site do provide long-term effectiveness, although to significantly varying degrees

Of the on-site containment alternatives, Alternative 4 offers the highest degree of long-term effectiveness and permanence because all of the contamination is consolidated into two areas Alternatives 2 and 3 leave more contamination in the wetland areas (Alternative 2 does not address NAPL contamination in lower Hershey Run) and rely on sediment caps to prevent recontamination (note that generally only an additional 2 ft of excavation would be required to remove all of the contamination and eliminate the need for the sediment caps) The inclusion in Alternative 4 of NAPL recovery from within the containment area would provide an additional degree of long-term effectiveness and permanence by removing NAPL that otherwise that may have the potential to flow downward into the Potomac Alternatives 2 and 3 would be more susceptible to waste being exposed during severe storm or other erosional event as compared to Alternative 4

Reduction of Toxicity, Mobility or Volume of Contaminants through Treatment

This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances as their principal element This preference is satisfied when treatment is used to reduce the principal threats at a site

Alternative 5, by including *in-situ* extraction of subsurface NAPL, would provide the highest degree of reduction in the toxicity, mobility or volume of contaminants The steam injection would destroy some contamination and would remove a majority from the environment, to be disposed of off-site

The other alternatives would include sheetpiling and passive recovery (with off-site treatment and disposal) of NAPL (with Alternative 4 offering the most extensive recovery) that would provide for a reduction of the volume and mobility of NAPL

Short-term Effectiveness

This evaluation criterion addresses the effects of the alternative, during the construction and implementation phase until remedial action objectives are met It considers risk to the community and on-site workers and available mitigation measures, as well as the time frame for attainment of the response objectives

The construction of a soil cover or engineered cap in Alternatives 2, 3 and 4 would involve the delivery of a significant amount of clean soil, creating risks due to traffic through the small town of Newport and the Ciba Specialty Chemicals facility This would be minimized by avoiding or minimizing the need for imported fill (i e , through the use of clean soil from the Site for Alternative 4), and through the use of flag men and a zero-tolerance policy on speeding by the truck drivers

The use of erosion and surface water control measures in each of the alternatives would minimize the potential for any release of contaminated sediment or soil to Hershey Run and White Clay Creek during construction There is a chance for an air release of dust and contamination during excavation and when stockpiled material is stabilized or graded (a common element to several alternatives), but this can be monitored and controlled Dust will have to be controlled during construction for any of the alternatives

Alternative 5 offers the lowest degree of short-term effectiveness since it would take the longest to complete and would involve potential impacts due to the transportation of contaminated soil for off-site treatment and disposal In addition, Alternative 5 includes the risk that high-temperature steam or contamination could escape to the air during the *in-situ* treatment

From one aspect, Alternative 2 offers the highest degree of short-term effectiveness since it could be implemented in the shortest time period and would disturb the least acreage of the Site, minimizing the potential for a release of contamination during construction However, Alternative 2 would not involve any steps to reduce risk in lower Hershey Run Alternatives 3 and 4 provide nearly the same degree of short-term effectiveness, with Alternative 4 providing slightly less because it involves the disturbance of more contaminated material

Implementability

The evaluation of alternatives under this criterion considers the technical and administrative feasibility of implementing an alternative and the availability of services and materials required during implementation

Each of the alternatives is implementable, and the services and materials required for each alternative are readily available However, some would be more difficult to implement than others

Alternatives 2 and 5 would be significantly more difficult to implement since they would require far more truck trips to bring in or remove material This truck traffic would have to pass through an operating chemical plant, then through a small town. The added traffic burden to both the plant and the town is likely to meet some resistance, in addition to posing safety hazards for both

Alternatives 2, 3 and 4 use simple construction techniques that are well understood Alternatives 3 and 4 would require the minimum truck traffic of all of the alternatives Alternative 4 has the added benefit of localizing the construction of containment systems into just two areas, rather than the widespread construction of caps and covers included in Alternative 3 In addition, both Alternatives 3 and 4 would excavate sediments in Hershey Run However, Alternative 3 also proposes to construct caps where contamination extends to depth Alternative 4 does not require capping over widespread areas of the Site, but instead increases the depth of excavation, introducing some difficulties associated with any deeper excavation (e g , slope stabilization)

Alternative 5 utilizes complex technology that is not widely regarded as proven and is by no means simple In addition to a great deal of equipment that would have to be brought in, Alternative 5 would require the most infrastructure to be built at the Site

Each of the alternatives (besides "no action") requires construction within a floodplain, which presents several difficulties Steps must be taken to make sure that, for example, soil or sediment is not washed downstream if an extreme storm event occurs during construction

In addition, each of the alternatives requires actions to be taken in the wetlands on-site Numerous difficulties are presented when working in a wetland, specifically related to the prevalence of soft ground and the added difficulty of de-watering all excavated or dredged materials However, these difficulties are neither unique nor insurmountable

Cost

Alternative 4 is the most cost-effective alternative In evaluating the costs for the alternatives, it is worth noting that the O&M costs may appear high for Alternative 4 due to the inclusion in that alternative of extensive efforts to passively recovery NAPL and manage ground water For Alternative 5 the O&M costs may appear low due to the inclusion of the operating costs of the *in-situ* steam extraction with the capital cost as part of the alternative Under the preferred alternative, NAPL recovery would be expected to taper off, which would reduce O&M costs Alternatives 2 and 3 do not include aggressive efforts to recover NAPL, nor do they include provisions to manage ground water, which could build up behind the containment areas and potentially re-contaminate wetlands The high O&M costs associated with Alternative 3 are largely due to the need to maintain caps and wetlands across a large area for 30 years

Several points stand out when evaluating the costs First, there is a large increase in cost for Alternative 5, as compared to Alternatives 2, 3 and 4 Alternatives 2 through 4 are containment remedies Alternative 5 has been included as representative of a treatment remedy – other treatment remedies were considered in detail in the Feasibility Study Some treatment remedies were less costly (i e , solidification/stabilization at approximately $85 million), and others were more costly (i e., *in-situ* thermally-enhanced extraction of subsurface NAPL combined with excavation and off-site incineration of soils and sediments at approximately $280 million) Second, the preferred alternative, Alternative 4, is approximately $8 4 million more costly than Alternative 3 For this increase in cost, Alternative 4 restores ground water outside the containment area to its beneficial use and consolidates all of the contamination to two areas, thus avoiding long-term monitoring of vast areas of wetlands for recontamination

The Alternative Cost Summary Table (see Table 9) summarizes the capital, annual operation and maintenance ("O&M"), and total present worth costs for each alternative The total present worth is based on an O&M time period of 30 years for the engineered cover, containment, NAPL recovery and ground water treatment systems A discount rate of 7% was used on the present worth calculation For an additional cost estimate breakdown, see the Administrative Record

State Acceptance

DNREC has reviewed comments from the public and the Record of Decision, and concurs with the selected remedy

Community Acceptance

From October 7, 2004 to December 7, 2004, EPA held a 60-day public comment period to accept public comments on the remedial alternatives presented in the *Feasibility Study* and the Proposed Plan and the other documents contained within the Administrative Record for the Site On October 21, 2004, EPA held a public meeting to discuss the Proposed Plan and accept comments A transcript of this meeting is included in the Administrative Record The summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary, which is a part of this Record of Decision

11.0 SELECTED REMEDY

Following review and consideration of the information in the Administrative Record, the requirements of CERCLA and the NCP, and public comment, EPA has selected Alternative 4 (see page 23), as the remedy for the Koppers Site

11.1 Summary of the Rationale for the Selected Remedy

EPA's preferred alternative meets the threshold criteria of overall protection to human health and the environment and compliance with ARARs [6] Based on the information currently available, EPA (the lead agency) believes Alternative 4 provides the best balance of tradeoffs among the alternatives with respect to the balancing criteria For example, EPA's preferred alterative

1) will be protective of both human health and the environment in the least amount of time,

2) will, compared to Alternatives 2 and 5, have significantly less impact to the community during construction, and

3) is the least costly of the alternatives that provide overall protection to human health and the environment

Alternative 4 also offers the highest degree of State acceptance since it provides for the maximum flexibility in the reuse of the Site In addition, EPA's preferred alternative is consistent with EPA's ground water policy and policies pertaining to the removal and/or containment of NAPL Overall, EPA's preferred alternative satisfies the statutory requirements

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[6]Note that while each alternative, (other than the "no action" alternative) addresses some of the risks at the Site, the only other alternative to completely meet these threshold criteria was Alternative 5

of CERCLA §121(b) by being protective of human health and the environment; complying with ARARs; being cost-effective, utilizing permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfying the preference for treatment as a principal element.

11.2 Description of the Selected Remedy and Performance Standards

Based on the comparison of the nine criteria, EPA's preferred alternative is Alternative 4 The total present worth cost of EPA's preferred alternative is $51,760,000 In addition to the common elements described on page 17 (e g , ground water monitoring and institutional controls), the major components of Alternative 4 (as discussed in detail on page 23) are

The selected remedy includes

1 Excavating and consolidating all contaminated soils and sediments (soils with total PAHs greater than 600 mg/kg and sediments with total PAHs greater than 150 mg/kg) into one or two on-site landfills or containment areas, herein referred to collectively as "the Containment Area," to be located in the areas of the worst NAPL contamination,

2. Installing, operating and maintaining a ground water treatment system (e g., liquid carbon filtration) to prevent the migration of contaminated ground water, as well as to prevent the discharge of contaminated ground water from the recovery operation; and an oil-water separator (e g , belt skimmer or baffle tank) to facilitate the recovery of free-phase NAPL, as well as to prevent NAPL from reaching the ground water treatment system,

3. Treating ground water as necessary to meet discharge requirements,

4 Constructing ground water barrier walls and collection systems (e g , passive recovery trenches) in the Containment Area to prevent further migration of ground water contamination, including NAPL,

5 Managing the hydraulic head of ground water and collecting NAPL contamination in the ground water through the use of the passive recovery trenches;

6 Separating creosote from ground water and transporting creosote off-site for disposal or recycling in accordance with Section 121(d)(3) of CERCLA,

7 Moving debris to a location on-site where they can be placed under the RCRA (Resource Conservation and Recovery Act) modified cap,

8 Installing a RCRA modified cap across the Containment Area,

9 Relocating a portion of the existing channel of Hershey Run, if the Containment Area shall extend into the Hershey Run wetlands,

10 Creating wetlands to replace any that are filled in as part of the landfill construction,

11 Monitoring ground water, surface water, sediments and wetlands to ensure the effectiveness of the remedy,

12. Prevent exposure to contamination inside the Containment Area or in ground water beneath the Site, and prevent the drawdown of contamination into the deeper aquifer or elsewhere, through land and ground water use restrictions for the Site and surrounding area (as appropriate)

Institutional controls shall be implemented in order to ensure the effectiveness of the remedial action The selected remedy shall meet all applicable or relevant and appropriate requirements contained in the attached Table 8

11.2.1 Excavate and Consolidate Contaminated Soils and Sediments

Soils and sediments exceeding cleanup criteria shall be excavated and consolidated on-site into one or two containment areas (referred to as the "Containment Area") with amendments for geotechnical stabilization added as necessary to achieve adequate compaction and slope stability The exact location and configuration of the Containment Area will be determined during the remedial design, and subject to EPA approval Roads constructed for the purpose of excavating sediments shall be constructed in a manner to minimize disturbance to wetlands.

Performance Standards for Excavating and Consolidating Contaminated Soils and Sediments

1 Develop and follow plans for excavation near any historic structures in accordance with the National Historic Preservation Act of 1966, as amended

2 Translocate faunal populations present in intended excavation areas to alternate suitable locations in advance of excavation activities

3 In areas lying outside the boundary of the Containment Area (as described in 4, below), excavate all soils and sediments having PAHs present at concentrations greater than 600 mg/kg and 150 mg/kg respectively (the soil and sediment cleanup criteria), excavation depths on average will be 5-15 ft, with a few locations expected to reach depths of 30 ft

4 Consolidate all excavated material into a Containment Area(s) to be located approximately within the former Process Area (the portion of the upland nearest the active railroad tracks and the Fire Pond, see Figure 11).

5 Air emissions during Site grading activities shall comply with the substantive requirements of Delaware emission standards and Delaware regulations governing toxic air pollutants.

6 Any NAPL discovered during excavation or grading activities shall be collected and managed on-site in compliance with substantive requirements of regulations applicable to generators of hazardous waste, and treated and/or disposed of off-site at a RCRA

hazardous waste facility, in compliance with the permitting and other requirements of RCRA and applicable state hazardous waste regulations

7 All excavation activities that will affect wetlands, floodplains, or waters of the United States shall be conducted in accordance with the substantive requirements of Federal Regulation of Activities in or Affecting Wetlands/Floodplains, 40 C F R Sections 6 302(a) and (b), and Delaware Water Management Construction on Non-tidal Waters and Floodplains regulations

11.2.2 Install, Operate and Maintain a Ground Water Collection and Treatment System

Prevent the migration of contaminated ground water and facilitate the recovery of free-phase NAPL through the installation, operation and maintenance of a ground water collection and treatment system (to be supplied with ground water from the passive collection systems described in Sections 11 2 4 and 11 2 5)

Ground water from within the Containment Area shall be contained, collected and treated as necessary on-site, by using a constructed ground water and NAPL containment and recovery system to achieve the following performance standards The ground water collection and treatment system consists of four main components (1) ground water treatment system (e g , liquid carbon filtration; see 11.2 2 and 11 2 3), (2) sub-surface barrier walls to provide containment and isolate contaminated ground water from clean ground water and from tidal influences (see 11 2 4), (3) collection trenches, drainage ways, piping, and associated pumping and NAPL/water separation equipment (see 11 2 4), and (4) an impervious protective cover to prevent direct contact and excessive rainwater infiltration (see 11 2 8)

Performance Standards for Ground Water Collection and Treatment System

1. Prevent the migration of contaminated ground water from the Containment Area and facilitate the recovery of free phase NAPL from the Containment Area through the installation, operation and maintenance of a ground water collection (e g , holding tanks) and treatment system (e g., liquid carbon filtration or equivalent technology) on-site

2 Operate and maintain the ground water collection and treatment system until NAPL is no longer recovered and ground water contamination levels are such that contamination will not spread beyond the Containment Area for a period of three consecutive years. EPA approval shall be required in the determination that these conditions have been met

3 Separate collected NAPL from collected ground water and prevent NAPL from reaching the ground water treatment system through the installation, operation and maintenance of an oil-water separator (e g , belt skimmer or baffle tanks)

11.2.3 Treat Collected Ground Water as Necessary to Meet Discharge Requirements

Collected ground water shall be treated to achieve NPDES discharge requirements (for example, through the use of liquid carbon filtration or equivalent technology) The treated ground water shall be discharged to Hershey Run, the Christina River, or possibly the publicly owned treatment works ("POTW", the final discharge location and configuration shall be determined during the design, subject to EPA approval)

Performance Standards for Treating Collected Ground Water as Necessary to Meet Discharge Requirements

1 Collected ground water shall be treated prior to discharge to comply with the substantive requirements of the National Pollutant Discharge Elimination System ("NPDES") program and the Delaware Regulations Governing the Control of Water Pollution and monitoring requirements

2 Treated collected ground water shall be discharged to either Hershey Run, the Christina River or the local POTW

3. A capacity evaluation shall be completed during the remedial design to determine if additional treatment capacity is required The evaluation shall consider the volume of ground water currently being collected, and the volume, with a safety factor, that could reasonably be assumed to be collected during a wet weather year. The evaluation shall be documented and submitted to EPA in a report Based on the capacity evaluation report, which shall be updated every two years (unless otherwise specified by EPA), EPA will determine if expansion is necessary to prevent untreated ground water from bypassing the containment system If expansion or other modifications are deemed necessary by EPA, the system shall be modified accordingly

4 Treatment system components shall be maintained and replaced, as necessary, to minimize downtime and equipment leaks, and to maximize treatment performance

5 Monitoring reports shall be submitted to EPA at such frequency and in such detail to allow EPA to determine whether or not the NAPL recovery and ground water treatment systems are in compliance with this ROD and, in particular, whether performance standards 1 through 3 above have been achieved and are being maintained

6. On-site handling of hazardous waste and solid waste, resulting from the operation of the ground water treatment plant, shall be in accordance with ARARs Waste resulting from the operation of the plant shall be disposed of off-site. Off-site disposal and handling shall be in accordance with State and Federal waste laws and regulations, as set forth in Section 121(d)(3) of CERCLA and 40 CFR 300 440. Waste streams shall be characterized on a yearly basis, unless regulations require more frequent characterization

11.2.4 Construct Ground Water Barrier Walls and Collection Systems

Prevent the horizontal migration of contaminated ground water and/or creosote NAPL through the construction and installation of subsurface ground water barrier walls (e g , slurry walls or sheetpiling) Collect accumulating ground water and creosote NAPL for recovery and treatment through the construction and installation of a collection system such as a stone-filled passive recovery trench (with associated piping, drainage structures and collection sumps to direct collected ground water to the oil-water separator and ground water treatment system described in Section 11 2 2)

Performance Standards for Ground Water Barrier Walls and Collection Systems

1 Prevent the horizontal migration of contaminated ground water and creosote NAPL by means of ground water barrier walls installed to surround the Containment Area on all down-gradient sides The barrier walls shall be impermeable (10^{-7}) to ground water and shall extend to such depth as to key into the clayey layers in the subsurface, up to 30 feet deep The barrier walls shall also prevent the entry of clean ground water from down-gradient into the collection systems

2 Intercept, collect and drain accumulating ground water and creosote NAPL, directing collected materials to a collection area near the oil-water separator and ground water treatment systems through the use of collection systems such as passive recovery trenches (e g , a stone-filled passive recovery trench and piping) installed up-gradient of the ground water barrier walls The collection trenches shall be constructed in such a way as to present a preferential pathway of high permeability and conductivity such that ground water and NAPL freely drain into them.

11.2.5 Manage the Hydraulic Head of Ground Water and Collect NAPL Contamination Through the Use of the Passive Recovery Trenches

The ground water inside the Containment Area shall be managed in such a way to prevent mounding inside the Containment Area and to prevent up-gradient mounding or flooding, ground water gradient shall be maintained through the use of the passive recovery trenches described in Section 11 2 4; trenches shall also be used for the passive recovery of creosote NAPL from inside of the Containment Areas

Performance Standards for Managing the Hydraulic Head of Ground Water and Collecting NAPL Contamination Through the Use of the Passive Recovery Trenches

1 Manage the hydraulic head of ground water inside of the Containment Area to be kept lower than surrounding areas, thereby creating an inward-gradient, minimizing the risk of contaminated ground water or NAPL escaping into the deeper aquifer

2 Manage ground water so as to prevent flooding up-gradient of the barrier walls and Containment Area (i e., to the north of the active railroad line)

3 Collect NAPL from within the Containment Area through the use of the passive recovery trenches and the oil-water separator described in Section 11 2 2

11.2.6 Separate Creosote NAPL *from* Ground Water *for* Off-Site Disposal *or* Recycling

Creosote NAPL recovered pursuant to 11 2 2(3) and 11 2 5(3) above shall be separated, collected and dısposed of or recycled off-sıte, ın accordance wıth CERCLA 121(d)(3) and 40 CFR 300 440 Creosote that ıs stored on-sıte whıle awaıtıng off-sıte dısposal or recyclıng shall be managed ın accordance wıth RCRA

Performance Standards for Separating Creosote NAPL from Ground Water for Off-Site Disposal or Recycling

1 Creosote NAPL recovered pursuant to 11 2 2(3) and 11 2 5(3) above shall be separated, collected and dısposed of or recycled off-sıte, ın accordance wıth CERCLA 121(d)(3) and 40 CFR 300 440. Creosote that ıs stored on-sıte whıle awaıtıng off-sıte dısposal or recyclıng shall be managed ın accordance wıth RCRA

11.2.7 Move Debris to a Location On-Site where they can be placed Under the RCRA Modified Cap

Debrıs (such as old raılroad tıes and concrete from old foundatıons) encountered at the Sıte shall be consolıdated and placed ınto the Contaınment Area Debrıs consolıdatıon ıs requıred to (1) enable proper ınstallatıon of the RCRA modıfied cap and to ensure ıts ıntegrıty, (2) remove the potentıal hazard posed to people by the debrıs, and (3) enable excavatıon and gradıng of contamınated areas of the Sıte wıthout the need to send truck traffic off-sıte for debrıs dısposal The use of on-sıte soıl and debrıs that meet COMAR 26 04 07 04C(5) wıll mınımıze the need for clean-fill durıng preparatıon of the sub-base for the RCRA modıfied cap

Performance Standards for Moving Debris to a Location On-Site where they can be placed under the RCRA Modified Cap

1 Move and place debrıs (such as old raılroad tıes and concrete from old foundatıons) ınto the Contaınment Area.

2. Cover debrıs wıth consolıdated soıl and sedıment so as to not extend ınto the sub-base for the cap (and rısk puncturıng the cap).

11.2.8 Install a RCRA Modified Cap across the Containment Area

Prevent dırect contact wıth contamınated soıls, sedıments and ground water, whıch would result ın unacceptable exposure rısks, and dıvert raınwater ınfiltratıon, whıch would hınder the capacıty of the ground water collectıon and treatment system, through the ınstallatıon and maıntenance of a RCRA modıfied cap across the Contaınment Area as ıdentıfied ın Fıgure 11 (the precıse locatıon of whıch shall be determıned durıng the remedıal desıgn, subject to EPA approval) Fınal gradıng shall promote draınage off of the Sıte and provıde a vegetatıve cover to prevent erosıon

Performance Standards for Installing a RCRA Modified Cap across the Containment Area

1 Prepare the sub-base for the RCRA modıfied cap

a. Stockpiled soils and debris piles shall be graded as part of the sub-base

b. The sub-base (e g , clean soil fill) shall be placed over consolidated materials in the Containment Area, and shall provide a clean base for the RCRA modified cap

c Grading shall be performed to provide a sub-base to the cap that will serve to divert water off of the cap

d The graded sub-base soils shall not contain stones or debris that could cause a puncture in the cap

2 Install a low-permeability cover (cap), with a permeability of 1 x 10^{-7} cm/sec or less, over the consolidated materials (contaminated soils and sediments and debris and the sub-base) placed in the Containment Area The cap shall have at least two layers of low-permeability material (e g , 60 mil high density polyethylene, "HDPE"), one of which shall be a geosynthetic membrane

3. The cap shall be installed to completely cover the Containment Area (see Figure 11 for the approximate area of this cap)

4. The cap shall be designed and constructed to function with minimum maintenance, to promote drainage and minimize erosion or abrasion of the cover, to accommodate settling so that the cover's integrity is maintained, and to provide adequate freeze protection for the liner material.

5 The cap shall be designed and constructed to accommodate access to monitoring wells and NAPL recovery/ground water treatment trench maintenance points and associated piping and tanks

6 Vegetate and maintain the cap in such a way as to prevent erosion of soils above the liner material. The vegetation on the cap shall be controlled so as to prevent or limit the growth of any plants which would damage the cap with deep root systems (for example, by mowing to trim back woody plants). The types of vegetation shall be identified in the remedial design The remedial design shall be submitted to EPA and the State for review and approval by EPA

7 If needed, the cap shall be designed to permit gas venting. Presently, it is not known whether VOC emissions beneath the cap would exceed levels that require control under Federal and State regulations Field data shall be collected during the remedial design in order to assess air emissions, and controls shall be implemented as necessary to comply with the Federal and State ARARs identified in this ROD

11.2.9 Relocate a Portion of the Existing Channel of Hershey Run

If the Containment Area shall extend into the wetlands areas (which shall be determined during the remedial design), relocate the Hershey Run channel away from such Containment Area

Consideration of the hydrodynamics of Hershey Run shall be included in the remedial design to determine the optimal configuration of the new channel Ensure the stability of the filled former channel and the Containment Area in the former wetlands through the installation of appropriate armoring The new channel shall not alter in any negative way the existing capacity of Hershey Run for the conveyance of water. The new channel shall not alter drainage in the area in such a way as to promote flooding upstream

Performance Standards for Relocating a Portion of the Existing Channel of Hershey Run

1 Locate the new channel so that the stream is routed away from the portion of the Containment Area that extends into the wetlands

2 Configure the new channel so that it conveys both normal water levels (including the incoming and outgoing tides) and storm water runoff in a manner similar to the original channel, so as to prevent any increased negative effects to the area (e g , abnormal flooding).

3 Configure the new channel so that it creates environments similar in type and function to those of the original channel (to protect fish and wildlife resources)

4 The location and configuration of the new channel shall be determined in consideration of both the hydrodynamic and the ecological trade-offs associated with determining its final path, this consideration shall be made through a hydrodynamic study and wetland assessment to be conducted during the remedial design in consultation with USFWS, DNREC and EPA.

5 Ensure the stability of the filled former channel and the Containment Area in the former wetlands through the installation of appropriate armoring

11.2.10 Create Wetlands to replace any that are filled in as part of the Landfill Construction

Create replacement wetlands of similar type and ecological function according to what was filled or excavated during excavation of contaminated sediments (restoration), relocate the Hershey Run channel away from the Containment Area (if the Containment Area shall extend into the wetlands) and construct the Containment Area extending into the former wetlands (unless it is determined during design that the Containment Area shall not extend into the wetlands) Vegetation in the replacement or restored wetlands shall be similar to the filled or disturbed wetlands

Performance Standards for Creating Wetlands to replace any that are filled in as part of the Landfill Construction

1 Create at least as many acres of wetlands having a similar type, function and ecological diversity as any acres of wetlands that are filled as part of the remedial action (resulting, at a minimum, in no net loss of wetlands)

11.2.11 Monitor Ground Water, Surface Water, Sediments and Wetlands to Ensure the Effectiveness of the Remedy

Collect and analyze data from the ground water within and surrounding the Containment Area, surface water and sediments to determine if the containment, NAPL recovery and ground water treatment systems are operating effectively Develop and follow a plan to accomplish this during the remedial design

Performance Standards for Monitoring Ground Water, Surface Water, Sediments and Wetlands to Ensure the Effectiveness of the Remedy

1 Collect and analyze ground water, surface water, soil and sediment samples from multiple locations on-site, the specific locations and frequency shall be determined in the Operations and Maintenance Monitoring Plan, which will be drafted as a part of the remedial design, and finalized following implementation of the remedy

2. Update the monitoring plan every five years, coinciding with EPA's five year reviews, unless EPA accepts an alternate schedule

11.2.12 Land and Ground Water Use Restrictions for the Site and Surrounding Area (as appropriate) since Contamination will Remain at the Site

A Land Use Control Assurance Plan ("LUCAP") shall be developed to address institutional controls, including land and ground water use restrictions, for the Site The institutional controls contained in this ROD are based on current, reasonably anticipated uses of the Site and areas in the vicinity of the Site The purpose of the institutional controls shall be to prevent exposure to unacceptable risks associated with remaining Site-related contaminants and to protect the components of the selected remedy A status report on such institutional controls shall be prepared and submitted for EPA's review every five (5) years following the issuance of the ROD, unless EPA approves an alternate schedule

Performance Standards for Land and Ground Water Use Restrictions for the Site and Surrounding Area

1 Maintain and protect the integrity of the protective cap over the Containment Area and prohibit interference with the integrity of the cap

The integrity of the cap shall not be disturbed There shall be no activity or property use within the Containment Area that could compromise the integrity of the cap, including erosion resulting from activities that would disturb the vegetated soil layer or direct excavation, construction of below-grade foundations or footers, borings, well installation, or placement of heavy equipment, trailers, or other similar activities, without EPA's prior determination that such use could not compromise the integrity of the cap Institutional controls, such as land use restrictions (e g , restrictive covenants), shall be implemented to accomplish this

2 Prohibit exposure to contaminated ground water

Use and/or contact with contaminated ground water at the Site, via ingestion, vapor inhalation or dermal contact shall be prohibited to avoid unacceptable exposure to contaminants in ground water Institutional controls shall be implemented for the Site and the Containment Area on-site (see Figure 11) to accomplish this

3 Prohibit interference with the NAPL recovery and ground water treatment systems

Any activity or use that could interfere with the operation of the NAPL Recovery and Ground Water Treatment Systems, such as excavation and/or construction within the area of the trenches or treatment system, shall be prohibited Institutional controls shall be implemented to accomplish this

4. Prohibit interference with the structure and function of restored wetlands

Any activity that could interfere with the structure and function of restored wetlands at the Site shall be prohibited Institutional controls shall be implemented to accomplish this

11.3 Summary of the Estimated Remedy Costs

The estimated present worth cost of the selected remedy is $51,756,239 This figure includes the costs presented in the detailed cost summary in Table 10

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the response action This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative Minor changes may be documented in the form of a memorandum in the Administrative Record Changes that are significant, but not fundamental, may be documented in an Explanation of Significant Differences Any fundamental changes would be documented in a ROD amendment

11.4 Expected Outcomes of the Selected Remedy

This section presents the expected outcomes of the selected remedy in terms of resulting land and ground water uses and risk reduction achieved as a result of the response action

The consolidation and containment of contaminated soils and sediments at the Site will end the ongoing hazard posed to human health and the environment by the high levels of PAHs present The containment and the NAPL recovery and ground water treatment system will allow Hershey Run to undergo an enormous reduction in risk posed to ecological receptors by the very high levels of PAHs in the sediments The ecological habitat that will be developed in the constructed wetlands or restored in other areas at the Site will continue to be maintained as a natural environmental setting, which benefits people and wildlife The ultimate future use of the Site will be determined by the landowner provided that such use is compatible with the restrictions outlined in this document

At this time, it is anticipated that the Site itself will be mostly re-vegetated open space, with constructed wetlands occupying any deeper excavation areas that remain wet However, if the property owner chooses, it may be further developed into a larger wetlands bank in a manner consistent with the land use restrictions identified above While the creation of a wetlands bank is one possible scenario, the future use of the remediated uplands of the Site has not been determined at this time Once Hershey Run has been restored, biological and toxicological monitoring will show that risks to ecological receptors (such as fish) will have been dramatically reduced Site visitors and workers could enter the Site knowing that there is a protective cap or barrier between them and the contamination below The plastic layer of the cap will provide a clear separation between clean cover soil above and contaminated soil and sediment below, and will be beneficial in the event of storm erosion or flood wash-outs

Institutional controls will restrict residential development and any use of ground water within the Site and activities that could interfere with the protective barrier cap, operation of the NAPL Recovery and Ground Water Treatment Systems

12.0 STATUTORY DETERMINATIONS

Under CERCLA, selected remedies must protect human health and the environment, comply with ARARs, be cost-effective and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable Additionally, CERCLA includes a preference for remedies that use treatment to significantly and permanently reduce the volume, toxicity or mobility of hazardous wastes, as their principal element The following sections discuss how the selected remedy for the Koppers Site meets these statutory requirements

12.1 Protection of Human Health and the Environment

The selected remedy will protect human health and the environment by eliminating exposure or the potential for exposure to Site-related contaminants through the consolidation and containment of contaminated soils and sediments. In addition, the NAPL recovery system and ground water treatment system will prevent the recontamination of Hershey Run surface waters and sediments A multi-layer cap over the consolidation area will provide protection against direct contact with consolidated contaminated soils and sediments for potential future industrial/construction workers or other visitors to the Site

The potential for contamination to migrate down from the Containment Area into the Potomac Aquifer ground water will be prevented by restricting ground water pumping in the area and by managing hydraulic head within the Containment Area via the recovery trenches The trenches will also provide a preferential pathway for the contamination to be recovered, thereby reducing the volume that could potentially migrate downward

Treated ground water, which may be discharged to Hershey Run, will meet all appropriate water quality standards and NPDES limitations in order to prevent any adverse human health and environmental effects

12.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will attain all applicable or relevant and appropriate requirements, which are identified as a performance standard in Section 11 2 and specified in Table 8 of this ROD

12.3 Cost Effectiveness

The selected remedy is cost effective in that it eliminates or mitigates the risks posed by the contaminants at the Site, meets all requirements of CERCLA and the NCP, and its overall effectiveness in meeting the remedial action objectives is proportional to its cost In fact, the selected remedy is nearly the lowest cost (see Table 9), yet ranks the highest or near highest in terms of long-term effectiveness and permanence, reduction in toxicity, mobility or volume, and short-term effectiveness, as compared to the other alternatives

12.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes long-term solutions and treatment technologies to the maximum extent practicable through the use of containment, collection, and treatment of contaminants of concern from soil, sediments and ground water. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best balance of tradeoffs, in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element, and State and community acceptance

12.5 Preference for Treatment as a Principal Element

The selected remedy will meet the statutory preference for treatment as a principal element, since it treats the principal threat waste present at the Site This is done through a combination consolidation of contaminated soil and sediment, which contains principal threat wastes, and passive NAPL recovery, including ground water treatment as needed While Alternative 5 may have best met this preference for treatment, it would have done so at a drastically higher cost with significant implementability issues and no assurance of complete success, as discussed in the evaluation of alternatives.

12.6 Five-Year Review Requirements

Because the remedy will result in hazardous substances remaining on-site above levels that will allow for unlimited use and unrestricted exposure, a review will be conducted at least every five years after initiation of the remedial action, pursuant to CERCLA Section 121(c) and the NCP, 40 C F R Section 300 430(f)(5)(iii)(C), in order to ensure that the remedy continues to provide adequate protection of human health and the environment

13.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There have been no significant or fundamental changes to the proposed remedy as a result of public comments

III. RESPONSIVENESS SUMMARY

KOPPERS CO., INC. (NEWPORT PLANT)
SUPERFUND SITE

NEWPORT / NEW CASTLE COUNTY, DELAWARE

RESPONSIVENESS SUMMARY

This Responsiveness Summary documents public participation in the remedy selection process for the Koppers Co , Inc Superfund Site It contains a summary of the major comments received by EPA during the public comment period on the Proposed Remedial Action Plan ("Proposed Plan" or "PRAP") for the Site and EPA's responses to those comments

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I. Comments from October 21, 2004 Public Meeting and Written Comments with EPA Responses

EPA held a public meeting near the Site on October 21, 2004 to accept public comments on EPA's Proposed Plan The significant comments received regarding the plan are summarized here, along with EPA's responses thereto Because this Responsiveness Summary is a statutorily required document designed to meet the legal requirement that EPA summarize and respond to significant comments received regarding the Proposed Plan, EPA will provide a brief overview of the comments related to the remedy issues and the Agency's response The entire transcript of the meeting, including all comments received on any topic and EPA's response, is included in the publicly available portion of the Administrative Record for anyone who wants to view them

A. General Comments

Comments in Support of the Proposed Remedy

[Resident/citizen] - I would prefer to accept the recommendation of the EPA - Alternative 4 - how can I ensure that this is what is carried out?

[Resident/citizen] - Regarding the Koppers Superfund Site, I agree that this mess should be cleaned up.

[Ciba] - Ciba does not object to the preferred remedial alternative stated in the Proposed Plan.

[DuPont] - Overall, DuPont supports the EPA proposed alternative of on-site containment rather than treatment to address principal waste threat. We also believe it is important that future land use of the Site be considered in developing the Proposed Plan.

EPA RESPONSE: *EPA notes for the Administrative Record the above-referenced general comments in support of the proposed remedy.*

B. Specific Comments

Miscellaneous Comments

[Oral Comment] - What is the cap and how will it look?

EPA RESPONSE: *It is a cap that will be designed to RCRA landfill specifications. It will probably consist of a high-density polyethylene (HDPE) barrier and other layers of sands and soils. It is likely to look like a grassy hill when it is done.*

[Oral Comment] - What about RR ties on site? Will property values be affected?

EPA RESPONSE: *Ties on the site will likely end up in the consolidation area under the RCRA modified cap. EPA's experience is that land values are not normally affected. The Site is being cleaned up, and is under control. This may be considered better than living next to an unknown.*

[Resident/citizen] - Is this why the community is voting?

EPA RESPONSE: *The Koppers Superfund Site is unrelated to any vote currently occurring in the community.*

Comments Concerning Funding for the Cleanup

[Resident/citizen] - who is paying for this clean up?

[Oral Comment] - A gentleman made a theatrical appearance, drinking some water in which he had placed a chip of dried creosote, presumably to demonstrate the lack of toxicity of creosote, and indicated that there was lots of creosote around in railroad ties and telephone poles that nobody seemed concerned about. After his statement, he asked, " who pays for cleanup of the site?"

EPA RESPONSE: *During the Public Meeting, EPA explained the PRP aspects of CERCLA and indicated that not only did Beazer and DuPont (both of the PRPs) pay for what has been done so far, including the cost of EPA oversight, but will very likely pay for the cleanup as well. However, not only is the recommended alternative for remediation of the site out for comment by the public, but it is also open for comment by the PRPs at this time. EPA would like to add that there exists abundant information about the toxicity of creosote, and while it is likely that the water the gentleman drank contained only trace amounts of any of the PAH compounds found in creosote, EPA would caution against anyone knowingly consuming water contaminated by creosote or creosote constituents; to do so on a regular basis could constitute a significant risk to health.*

Comments Concerning Drinking Water

[Resident/citizen] - I live [nearby] - is my water at risk for contamination?

[Oral Comment] - Where is the public water coming from? There is some sort of pump in the neighborhood.

EPA RESPONSE: *State records show no wells using the aquifer in the vicinity of the Site. Public drinking water does not come from the Site. There appears to be a pumping station for either sewer or the public water supply in the area. Public water in the area is supplied from* *surface water or ground water from the Potomac aquifer, though not from the immediate vicinity of the Site.*

[Oral Comment] - Concerns regarding the flow of groundwater off-site were expressed.

EPA RESPONSE: *EPA assured the questioner that the groundwater's normal flow is away from the residential areas. In addition, the creosote is not very mobile and groundwater monitoring has indicated that it is not leaving the Site.*

[Oral Comment] - Will the probability of contamination of the Potomac aquifer be increased?

EPA RESPONSE: *No. The proposed alternative includes passive recovery trenches that will act as a "drain" within the containment area. This "drain" will relieve any pressure head of groundwater and inhibit groundwater migration through the clayey layers and into the Potomac aquifer.*

[Oral Comment] - What happens regarding past exposure to water in wells (before public water supplies)?

EPA RESPONSE: *Any wells in the residential area are up-gradient of the site, so this is not likely a problem. Regarding past exposure, any wells that were up-gradient of the Site probably did not have any Site-related contamination, but it is impossible to know with any certainty. Current records show no wells in the vicinity of the Site.*

Comments Concerning Short-term Impacts of the Remedy

[Resident/citizen] - I only ask you to consider those residents nearby. We have not been exposed to that much of the hazard since most of the problem is in the water, not airborne. That will change as dust rises. Also all the little, and not so little, rodents and snakes will go searching for new homes. You might consider starting near the railroad to chase the animals toward the river, and providing adequate or better dust control.

[Oral Comment] - During construction, will wildlife flee to the neighborhoods and will they be looked after? There are bald eagles in the neighborhood that may be disturbed as well as countless other critters that might be scared out of their normal habitat

EPA RESPONSE: *Wildlife inhabiting the Site could be disturbed during construction. EPA is working closely with wildlife authorities to coordinate remedial activities to prevent negatively impacting existing wildlife and endangered species in particular. However, the translocation of species is contemplated in the ROD, if the natural habitats are affected by the remedial activities. Air emissions and dust control are concerns of the EPA and will be monitored and controlled during remediation of the Site.*

[Oral Comment] - How far will they dig down and what about air emissions during construction?

EPA RESPONSE: *Depth will vary between 15 and 30 feet in soils and around 2 to 4 feet in most of the sediments. Air emissions and dust control are concerns of the EPA and will be monitored and controlled during remediation of the Site.*

[Oral Comment] - Will there be enough commotion during construction to damage house foundations?

EPA RESPONSE: *EPA expects that, as with any excavation and consolidation activities, there would be some vibrations, but any such vibrations would probably be less noticeable than when a fast train passes.*

Comments Concerning Health Effects

[Oral Comment] - In reviewing the plan, it seems that EPA is moving the creosote-contaminated soil and sediment closer to the public by consolidating it along the RR tracks Should we be concerned about eating deer meat from animals taken in that area? Should we be concerned about breathing smoke from the brush fire that was at the site two years ago?

EPA RESPONSE: *The material is being consolidated to the areas where it is already at its worst. The material will be contained by sheet piles, a RCRA hazardous waste landfill cap, and the clay layer of soil between the Columbia formation and the Potomac formation. It should be much safer than now. Creosote does not bioaccumulate, so it should not be a problem when consuming an animal that lives in the immediate area. The fire was not in an area where creosote is a problem. Creosote is on the surface at only few locations, it is mostly sub surface and in sediment. The fire was confined to brush in an area where there is no surface creosote.*

[Oral Comment] - Concern was expressed regarding the effect of creosote on fish

EPA RESPONSE: *Studies indicated that 43% of fish sampled had liver tumors. Recent studies have indicated that this high incidence of tumors is unique in the area to Hershey Run in the vicinity of the Site. Even if not cancerous, such a high incidence of tumors is not normal and is one of the reasons remediation is planned. In addition, there is a fish consumption advisory in the area of the Site due to the presence of PCBs in fish tissue (although the PCBs are not Site-related contaminants).*

[Oral Comment] - Vincent Gruff of the Pleasant Hills community association asked if anybody's kids will get sick. There are quite a few homes (about 40 of the 80 homes in the association) in the area where somebody in the family has cancer. Could a study of the situation be performed?

EPA RESPONSE: *EPA introduced ATSDR (from CDC) and the state public health official. The representative from CDC explained that cause and effect in cancer clusters is normally very hard to show. The purpose of EPA's risk assessment is to determine the risks posed to human health and the environment if the Site is not remediated. The EPA's risk assessment for the Site revealed that ecological-risk was posed by the hazardous substances at the Site. The selected remedy will address the identified risks. After the implementation of the ROD, during 5-year reviews, the protectiveness of the remedy will be evaluated on an on-going basis.*

Comments Concerning Construction Traffic and Access

[Ciba] - Ciba's main concerns relate to the means of access to the Koppers site required to implement the proposed remedy. Ciba requests that this plan be amended to include construction of an access route to the Koppers site through a means other than Ciba's private right-of-way. As the Proposed Plan (p.1) and Figure 1 note, Ciba's Newport facility is adjacent to the Koppers site; and the current single means of access to the Koppers site is via a private road (the "Roadway") extending due west from James Street which runs through the middle of Ciba's Newport pigments production facility and which serves as the main artery for vehicular and pedestrian traffic at this facility. Ciba is deeply concerned that the use of this private road would pose significant disruption to the operations being conducted at its Newport facility, would present significant safety and security concern and would impose significant expense upon Ciba, in addition to depriving it of its property rights.

Ciba's concerns--should its private Roadway be used to allow access of construction personnel, supervision, machinery and heavy equipment to the Koppers site--focus on a number of areas, including safety, security, disruption of business activities, imposition of additional expenses, and the deprivation of property rights.

Ciba, while not objecting to the preferred remedy contained in the Proposed Plan, requests that it be further amended to provide for the construction of a separate access road to the Koppers site-one that will not traverse Ciba's property and which will not result in increased safety and security risks, disruption of Ciba's Newport operations and the burden of additional expense to Ciba.

EPA RESPONSE: *EPA will work with CIBA and the PRP, as well as other stakeholders, to address these potential issues and concerns regarding truck traffic and site-access during the critical remedial design phase of the work.*

Comments Concerning Metals/PCBs in Sediments

[DuPont] - Specific comments on the Proposed Plan are limited to the second footnote on page 15 and 16. This footnote discusses elevated concentrations of zinc at the Site that are co-located with PAHs, as well as zinc that was detected at depth in the sediment (and does not pose a potential threat to ecological receptors) Within this footnote, EPA indicates that zinc "most likely" came from the adjacent DuPont-Newport Superfund site.

As indicated by EPA in the Proposed Plan, there are numerous sources of zinc within the Christina River watershed. We suggest that EPA review the Technical Background and Basis Documents for the Total Maximum Daily Loads (TMDLs) that have been established by the Delaware Department of Natural Resources and Environmental Control (DNREC) for zinc. In 1999, TMDLs were established for zinc in both the Red Clay and White Clay Creeks According to the DNREC TMDL website (http://www.dnrec.state.de.us/water2000/sections/watershed/tmdl/tmdlinfo.htm), a TMDL for zinc was not established, nor is one proposed for the Christina River According to the Technical Background and Basis Documents, NVF Yorklyn Site is the major source of zinc to the Red Clay Creek, and the NVF Newark Site is the major source of zinc to the White Clay Creek. Historic and current discharges (contaminated groundwater and permitted discharges) from both of these facilities entered into the Red Clay and White Clay Creeks. The Red Clay Creek enters into the White Clay Creek near Stanton upgradient of the Koppers Site The White Clay Creek flows past the Koppers property before flowing into the Christina River.

With these known major sources of zinc located upstream of the Site in the Red and White Clay Creeks, and the uncertainty associated with potential upstream sources in Hershey Run, there is a great deal of uncertainty in stating that zinc came from only one potential source. We believe that EPA needs to acknowledge this uncertainty and remove the reference to the DuPont Newport Site.

EPA RESPONSE: *EPA acknowledges that there are numerous other potential sources of zinc in the area, though the adjacent DuPont-Newport Superfund Site remains the closest in proximity and was found to have zinc as a major site-contaminant.*

[Oral Comment] - What about metals and PCBs in sediments and surface waters in the area? Some areas have PCB warnings for fish. Has testing been done on the North side of the RR tracks?

EPA RESPONSE: *This is an industrial area. PCBs and metals contaminations are from other sites and have accumulated in the sediments and wetlands of this site and surrounding areas.*

The sediments that get removed will be consolidated into the containment area. Anything in the sediments will end up there. Overall, things should be cleaner even beyond the Site-related contamination. Testing of ground water from monitoring wells on the north side of the tracks has shown no contamination to date, though future delineation and monitoring will occur there. PCBs in fish near industrial areas are not uncommon.

Comments Concerning Flooding

[Oral Comments] - Concern was expressed regarding flooding if Hershey Run is rechanneled. Recent flooding has been a problem.

EPA RESPONSE: *The redesign of the channel will have to take worst-case flood scenarios into account. These flood scenarios will be considered during the remedial design phase. Recent flooding was caused by flow restrictions north of the RR tracks. Modifications to the channel are all south of the RR tracks and should not impact the up gradient locations that recently experienced flooding.*

AR315964

II. Comments Submitted by Beazer East, Inc. (PRP)

A. Beazer's Comment Letter

This letter summarizes Beazer East, Inc.'s ("Beazer's") comments on the United States Environmental Protection Agency's ("EPA's") Proposed Remedial Action Plan ("PRAP") issued on October 7, 2004 for the Koppers Company Inc. ("Newport Plant") Superfund Site ("Site") located in Newport, Delaware The EPA previously granted Beazer an extension of time within which to file these comments until December 6, 2004. As you know, Section 121(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 ("CERCLA"), as amended, 42 U.S.C. 9601 et seq. ("Superfund"), requires that when the EPA selects a remedial action in accordance with its Superfund authority, the EPA must "select *appropriate* remedial actions determined to be *necessary* to be carried out... which are in accordance with this section and, to the extent practicable, the national contingency plan, and which provide for a cost-effective response." In general, Beazer does not believe that EPA's action in proposing the remedy selected in the PRAP comports with its statutory obligations. Beazer believes that many components of the EPA's preferred cleanup alternative ("Alternative 4") are unnecessary, inappropriate and/or not cost-effective given the data that have been generated during the Site investigations and the feasibility analyses.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions regarding EPA's action, but does not believe that they are correct. The basis for EPA's actions are supported by the studies and investigations conducted over many years at the Site, which are available for review in the Administrative Record. Additionally, the selected remedy is analyzed in accordance with EPA's statutory obligations and is evaluated in light of the nine-criteria set forth in the NCP. EPA's analysis of the selected remedy is fully documented in the Administrative Record.*

In particular, Beazer has significant concerns with respect to the projected costs for implementation of Alternative 4 in the PRAP. Section 121(a) of Superfund directly addresses this key component of remedy selection as follows. "In evaluating the cost-effectiveness of proposed alternative remedial actions, [EPA] shall take into account the total short- and long-term costs of such actions, including the costs of operation and maintenance for the entire period during which such activities will be required " A close review of the PRAP indicates that the EPA has taken different elements of the alternatives presented by Beazer in the Feasibility Study ("FS") and the FS Addendum and added additional elements of significant cost to develop the PRAP. As a result, the PRAP now contains a number of redundant elements that have been incorporated at a significant cost but do not improve the performance of the remedy Furthermore, Beazer believes that the EPA has improperly considered or ignored a number of technical issues, and inappropriately integrated considerations of a possible future reuse, to create a PRAP which we believe is not supportable under CERCLA or the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, but does not believe that they are correct. EPA does not believe that any components of the remedy are redundant. EPA reviewed and considered Beazer's supplemental cost estimates for various components of the remedy. Issues related to potential future use are discussed in more detail within this document, however, the proposed remedy does not make any decision regarding future use, as is suggested in the comment. Rather, the proposed remedy is stated to be " compatible with one potential future use " referring to the proposal that Beazer brought before EPA to possibly use the Site as a wetlands bank for the Delaware Department of Transportation (DelDOT). For the purposes of* *comparison, EPA retained the discussion of future wetlands development as provided in Beazer's FS Addendum (Alternative 10) cost estimates, but these costs were not included in the cost of the proposed remedy itself, as they are related to additional excavation work associated with a potential future use and not directly related to the remedy.*

We request that the EPA address these comments to the PRAP and select a revised remedial action at the Newport Site that not only comports with the requirements of law but, in addition, provides a practical answer to the complex remediation issues that this Site presents Failure to do so represents agency action that is arbitrary, capricious, an abuse of discretion, and otherwise contrary to law. A summary of the most significant issues is provided in this letter and an expanded discussion of these points is contained in the attached document

EPA RESPONSE: *EPA has carefully considered Beazer's comments and believes that the selected remedy addresses the risks posed by the Site. The basis of EPA's selected remedy includes a decade of data collection, which EPA has carefully reviewed and evaluated. EPA has proposed a cost-effective remedial action that is consistent with CERCLA, the NCP, and ARARs. The basis for the proposed remedy is well documented in the Administrative Record, including, but not limited to, EPA's numerous comments on the Remedial Investigation and Feasibility Study, EPA's presentation and response to the National Remedy Review Board, and the Proposed Remedial Action Plan. As stated previously, EPA has proposed a remedy that is consistent with CERCLA, the NCP, and ARARs. Furthermore, EPA's proposed remedy is largely based on an alternative developed by and proposed by Beazer as an addendum to the FS and based upon studies and investigations, which Beazer financed, conducted and submitted to EPA for review and consideration.*

GENERAL ISSUES

1. The Site-specific cleanup ecological risk-based criterion developed for polycyclic aromatic hydrocarbons (PAHs) in sediments (150 milligrams per kilogram [mg/kg]) has been inappropriately applied as a universal soil cleanup criterion, resulting in deeper and more extensive soil removal than is required to mitigate site risks. Beazer's best estimate of the cost, including contingency, for this deeper and more extensive soil removal, is approximately $6 7 million based upon the information provided by the EPA

EPA RESPONSE: *EPA has considered Beazer's assertions, but does not believe that the cleanup criteria are inappropriate for the risks posed at this Site. As discussed in the PRAP and in the ROD, the sediment cleanup criterion is protective and is to apply to those soils where wetlands will be created. Regarding matters of cost, EPA has prepared an extensive analyses of costs, which is attached hereto. Beazer's submittal to EPA of supplemental cost estimates or various components of the remedy were carefully reviewed and considered in EPA's discussion of the cost criterion. Note that PRAP Alternative 3 details what a 2-foot excavation of soil with backfill and cover would cost. Soil excavation for Alternative 3 totaled approximately $7.2M, while soil excavation in Alternative 4 totaled approximately $8.4M - while this is a significant difference, it is not as large a difference as suggested in the comment. As discussed earlier in this document, note that the original cost estimates in the 2003 FS Addendum (FS Alternative 10) split the cost of deeper soil excavations (beyond that required by the remedy) between the remedy and the "wetlands developer". EPA adopted this approach in order to be consistent for the purposes of comparison, but is not requiring the further excavations of materials to create a wetlands bank, as that is not part of the selected remedy. Rather, as stated in the PRAP, EPA's selected remedy is compatible with that potential future use, should such a use materialize in the future.*

2. The EPA has inappropriately required an extensive sediment removal action in Lower Hershey Run and other aquatic Site areas (such as the Fire Pond, South Pond, K Area, and West

Central Drainage Area) through misapplication of both the risk-based site-specific cleanup criterion, and EPA's document titled Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (EPA, 2002). Beazer's best estimate of the cost, including contingency, for the extensive sediment removal in Hershey Run alone is approximately $13.8 million, based upon the information provided by the EPA.

EPA RESPONSE: *EPA has considered Beazer's assertions, but does not believe that they are correct. As stated in the PRAP, the sediment in Hershey Run contains very high levels of TPAHs, in some areas the levels are so high as to constitute a principal threat source area. Therefore, addressing this sediment is certainly appropriate. Regarding matters of cost, please see the attached discussion of cost estimates, and please also refer to Beazer's own supplemental cost estimates for various components of the remedy. In response to EPA's comments on the 2003 FS Addendum, Beazer provided its best-cost estimate for the sediment removal as $3.2 million. Beazer's FS Addendum states:*

> *"Removal of NAPL-contaminated sediments from the lower reaches of Hershey Run would include the removal of approximately 21,300 cubic yards of sediment from the upper 1 to 4 feet, disposal in the onsite containment area, and backfill with clean sand as is proposed for FS alternatives 6 through 9. The additional cost of this option is estimated to be $3.2 million based on the FS costs for Alternatives 6 through 9."*

In contrast, the estimate that EPA presented to the National Remedy Review Board ("NRRB") regarding the additional cost of addressing the sediments in the lower reaches of Hershey Run was approximately $6.5M.

3 The proposed EPA plan for passive and possibly active groundwater and dense non-aqueous phase liquids ("DNAPL") collection within the vertically contained consolidation areas is largely a redundant remedial element Both the vertical barrier wall and the groundwater and DNAPL system are intended to control the source of groundwater impacts and prevent future releases of DNAPL to surface water and sediments. Beazer's best estimate of the cost, including contingency, for the DNAPL collection element is approximately $7.4 million, based upon the information provided by the EPA.

EPA RESPONSE: *EPA has considered Beazer's assertions, but does not believe that they are correct. Due to the actual mobility and the potential for mobilization of NAPL in the subsurface during construction, the vertical barrier wall will prevent any lateral migration of NAPL out of the containment area during the installation of the recovery trench system, as well as during the subsequent excavation of material outside of the containment area which will most certainly change the hydraulic conditions in the surrounding area of the Site. In addition, the vertical barrier wall will isolate ground water outside of the containment area, ensuring that only ground water from within is collected by the passive recovery trenches. Therefore, EPA does not believe that this remedial component is redundant, but is necessary to address the mobility of NAPL. EPA's cost estimate shows a cost of approximately $4.5 million for the DNAPL recovery trench system.*

4. The EPA-recommended remedy is supported largely by its unfounded intention to restore Site groundwater to its beneficial use as a potential source of drinking water. Beazer considers this intention to be both inappropriate and technically impracticable. The goal is inappropriate because the impacted aquifer is not a source of drinking water and technically impracticable because no proven technologies exist that could restore this impacted shallow groundwater to drinking water standards Moreover, any serious efforts at exploiting shallow groundwater for potable purposes could result in a greater damage to the environment due to the likelihood of saltwater intrusion. Thus, Beazer believes that the EPA has incorrectly

designated the aquifer for potable use thereby applying incorrect Applicable or Relevant and Appropriate Requirements ("ARARs") in the PRAP. In the alternative, if the groundwater ARARs are found to be appropriate, a position with which Beazer strongly disagrees, Beazer should qualify for an ARAR waiver for impacted shallow groundwater We note, for the record, that the EPA approved an ARAR waiver for shallow groundwater for similar reasons and incorporated it into a 1993 Record of Decision ("ROD") at the adjacent E I. DuPont de Nemours & Co., Inc. Pigment Plant Landfill Site (in Newport, Delaware). Estimated costs are included under point 1 above.

EPA RESPONSE: *EPA has considered Beazer's assertions, but does not believe that they are correct. The PRAP neither refers to, nor suggests, that the Columbia aquifer is or should be restored to conditions consistent with potable use. Rather, the PRAP states that the Columbia Aquifer is a "potential drinking water aquifer," as designated by the State. EPA does not designate an aquifer for potable use, since such designations for ground water use is a State function. EPA does, however, pursuant to its statutory obligation, "expect to restore ground water to its beneficial use, to the maximum extent practicable " Contrary to the assertion in the comment, EPA believes and states in the PRAP that the excavation and consolidation of the NAPL- and PAH-contaminated material present in the aquifer will allow for physical and biological attenuation processes to ultimately eliminate any residual contamination, thus restoring the ground water outside of the containment area.*

5. The PRAP unfairly assumes that future reuse of the Site will occur and this assumption drives key components of the remedy. Aggressive cleanup of wetlands and groundwater to allow specific reuse of the Site as a wetlands bank is premature and represents an unacceptable basis for establishing the extent of soil and sediment cleanup required Aggressive wetlands cleanup may also permanently disturb wetland habitat and function Additionally, it is our understanding that alternative properties in the area may be more viable options for wetland construction and/or banking than the Site. Since the time Beazer evaluated reuse of the Site as a wetlands bank, other types of uses have been proposed by Site and area stakeholders, including the potential for the location of a drinking water storage reservoir at the Site, it is evident that an appropriate reuse scenario will not be determined for some time.

EPA RESPONSE: *EPA has considered Beazer's assertions and recognizes their role as the property owner regarding the future use of the Site. The PRAP does not assume any future re-use scenario; rather, the remedial components are driven by the risk assessment data and the proposed remedy is stated to be "compatible" with future use, with no expected restriction on land use outside of the containment area. The soil and sediment cleanup is driven by the risks posed at the Site. EPA understands that the cleanup may disturb wetland habitat and function; however, any wetlands disturbance during the cleanup will be mitigated in accordance with the stated ARARs. The extent of excavation is not for the purposes of creating a wetlands bank which is not a remedial component of the selected remedy, but rather to address the Site risks posed by the hazardous substances in soils and sediments. EPA understands the future use of the Site has not been determined yet.*

6. The agency has arbitrarily mandated several prescriptive requirements to the remedy that are likely to change during the remedial design (e.g., the location and size of the on-site containment areas, the extent of areas that need to be excavated, etc.). Beazer believes that it is unnecessary and unreasonably restrictive to incorporate these requirements into the preferred remedy at this stage.

EPA RESPONSE: *EPA has considered Beazer's assertions, but does not believe that they are correct. EPA is aware that estimates of areas and volumes to be excavated and contained are just that: estimates. For the purposes of estimating the cost and to evaluate completely* *the suitability of the remedy, detailed estimates were created, and the text of the PRAP stated that these exact figures and locations would likely change during the Remedial Design and further delineation efforts to determine the scope and extent of the hazardous substances on-Site.*

7. The agency has failed to clearly specify the cost components of the preferred remedy in sufficient detail for Beazer and the other stakeholders to understand the basis for EPA's decisions. Failure to adequately disclose the amounts and underlying rationale for these enormous costs deprives Beazer of an opportunity to comment meaningfully on the PRAP, in violation of Section 121(a) of CERCLA and due process of law.

EPA RESPONSE: *EPA has considered Beazer's assertions, but does not believe that they are correct. There is significant identification and discussion of the remedial cost components in the Administrative Record. The cost estimates were (1) based on FS documents submitted to EPA by Beazer, (2) clearly documented in the Administrative Record, and (3.) presented to the NRRB for rigorous review. The original early estimates of volumes of soils and sediments potentially subject to remediation were developed by EPA due to Beazer's continued failure to provide that information upon EPA's request during the RI/FS process. Since that time, Beazer's additional studies, and EPA's subsequent evaluation of the new and existing data have provided EPA with sufficient information concerning the Site-contamination, and therefore, the estimated volumes of materials potentially subject to remediation. Further delineation will be performed during the RD, which is consistent with the Superfund process.*

8. Finally, Beazer believes that the EPA has improperly applied the required analysis of the nine criteria contained in 40 C.F.R. 300 430(e)(9) in selecting its preferred remedy in contravention of the agency's obligation in the NCP. In particular, and without limitation, Beazer believes that the threshold criteria have been misapplied inasmuch as cleanup beyond that necessary to protect human health and the environment has been proposed, and the ARARs for potable groundwater have been misinterpreted and applied to require extensive subsurface excavation activities. Secondly, and without limitation, the balancing criteria have been unfairly weighted particularly for short-term effectiveness, implementability, and cost, particularly with respect to the mandatory requirements for soils and sediments discussed above and for other reasons discussed in the attachment.

EPA RESPONSE: *EPA has considered Beazer's assertions, but does not believe that they are correct. EPA has responded to the "potable use" issue above in #4. As stated in the PRAP, EPA expects to restore ground water outside of the containment area to beneficial use.*

The comment underestimates the downward pathway of contamination to the underlying Potomac aquifer. Nonetheless, the Columbia ***is*** *classified as a potential drinking water aquifer (a designation placed by the state, not by EPA), creosote NAPL at the Site* ***is*** *mobile and* ***has been*** *discharging to surface water for many years. Due to its mobility, EPA's remedial action components have been selected to mitigate this potential spread of contaminant.*

9. Conclusion -- Beazer requests that the EPA take all of these comments into account in its further decision-making at this Site to achieve an appropriate and practical resolution of Site cleanup.

EPA RESPONSE: *EPA has carefully reviewed all the information and data presented to EPA by Beazer during the many years it has conducted the Site investigations and studies. EPA has thoughtfully considered the comments presented by Beazer during each phase of the Superfund process, including the comments submitted herein on the PRAP. EPA has selected* *a remedy in accordance with CERCLA, the NCP and ARARs. The information forming the basis of EPA's decision has been made available in the Administrative Record for the Site.*

B. Beazer's Comments Attachment

Beazer Comments on the PRAP for the Koppers Company, Inc. Superfund Site

This attachment presents Beazer East, Inc.'s ("Beazer") comments in response to the United States Environmental Protection Agency's ("EPA") Proposed Remedial Action Plan ("PRAP") issued on October 7, 2004 for the Koppers Company Inc ("Newport Plant") Superfund Site ("Site") located in Newport, Delaware. Provided below is a brief description of what Beazer believes are the most significant issues related to EPA's recommended remedy, followed by a more detailed discussion of these issues, and finally, a specific page-by-page comments.

1.0 GENERAL ISSUES

1. The Site-specific cleanup ecological risk-based criterion developed for polycyclic aromatic hydrocarbons (PAHs) in sediments (150 milligrams per kilogram [mg/kg]) has been inappropriately applied as a universal soil cleanup criterion, resulting in deeper and more extensive soil removal than is required to mitigate Site risks. Beazer's best estimate of the cost, including contingency, for this deeper and more extensive soil removal, is approximately $6.7 million based upon the information provided by the EPA.

EPA RESPONSE: *EPA has thoughtfully considered Beazer's assertions, but does not believe that they are correct. EPA has fully addressed this comment in EPA's response to Beazer's Comment 1, above.*

2. The EPA has inappropriately required an extensive sediment removal action in Lower Hershey Run and other aquatic Site areas (such as the Fire Pond, South Pond, K Area, and West Central Drainage Area) through misapplication of both the risk-based Site-specific cleanup criterion, and the EPA's document titled Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (EPA, 2002). Beazer's best estimate of the cost, including contingency, for the extensive sediment removal in Hershey Run alone is approximately $13 8 million, based upon the information provided by the EPA

EPA RESPONSE: *EPA has thoughtfully considered Beazer's assertions, but does not believe that they are correct. EPA has fully addressed this comment in EPA's response to Beazer's Comment 2. above.*

3. The proposed EPA plan for passive and possibly active groundwater and dense non-aqueous phase liquids ("DNAPL") collection within the vertically contained consolidation areas is largely a redundant remedial element. Both the vertical barrier wall and the groundwater and DNAPL system are intended to control the source of groundwater impacts and prevent future releases of DNAPL to surface water and sediments. Beazer's best estimate of the cost, including contingency, for the DNAPL collection element is approximately $7.4 million, based upon the information provided by the EPA.

EPA RESPONSE: *EPA has thoughtfully considered Beazer's assertions, but does not believe that they are correct. EPA has fully addressed this comment in EPA's response to Beazer's Comment 3, above*

4 The EPA-recommended remedy is supported largely by its unfounded intention to restore Site groundwater to its beneficial use as a potential source of drinking water. Beazer considers this intention to be both inappropriate and technically impracticable The goal is inappropriate because the impacted aquifer is not a source of drinking water and technically impracticable because no proven technologies exist that could restore this impacted shallow groundwater to drinking water standards. Moreover, any serious efforts at exploiting shallow groundwater for potable purposes could result in a greater damage to the environment due to the likelihood of saltwater intrusion. Thus, Beazer believes that the EPA has incorrectly designated the aquifer for potable use thereby applying incorrect Applicable or Relevant and Appropriate Requirements ("ARARs") in the PRAP. In the alternative, if the groundwater ARARs are found to be appropriate, a position with which Beazer strongly disagrees, Beazer should qualify for an ARAR waiver for impacted shallow groundwater. We note, for the record, that the EPA approved an ARAR waiver for shallow groundwater for similar reasons and incorporated it into a 1993 Record of Decision ("ROD") at the adjacent E.I. DuPont de Nemours & Co., Inc. Pigment Plant Landfill Site (in Newport, Delaware). Estimated costs are included under point 1 above.

EPA RESPONSE: *EPA has thoughtfully considered Beazer's assertions, but does not believe that they are correct. EPA has fully addressed this comment in EPA's response to Beazer's Comment 4, above. Additionally, with respect to the ARAR waiver at the DuPont (Newport) Site, although similarities exist between Superfund sites, EPA's remedies are Site-specific with remedial components identified through the nine criteria set forth in the NCP. The ARAR waiver at DuPont (Newport) is not relevant to this Site.*

5. The PRAP unfairly assumes that future reuse of the Site will occur and this assumption drives key components of the remedy. Aggressive cleanup of wetlands and groundwater to allow specific reuse of the Site as a wetlands bank is premature and represents an unacceptable basis for establishing the extent of soil and sediment cleanup required. Aggressive wetlands cleanup may also permanently disturb wetland habitat and function. Additionally, it is our understanding that alternative properties in the area may be more viable options for wetland construction and/or banking than the Site. Since the time, Beazer evaluated reuse of the Site as a wetlands bank, other types of uses have been proposed by Site and area stakeholders including the potential for the location of a drinking water storage reservoir at the Site; it is evident that an appropriate reuse scenario will not be determined for some time

EPA RESPONSE: *EPA has thoughtfully considered Beazer's assertions. EPA has fully addressed this comment in EPA's response to Beazer's Comment 5, above.*

6. The agency has arbitrarily mandated several prescriptive requirements to the remedy that are likely to change during the remedial design (e.g., the location and size of the onsite containment areas, the extent of areas that need to be excavated, etc.) Beazer believes that it is unnecessary and unreasonably restrictive to incorporate these requirements into the preferred remedy at this stage.

EPA RESPONSE: *EPA has thoughtfully considered Beazer's assertions, but does not believe that they are correct. EPA has fully addressed this comment in EPA's response to Beazer's Comment 6, above.*

7 The agency has failed to clearly specify the cost components of the preferred remedy in sufficient detail for Beazer and the other stakeholders to understand the basis for EPA's decisions. Failure to adequately disclose the amounts and underlying rationale for these enormous costs deprives Beazer of an opportunity to comment meaningfully on the PRAP in violation of Section 121(a) of CERCLA and due process of law.

EPA RESPONSE: EPA has thoughtfully considered Beazer's assertions, but does not believe that they are correct. EPA has fully addressed this comment in EPA's response to Beazer's Comment 7, above.

8. Finally, Beazer believes that the EPA has improperly applied the required analysis of the nine criteria contained in 40 C.F.R. 300.430(e)(9) in selecting its preferred remedy in contravention of the agency's obligation in the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"). In particular, and without limitation, Beazer believes that the threshold criteria have been misapplied inasmuch as cleanup beyond that necessary to protect HH and the environment has been proposed, and the ARARs for potable groundwater have been misinterpreted and applied to require extensive subsurface excavation activities. Secondly, and without limitation, the balancing criteria have been unfairly weighted particularly for short-term effectiveness, implementability, and cost, particularly with respect to the mandatory requirements for soils and sediments discussed above and for other reasons discussed in the attachment

EPA RESPONSE: EPA has thoughtfully considered Beazer's assertions, but does not believe that they are correct. EPA has fully addressed this comment in EPA's response to Beazer's Comment 7, above.

The estimated total cost of the issues addressed above amounts to approximately $27.9 million, which represents over 50% of the total remedy cost. Beazer believes that a significant portion of these costs is unnecessary to protect human health and the environment and improperly imposed in the PRAP as result of improper balancing of the NCP balancing criteria in 40 C F.R. 300.430(e)(9).

EPA RESPONSE: EPA has considered Beazer's assertions, but does not believe that they are correct. Regarding matters of cost, please see the attached discussion of cost estimates, and please also refer to Beazer's own supplemental cost estimates for various components of the remedy. Note that PRAP Alternative 3 details what a 2-foot excavation of soil with backfill and cover would cost. Soil excavation for Alternative 3 totaled approximately $7.2M, while soil excavation in Alternative 4 totaled approximately $8.4M - while this is a significant difference, it is not as large a difference as suggested in the comment. As discussed earlier in this document, note that the original cost estimates in the 2003 FS Addendum (FS Alternative 10) split the cost of deeper soil excavations (beyond that required by the remedy) between the remedy and the "wetlands developer". EPA adopted this approach in order to be consistent for the purposes of comparison, but is not requiring the further excavations of materials to create a wetlands bank, as that is not part of the selected remedy. Rather, as stated in the PRAP, EPA's selected remedy is compatible with that potential future use, should such a use materialize in the future.

2.0 DISCUSSION OF GENERAL ISSUES

This section expands upon the issues outlined above.

2.1 ISSUE 1: SOIL CLEANUP CRITERIA AND APPROACHES

Under the PRAP, the EPA proposes to excavate all surface and subsurface soil with PAH concentrations greater than 150 mg/kg PAH. Beazer believes that the EPA's proposal is arbitrary and without basis for several reasons. First, the 150 mg/kg PAH criterion is the *sediment cleanup criterion* and has no significance for surface and subsurface soils. The EPA prematurely states that the application of this criterion is necessary for soils and subsoils because of its determination regarding future use of the Site for wetlands banking However, even if conversion of terrestrial habitats to wetlands for wetland banking purposes is considered a viable end use, the requirement to remove all soil with PAH concentrations above 150 mg/kg is overly protective.

EPA RESPONSE: *EPA has considered Beazer's assertions, and agrees that "the 150 mg/kg PAH criterion is the sediment cleanup criterion." However, the PRAP and the ROD clearly state that the sediment cleanup criterion shall be applied to soils in those areas where wetlands will be created. Furthermore, wetlands creation is listed as a possible future use, and not prescribed at all as part of the remedy. In response to this comment, EPA has further clarified this point in the description of Alternative 4.*

Second, the EPA has decided to use this criterion as a fixed cleanup target without consideration of the option of placing clean surface soils as a buffer to mitigate potential exposure risks. This approach results in excessive soil removal volumes and greatly increases the cost and technical complexity associated with huge soil excavation and movement projects. Third, this approach will result in excessive and unnecessary disturbance to unique ecologically sensitive habitats that are present at the Site. These negative impacts are greatly exacerbated by EPA's insistence in the PRAP to remove all soil where concentrations exceed the target criterion, including material at depth, not just in the biologically active zone. The result of this approach is that soil excavation depth will average 5 to 15 feet, up to a maximum of 30 feet below ground surface.

EPA RESPONSE: *EPA has considered Beazer's assertions, and notes that in the PRAP EPA considered several options for cleanup. Specifically, in the PRAP Alternative 2, EPA clearly considered "the option of placing clean surface soils," even including a liner and burrow-inhibition layer. For the reasons clearly and carefully outlined and considered in the PRAP, including evaluation against the nine criteria, EPA believes this to be an inferior alternative to the selected remedy. Please refer to the previous comment regarding the actual application of the cleanup criteria, and please refer to the PRAP for a discussion of the comparison of the selected remedy and a cover-in-place alternative. EPA's selected remedy may temporarily disturb sensitive habitats, but will provide for the translocation of the species and provide permanent relief.*

With respect to the possible future exposure of aquatic organisms in created wetlands, Beazer's extensive review of the Site data indicate that it is not ecologically warranted. A review of the ecological literature indicates that sediment-dwelling organisms rarely occur at depths deeper than 10 to 30 centimeters. For example, 95% of chironomid larvae reside in the upper 10 centimeters of the sediment column in soft-bottom habitats (American Society for Testing and Materials [ASTM], 1995). Also, studies of the burrowing behavior of a broad range of freshwater insect taxa from four orders (i.e., Diptera, Ephemeroptera, Megaloptera, and Trichoptera) showed that burrows rarely exceeded 10 cm (Charbonneau et al , 1997; Charbonneau and Hare, 1998). These results indicate that removal of 1 to 2 feet of soil, and capping, if necessary, would be sufficient to prevent ecological organisms from re-exposure to PAHs remaining in soils underlying created wetlands. Furthermore, the EPA is not clear regarding its estimates of the associated impacted soil volumes. In the PRAP, excavation to the 600 mg/kg goal established based on earthworm toxicity tests is estimated at 115,000 cubic yards (cy) (see discussion of Alternative 3) and excavation to the more stringent goal of 150 mg/kg based on sediment toxicity tests is estimated at *a lesser* volume of 113,000 cy (see discussion of Alternative 4) Clearly, the EPA's calculations for soil removal volumes are incorrect.

EPA RESPONSE: *EPA has considered Beazer's assertions, and does not believe that they are correct. Regarding capping sediments please refer to the extensive discussions of a cover-in-place alternative presented in the PRAP Alternative 2, as further explained in the previous response. Regarding volumes, the PRAP proposes a smaller containment area in Alternative 3, resulting in a larger acreage to be excavated (due to the smaller footprint of the containment/consolidation area which results in greater excavation outside of that footprint).*

The previous response addresses EPA's selection of the cleanup criteria, and provides a further discussion of the ARARs as they apply to the media to be cleaned-up.

This issue was also noted by the National Remedy Review Board ("NRRB") in its first recommendation, in which it indicated that such deep excavations were not justified to achieve a protective remedy and that "the preferred alternative should identify only those CERCLA remedial actions necessary for a protective remedy." In response to this, the EPA indicated that the extensive depth of excavation was to restore groundwater in the Columbia formation for use as a potential drinking water source. The EPA has not provided any justification to prove that the excavation of soils exceeding 150 mg/kg is necessary for the protection of groundwater. As explained below (see Issue 4), evidence indicates that the Columbia aquifer cannot be used as a drinking water source due to its poor water quality by non-Site related constituents.

EPA RESPONSE: *EPA has considered Beazer's assertions, and notes that the comment does not accurately state the NRRB comment. Please note that what the NRRB actually commented was, "PRAP does not present the justification..." In response to the NRRB comment, EPA has included the thorough discussion of the justifications for deeper excavation and consolidation. In addition, EPA notes that while the Columbia aquifer is not presently used for drinking water, it is classified as a "potential drinking water source."*

To summarize then, Beazer believes that the EPA improperly has required the application of a more stringent standard for soil excavation than is required to protect human health and the environment, and has failed to consider the use of a suitable clean soil cover, or a combination of excavation and cover, as an equally protective approach.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions. EPA did consider the use of a clean soil cover, or a combination of excavation and cover in Alternative 2 of the PRAP.*

2.2 ISSUE 2: SEDIMENT REMEDIATION IN HERSHEY RUN

The EPA proposes to excavate all sediment from lower Hershey Run, and the marsh adjacent to the upper portion of Hershey Run where PAH concentrations exceed 150 mg/kg. Again, EPA's decision to use these criteria as cleanup targets improperly fails to consider: 1) the applicability of the cleanup target which applies to surficial sediments only; 2) the option of placing clean material covers to mitigate potential exposure risks; and 3) the unnecessarily excessive sediment removal volumes that will result in excessive disturbance to unique ecologically sensitive habitats to support the proposed excavation.

For aquatic plant and benthic invertebrate communities, the risk assessment for the Site (EPA, 2003a) concluded that impacts were only observed in localized areas within Hershey Run. Biodiversity increases with downstream distance from the Fire Pond, and the downstream area of Hershey Run is a diverse and functioning benthic community. However, the proposed alternative includes extensive sediment removal from all reaches of Hershey Run down to its confluence with White Clay Creek.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe they are correct. The toxicity data provided the most reliable indication of ecological risk. In addition, EPA believes that the benthic survey data has limited applicability, since the survey sampling was not conducted at the same time or in the same sampling locations as where toxicity samples were collected – an issue which was thoroughly discussed in the Ecological Risk Assessment ("ERA"). In addition, the resultant biodiversity data are not as conclusive as the toxicity data, as the ERA explains. The proposed alternative provides estimates of potential sediment excavation volumes, clearly stating that delineation efforts will be conducted during the RD.*

The EPA indicates that its proposed plan is consistent with the Eleven Risk Management Principles recommended in *Principles For Managing Contaminated Sediment Risks At Hazardous Waste Sites,* (OSWER Directive 9285.6-08) (EPA 2002) championed by the Contaminated Sediments Technical Advisory Group (CSTAG) The PRAP goes far beyond what is required to meet a sound risk management approach outlined in the above directive The first oversight is that principles 1, 5, and 11 of the OSWER Directive should be considered in conjunction with each other. These principles include: control sources early, use an iterative approach, and monitor during and after remediation. These principles point to a sediment solution that would cut off the upland DNAPL seeps near the Fire Pond, coupled with relocation of Upper Hershey Run as proposed by Beazer and by the EPA in the draft PRAP, followed by a period of monitoring to assess the benefits of this source control before implementing downstream remediation activities.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe that they are correct. EPA believes that Hershey Run is a principle threat source area. Creosote NAPL -- free product -- was observed throughout a significant distance of Hershey Run, well downstream of the proposed source control of the containment area. The "Eleven Principles" were indeed considered carefully, and a specific presentation was made to the CSTAG as part of the NRRB documents.*

The second oversight is that the EPA inappropriately contends that Monitored Natural Attenuation ("MNA") for sediments is not a viable option because Site operations ceased 30 years ago and there has been no reduction in risk. The EPA notes having seen DNAPL seeps to Hershey Run near the Fire Pond. Until source control measures are taken and monitoring data collected to assess the effectiveness of source control activities, the EPA is without basis to make statements regarding the viability of MNA. In fact, existing data provides indication of MNA, which might be greatly accelerated if upland sources (to the extent they exist) are mitigated.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, but does not believe that they are correct. EPA's position is well documented in the Administrative Record. EPA disagrees with Beazer that "monitored natural recovery" (MNR) or "monitored natural attenuation" (MNA), which may be appropriate for low concentrations of PAHs (10s-100s of mg/kg in sediment), is appropriate for this Site where thousands of PPM of PAHs occur. Under such high concentrations, the very organisms which would degrade the contaminants are unable to survive. MNA / MNR is not regarded as effective where such high concentrations as to constitute a principal threat are found. EPA does not agree that existing data provide any clear indication of MNA / MNR in sediments. However, EPA is confident that the toxicity and other data do provide a clear indication of ecological risk in much of Hershey Run.*

The EPA also contends that the potential disturbance of impacted sediments is high and can be caused by activities such as wading or bioturbation. The majority of impacted sediments in Lower Hershey Run is found at depth and generally considered stable with ongoing deposition of new material (0.24 to 0.36 inch per year) covering and more thoroughly containing Site-related PAHs over time. Field activities performed in 2002 paint a different picture than that proposed by the EPA in the PRAP. These activities indicate that the sediments were only disturbed through intrusive coring and probing activities, not wading. Additionally most literature indicates that the bioturbation is generally limited to the upper 6 inches of sediment.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe that they are correct. The photographs and documents in the Administrative Record do not support Beazer's assertions. Free product creosote NAPL is easily liberated from shallow sediments through the simple action of wading. In addition, Beazer continues to argue that "natural encapsulation" will isolate these contaminants because a total of 2 sediment samples analyzed* *from the Site, both taken from isolated locations well outside of any major drainage channel, indicated a depositional setting. EPA, whose position regarding this argument is well-documented in the Administrative Record, does not agree (1.) that these 2 isolated samples can necessarily speak for the center of the Hershey Run channel, which drains many square miles of impervious surfaces, and (2.) that even if these samples were from Hershey Run itself, a particular environment can change from depositional to erosional quite literally overnight. Hershey Run is not immune to flooding problems, which occur in the area. EPA remains convinced that principle threat sediments and NAPL in Hershey Run must be remediated and not left susceptible to erosion or exposure.*

The EPA further contends that capping is not a cost effective action because generally only 1 to 2 feet of material will need to be removed and a cap would require the removal of 2 feet to maintain the existing grade. The EPA has failed to balance the advantages of suitable alternatives recommended by Beazer. Obviously, in these areas the removal of only the impacted material is appropriate; however, in areas where proposed sediment removal is greater than 2 feet, such as in Reach 8, capping is still a viable option that would adequately reduce risk, provide suitable benthic habitat, and would do so in a cost effective manner with reduced short-term impacts on the environment.

EPA RESPONSE: *EPA has carefully considered Beazer's comments, and believes they are not correct. The PRAP includes an alternative, which carefully considered sediment capping, and was balanced against the nine criteria in the consideration of alternatives.*

Beazer believes that more appropriate alternatives to the above selected removal approach, could include selected hotspot removal followed by natural recovery, capping, or rechannelization of the complete length of Hershey Run coupled with backfilling and habitat restoration of the existing channel.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions and believes it has carefully considered multiple options, as have been clearly documented in the PRAP, NRRB documents and the AR, and has selected a remedy that best satisfies the nine criteria for remedy selection. EPA disagrees that hot spot removal, in the context of the comment, is a viable alternative because it would leave in place contaminated sediments with PAH levels exceeding the risk-based cleanup criterion, and therefore would not be protective; natural recovery would not reliably reduce risk in the remaining contaminated sediment, as is explained in the earlier response regarding "monitored natural recovery."*

2.3 ISSUE 3: PASSIVE DNAPL RECOVERY WITHIN THE CONTAINMENT AREAS

As discussed in the *Final Draft Remedial Investigation Report* (RI Report) (BBL, 2002), DNAPL in subsurface soils occurs in zones typically associated with historic Site operations. Within these zones, DNAPL was reported to occur either as discontinuous layers of potentially mobile liquid up to a few inches thick, as blebs that are not mobile, or as dry weathered seams that represent a residual and non-mobile phase. Contrary to the impression provided by the EPA in the PRAP, the data indicate that there is not a large mobile mass of DNAPL that poses any significant threat should it migrate, or that can be effectively removed. It is not physically or technically practicable under these conditions to remove even the mobile portion of the DNAPL because the product occurs in thin discontinuous layers, it migrates very slowly, if at all, and will not readily enter a collection well or trench.

EPA RESPONSE: *The boring logs and monitoring well data for the Site show that fluid NAPL has indeed migrated throughout the subsurface, even entering sediments and surface waters in Hershey Run. While there are limited data at depth in the subsurface where NAPL has been* *encountered, the data obtained are consistent with the behavior of creosote NAPL at other wood treatment sites, and indicate that fluid mobile NAPL is present.*

Beazer's review of the data submitted in the RI Report and subsequent data gathering indicates that only two Site monitoring wells (i.e., MW-2 and MW-8) have ever had DNAPL accumulations that would indicate the potential presence of recoverable quantities of DNAPL. Apparent DNAPL thicknesses measured at these monitoring wells were approximately 1 to 2 feet during RI activities in 1996. On the other hand, subsequent testing at these monitoring wells in 2003 indicated DNAPL thicknesses less than 0.01 foot. With such significant reductions in DNAPL thickness over time, it is not likely to be practicable to remove significant quantities of DNAPL.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and believes they are not correct. Data from the boring logs and the monitoring wells indicate that the DNAPL has moved over the years. The NAPL that was detected in earlier sampling events remains present in the subsurface. The fact that it is no longer present in those wells indicates that EPA's contention that NAPL is mobile is in fact accurate. In addition, NAPL need not be encountered in a significant thickness in order to be recoverable; a one-inch NAPL-saturated sand seam can recover a great deal of NAPL (potentially thousands of gallons), behaving in a way similar to a large pipe over time, given the large surface area with which such a seam would intersect a collection trench.*

Furthermore, the PRAP already incorporates a barrier wall around the above-referenced DNAPL areas. The application of barrier walls to isolate DNAPL is a proven technology that has been instituted at a number of wood treating and other chemical sites as a source control measure These consolidation areas will also be covered with a low-permeability liner that prevents precipitation infiltration into the areas. This will further serve to contain the DNAPL soils, and the mobility of any associated free-phase DNAPL. Given the redundant source containment measures included in the PRAP, it is apparent that DNAPL removal to the extent outlined in the PRAP would not be needed

As previously recommended by Beazer, if DNAPL removal is required, a position with which Beazer does not agree at this time, before DNAPL removal is required, its feasibility and effectiveness should be evaluated. We therefore continue to recommend that passive DNAPL recovery not be a required remedial element, but rather DNAPL removal pilot testing be conducted to determine the need for and potential effectiveness of a DNAPL recovery system within the proposed consolidation areas. This pilot testing could be done in parallel with the remedial design process, and the soil containment area design could allow for the inclusion of DNAPL removal systems should the pilot testing establish its feasibility and effectiveness

Therefore, Beazer believes that the EPA has not demonstrated the need for a passive DNAPL removal system when there is no evidence to suggest there are significant removable quantities of DNAPL and the DNAPL will be contained, in any event, within a barrier wall. DNAPL removal pilot studies can be conducted, thus allowing implementation of a more cost-effective DNAPL removal approach, tailored to Site-specific conditions

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and believes that they are not correct. Due to the actual mobility and the potential for mobilization of NAPL in the subsurface during construction, the vertical barrier wall will prevent and lateral migration of NAPL out of the containment area during the installation of the recovery trench system, as well as during the subsequent excavation of material outside of the containment area which will most certainly change the hydraulic conditions in the surrounding area of the Site. If EPA determines during the Remedial Design phase that the certainty of horizontal containment that this "belt and suspenders" approach could be achieved without the vertical barrier wall, both during* *construction and in perpetuity, EPA may revisit the necessity of the vertical barrier wall. Also, without a "drain" (the recovery trench system), the wall would cause mounding within the containment area, threatening the Potomac, and potentially causing up gradient flooding, threatening the rail lines and up gradient properties. Therefore, EPA does not believe that this remedial component is redundant, but is necessary to address the mobility of NAPL.*

2 4 ISSUE 4. GROUNDWATER REMEDIATION

The EPA recommended remedy is supported largely by its anticipated ability to restore Site groundwater to its beneficial use as a potential source of drinking water Beazer considers restoration of Site groundwater to beneficial use as a potential source of drinking water to be both inappropriate and technically impracticable for the reasons outlined below

Groundwater at the Site is found within two water-bearing zones. The upper, shallow groundwater-bearing zone resides in the Columbia Formation geologic unit and exists under unconfined, or water-table conditions. A limited portion of this shallow groundwater has been impacted with wood-treating residuals at the Site and is the focus of remedial alternatives being considered by the EPA.

The lower hydrostratigraphic unit, or deep groundwater-bearing zone, resides within the Potomac Formation geologic unit and exists under confining conditions. Groundwater in the lower hydrostratigraphic unit can be extracted at sufficient quantities, and is of sufficient quality, to render it an "aquifer" and has been given the name "Potomac Aquifer" in the state of Delaware. There are no users of this aquifer at or adjacent to the Site. The lower hydrostratigraphic unit has not been found to be impacted with Site-related constituents and, as a result, the PRAP proposes long-term monitoring of the lower unit as a protective measure.

EPA RESPONSE: *In addition to preventing ground water mounding in the overlying containment area, the ground water recovery system will maintain a safe hydraulic gradient for the containment of contaminants by not increasing vertical head, which would potentially force contaminants down into the Potomac if they are not already present. This hydraulic head management will (1) prevent any further release into the Potomac, and (2) enhance the effectiveness of the recovery trench by dragging/pushing NAPL into it.*

These two hydrostratigraphic units are separated by a low-permeability; fine grained silt and clay layer of varying thickness that the data demonstrate to be continuous across the Site. Evidence for the continuity of the low-permeability, fine grained silt and clay layer across the Site includes the fact that it has been detected in over 100 soil borings completed at the Site and the fact that the lower hydrostratigraphic unit has not been found to be impacted with Site-related constituents.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and believes that they are not correct. As has been discussed in numerous documents over the past several years during the extensive study and investigation of this Site, neither the data presented, nor literature of local geology reviewed support the claim of a continuous clay layer. The Columbia and Potomac Formations are fluvial in origin, and as such are laterally quite variable. They have been described in the literature as an "interconnected system," and as having variegated clays with interbedded silts, sands and gravel. While some of the boring logs for the Site describe the "clay," the lab analytical data for some of those same samples identify particle size distributions more consistent with silt or sand, not clay. The ground water data for the Site also indicate a connection between the Columbia and Potomac aquifers (e.g., similar flow direction, similar response to tidal fluctuations, and varying differences in hydraulic head). EPA understands that there may exist a competent clay layer functioning as an aquitard between these aquifers at other Sites, but at this Site, which is* *especially large in size, it is not surprising to find the lateral variability of these deposits occurring within the Site boundaries.*

The data indicate, and it is supported by the literature reviewed by EPA, that there is not likely a continuous clay beneath the Site. There are areas where lenses or stringers of clay with low permeability will inhibit downward flow of both ground water and NAPL, but due to the lateral variability and heterogeneity of the subsurface materials, the "clay layer" does not present the kind of vertical barrier to contaminant transport that Beazer describes.

Irrespective of any impacts from wood treating constituents at the Site, groundwater in the Columbia Formation at and near the Site does not represent a suitable potential future supply of potable water due to its characteristically poor quality. Therefore, selection of a remedial action objective (RAO) to restore groundwater in the Columbia formation to drinking water standards is not only inappropriate, but it is also impracticable. Groundwater in the Columbia Formation at many locations in New Castle County has been found to contain naturally occurring elevated concentrations of iron to render it non-potable without significant pre-treatment (Bachman and Ferrari, 1995; Woodruff, 1970; Rima, et al., 1964) Iron concentrations in background groundwater samples collected at up gradient monitoring wells ranged between approximately 306 and 5,280 micrograms per liter (µg/L; BBL, 2002), exceeding the EPA secondary drinking water regulation level of 300 µg/L

Similarly, groundwater in the Columbia Formation at many locations in New Castle County has been found to contain elevated concentrations of nitrate and other septic wastes to render it nonpotable without significant pre-treatment (Miller, 1975; Goehring and Carr, 1980; Svatos and Goehring, 1981, Hamilton and Shedlock, 1989). Although nitrate concentrations have never exceeded the EPA maximum contaminant level (MCL) of 10 milligrams per liter (mg/L) in any groundwater sample collected at the Site, nitrate concentrations in background groundwater samples collected at up gradient monitoring wells screened in the Columbia Formation during remedial investigations were found to range from approximately 0 6 to 1.3 mg/L Since nitrate concentrations above 0 4 mg/L are indicative of septic wastes (Bachman and Ferrari, 1995) and therefore not Site-related.

Furthermore, adopting EPA's preferred approach to groundwater in the PRAP could have the negative effect of exacerbating the already poor quality of the existing aquifer. Any attempt at extracting groundwater from the Columbia Formation at the Site for water supply purposes would likely result in the intrusion of high-salinity-content surface water from the Christina River, White Clay Creek, and Hershey Run Creek. These surface water features are tidally influenced with an average tidal range of about 6 feet and a salinity range of approximately 500 to 5,000 mg/L (BBL, 2002). Since groundwater in the Columbia Formation is hydraulically connected to, and temporarily recharged by these surface water features during high tide, attempts at exploiting groundwater in the Columbia Formation at this Site for water supply purposes run the likely risk of degrading water quality due to salt water intrusion Instances of salt-water intrusion at pumping sites in New Castle County have been documented by Hayes et al. (1998). Furthermore, Groot (1983) concluded that no water supply wells should be constructed within several miles of the presence of brackish water if drinking water quality is required."

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and believes that they are not correct. Beazer's barrier wall, as proposed, will isolate the containment area from tidal influence, and without a "drain" (the recovery trench system), the wall would cause mounding within the containment area, threatening the Potomac, and potentially causing up gradient flooding, threatening the rail lines and up gradient properties.*

The above Site-specific ground water quality information is consistent with the finding that ground water in the Columbia Formation is undesirable as a drinking water supply throughout much of the county. It is therefore evident that there would be no benefit achieved if wood treatment-related constituents could be removed from groundwater outside of the containment areas, particularly since the PRAP incorporates institutional controls that will prevent access to this water. Furthermore, as noted on page 10 of the PRAP, "exposure to groundwater without DNAPL present did not result in carcinogenic results outside the acceptable range"; and non-carcinogenic risk in groundwater without DNAPL present "was largely caused by high background levels of metals that occur in Columbia Aquifer ground water."

In summary, then, EPA's recommended remedy for groundwater is arbitrary and an abuse of the agency's discretion. EPA's goal of returning the impacted aquifer to potable status is inappropriate and technically impracticable. The EPA is applying ARARs that are not appropriate for this Site in violation of CERCLA and the NCP, which have a significant outcome on the remedy selection process. Section 300 430(a)(iii)(F) of the NCP directly addresses EPA's expectations for groundwater at a Site such as the Newport Plant. Although the NCP does establish an expectation on behalf of the EPA that it will return usable groundwater to its beneficial uses wherever practicable, the NCP states "[w]hen restoration of ground water to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated ground water, and evaluate further risk reduction " 40 C F R 430(a)(iii)(F) Beazer believes that the Site data establish that the return of this aquifer to potable status is impracticable and that further migration of the plume and exposure to contaminated groundwater would both be prevented by Beazer's recommended approach.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, but does not believe they are correct. The PRAP does not assert a position regarding the potable status of the Columbia aquifer; only to restore ground water to beneficial use to the maximum extent practicable outside of the containment area through consolidation only. Any remaining residual contamination would attenuate through physical and biological processes.*

Furthermore, even if the potable water ARARs were appropriate for this Site, a position with which Beazer does not agree, it is widely recognized that technical impracticality waivers are considered appropriate for these types of sites (EPA, 1993 and 1995) Because of these reasons, an ARAR waiver for the impacted portion of groundwater in the Columbia Formation at the former Koppers Co. Inc. Site would be appropriate given the following.

- Shallow groundwater has already been determined to be undesirable as a supply of potable water in New Castle County,
- No proven technologies exist that could restore impacted shallow groundwater to drinking water standards at the Site;
- Any serious efforts at exploiting shallow groundwater as a potable supply would likely result in greater risk to human health and the environment due to salt water intrusion; and
- The EPA has already approved an ARAR waiver for shallow groundwater in the Columbia Formation for similar reasons at the adjacent E I DuPont de Nemours & Co., Inc. Pigment Plant Landfill Site

EPA RESPONSE: *EPA has considered Beazer's assertions, and does not believe they are correct. The PRAP does not assert a position regarding the potable status of the Columbia aquifer, which has been addressed in previous responses. EPA has not designated the aquifer as a potential drinking water aquifer, but EPA does expect to restore ground water to its beneficial use, to the maximum extent practicable. Again, the issue of ground water restoration to beneficial use has been addressed in previous responses.*

2.5 ISSUE 5: REMEDIATION FOR A SPECIFIC SITE REUSE

Beazer objects to EPA's PRAP in that it assumes that the future reuse of the Site will include wetlands banking, a fact that drives enormous increases in costs to implement such reuse. Although Beazer recognizes the benefits of combining remediation with future reuse, we are not willing to finance the incremental future reuse costs, particularly those associated with specific reuse as a wetlands bank or as the location of a drinking water supply reservoir. Two very significant cost components in EPA's recommended remedy include: 1) costs to consolidate/dispose of an estimated 423,000 CY of excavated soil (currently considered acceptable for offsite reuse) if offsite reuse is deemed unacceptable or an offsite use cannot be identified; and 2) a wetland developer willing and able to cover the estimated $8.5 million to construct the wetlands. The EPA would therefore either have to wait for a third party investor in wetlands to commit, or allow for a lesser, more reasonable, amount of soil excavation and surface restoration as part of the remedy.

EPA RESPONSE: *EPA has considered Beazer's assertions, but does not believe that they are correct. As stated in the PRAP, the sediment cleanup criterion is to apply to those soils where wetlands will be created. Regarding matters of cost, please see the attached discussion of cost estimates, and please also refer to Beazer's own supplemental cost estimates for various components of the remedy. Note that PRAP Alternative 3 details what a 2-foot excavation of soil with backfill and cover would cost. Soil excavation for Alternative 3 totaled approximately $7.2M, while soil excavation in Alternative 4 totaled approximately $8.4M - while this is a significant difference, it is not as large a difference as suggested in the comment. As discussed earlier in this document, note that the original cost estimates in the 2003 FS Addendum (FS Alternative 10) split the cost of deeper soil excavations (beyond that required by the remedy) between the remedy and the "wetlands developer". EPA adopted this approach in order to be consistent for the purposes of comparison, but is not requiring the further excavations of materials to create a wetlands bank, as that is not part of the selected remedy. Rather, as stated in the PRAP, EPA's selected remedy is compatible with that potential future use, should such a use materialize in the future.*

The PRAP does not assert a position regarding future use, and specifically mentions that EPA has generally little input regarding future use. Beazer, in its submittals to EPA has identified a possible future use scenario. The PRAP does identifies portions of the Site could be available for future use, with restrictions placed on use of the containment area.

Beazer does not believe that either CERCLA or the NCP require that the EPA alter its remedy selection in order to accommodate a future use option that has been neither fully evaluated nor finalized. The appropriate reuse determination for the Site is within the Site owner's discretion and cannot be mandated by the EPA in a PRAP.

To summarize, Beazer believes that it is feasible to initiate some of the elements of the remedial action based on protection of human health and the environment, and upon establishing viable Site reuse, then complete remediation of the Site, consistent with the viable redevelopment plan

EPA RESPONSE: *The PRAP does not assert a position regarding future use, and specifically mentions that EPA has generally little input regarding future use. Beazer, in its submittals to EPA has identified a possible future use scenario. The PRAP does identifies portions of the Site could be available for future use, with restrictions placed on use of the containment area.*

2.6 ISSUE 6: PRESCRIPTIVE REQUIREMENTS

The PRAP contains arbitrarily mandated prescriptive elements of the remedy that are likely to change during the remedial design process or during further implementation of remedial action at this Site. These include:

- Two onsite landfills covering 38 acres (consolidation areas). The objective in these areas is to contain mobile DNAPL. In the design, one or more areas may be selected The designs will be based on further investigative work and groundwater modeling to locate and size the containment areas.
- Soils from approximately 39 acres of uplands would be excavated The remedial design would select areas to be excavated and these are likely to be different. Specific areas to be excavated would be identified as part of the remedial design.
- Passive DNAPL recovery trenches and drainages. As discussed above, the specific DNAPL removal technology should be based on science established through pilot testing, and not an arbitrarily selected high cost technology.

EPA RESPONSE: *EPA agrees that the PRAP identifies remedial components of the selected remedy. During Remedial Design, it is appropriate for the implementation of the remedial components to be planned for with specificity—for example the location and size of the containment system will be determined. Furthermore, the passive recovery trenches and drainages were selected as a remedial component. They are well understood to be more effective and less costly than recovery wells, and therefore, EPA believes they are less costly technology for DNAPL recovery. This "balancing" was discussed in the PRAP. Other effective options include in-situ or ex-situ thermal treatment and are fully discussed in the FS and PRAP.*

Beazer believes that it is unnecessary and unreasonably restrictive to incorporate these requirements into the preferred remedy at this stage. EPA's insistence on these premature requirements is particularly problematic to Beazer because we cannot determine from the PRAP whether these costs have been included within the total costs picture provided by the EPA To the extent that the costs do not include these prescriptive components, Beazer believes that the EPA has not complied with its duty under the NCP to fairly apprise the stakeholders of the costs of the preferred remedy.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe they are correct. It is appropriate for area and volume estimates, with exact delineations, are deferred to the RD. The PRAP clearly details assumptions for the cost estimates, which are well documented in the AR and were presented to the NRRB in detail. Please note that EPA's cost estimates are based on Beazer's estimates, with greater detail added and a number of refinements made by EPA to account for discrepancies.*

3.0 SPECIFIC PAGE BY PAGE ISSUES

1. Page 1 - EPA's stated goal of " restoring groundwater to its beneficial use as a potential drinking water aquifer." ignores the technical impracticability of achieving such a goal. Beazer incorporates by reference its discussion regarding this issue elsewhere in these comments and in the cover letter. This goal is used throughout the PRAP to justify the removal and management of thousands of yards of soil at increased cost without the application of previously calculated present or future predicted risks posed by the Site. The EPA is also acting contrary to the recommendations issued by the NRRB on June 14, 2004, which stated that the preferred alternative should identify only those CERCLA remedial actions necessary for a protective remedy. This overriding theme adds significant and unnecessary costs to the remedy.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe that they are correct. The NRRB requested that the PRAP be modified to include a more detailed* *justification of the remedial actions. EPA provided this justification. The NRRB did not suggest that there was a lack of justification or that such justification was not possible, as the comment suggests.*

Restoration of impacted groundwater at former creosote wood treating facilities has proven to be both complex and technically infeasible at a growing number of sites. Several relevant quotes from a report developed by an EPA - convened expert panel that examined the issue of DNAPL source depletion (EPA, 2003b) are provided below which support this:

- As far as the Panel is aware, there is no documented, peer-reviewed case study of DNAPL source zone depletion beneath the water table where U.S. drinking water standards, or MCLs have been achieved and sustained throughout the affected subsurface volume, regardless of the in-situ technology applied."
- " it is highly uncertain that MCLs can be achieved in source zones impacted with DNAPLs in most geologic settings."

EPA RESPONSE: *The NRRB is a peer-review process, which subjects EPA's remedies to a high-level of scrutiny. The Koppers Site PRAP was reviewed, commented upon and accepted by the Panel. The Final Report of the NRRB accepted that excavation can be 100% effective; passive NAPL recovery will recover DNAPL and will provide for a safe preferential pathway, which is necessary since neither a safe pathway nor effective containment now exist.*

This goal is also inconsistent with the ROD issued for groundwater media at the neighboring DuPont Newport Superfund Site for the same aquifer. Beazer would recommend that the EPA provide flexibility in the PRAP to incorporate the application of ARAR waivers, common for many RODs issued for sites containing DNAPL.

EPA RESPONSE: *EPA has carefully considered the assertions posed by Beazer. However, EPA believes that based upon the extensive study of creosote NAPL at the Site, the selected remedy will address the risks posed by the hazardous substances. Additionally, with respect to the ROD issued for the DuPont (Newport) Site, although similarities exist between Superfund sites, EPA's remedies are Site-specific with remedial components identified through the nine criteria set forth in the NCP. ARARs and performance standards are determined for each remedial component identified for the Site. Therefore, the ROD for the DuPont (Newport) Site may be distinguished on many bases and is not relevant to the Koppers Site.*

2. Page 2, paragraph 1 - The PRAP states that DNAPL material would be excavated "to the maximum extent practicable," correctly recognizing that removal of "all" DNAPL is not likely Given this statement, it is inconsistent for the EPA to assume and state in the following paragraph that " groundwater at the Site would be restored to its beneficial use (as a potential source of drinking water)." The requirement for removal of subsurface DNAPL outside of the containment area should be eliminated from the PRAP.

EPA RESPONSE: *"Practicable" is generally defined as "capable of being accomplished." While EPA recognizes that recovery of all NAPL is difficult and may present implementability challenges during construction of the remedy, EPA believes that this does not make it impracticable.*

3. Page 2, paragraph 3 - It appears that future Site use has played a role in supporting the EPA's decision to recommend extensive deep upland Site excavation (see also page 35, State Acceptance). The NRRB seems to have made similar observations, and rightfully noted, "The

preferred Alternative should identify only those CERCLA remedial actions necessary for a protective remedy." While the EPA noted in its response to NRRB comments that extensive upland removal was necessary to restore the Columbia aquifer (due to EPA's "general" expectation" at Superfund sites to return groundwater to its beneficial use), restoration as EPA has suggested is neither technically supportable, nor appropriate given the Site setting/history. In the absence of risk or a defined reuse plan with financial backing, extensive deep upland excavation is not justified and should not be a part of any Proposed Plan for the Site. The PRAP should specifically state that no remedial measures proposed at the Site are driven by expectations of some "undefined possible future land use."

EPA RESPONSE: *EPA has carefully considered Beazer's assertions and does not believe they are correct. EPA has not made a designation regarding future use of the Site. The PRAP states that EPA makes no decisions regarding future use of a property (except where Institutional Controls restricting certain uses are warranted for the protection of human health and the environment and to ensure the integrity of the remedy).*

4. Page 2 - The EPA's discussion of the use of institutional controls to restrict the installation of drinking water wells is incompatible and appears to be counter to its stated goal of restoring groundwater to its beneficial reuse as a drinking water supply.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe that they are correct. There is an hydraulic connection between the Columbia and Potomac aquifers. The Columbia is designated by the State as a potential drinking water source; the Potomac is a drinking water aquifer. Wells in the Potomac in the vicinity of the containment area would have the potential to draw contamination downward out of the containment area and into the Potomac. Therefore, consistent with CERCLA and the NCP, it is the goal of the Superfund program to restore ground water to beneficial use to the maximum extent possible. The Institutional Controls of restricting the installation of drinking water wells are warranted at this time in light of the high levels of creosote NAPL in the ground water. Also, the State may extend a Ground Water Management Zone in this area, both to protect public health and to minimize the potential for the downward migration of NAPL through well pumping that could affect the hydraulic regime at the Site.*

5. Page 2 - Beazer has not been provided with a copy of the comments and statement of position received from the Delaware Department of Natural Resources and Environmental Control (DNREC) by the EPA to understand how these were utilized in preparation of the PRAP. Beazer assumes that these documents will be included in the Administrative Record for review by the stakeholders. This statement is reiterated on Page 35

EPA RESPONSE: *As stated in the PRAP, DNREC has expressed its support for the proposed remedy, but actual concurrence is not received on the PRAP; rather, it is evaluated for the ROD. DNREC's letter of concurrence or non-concurrence will be included in the Administrative Record with the ROD.*

6 Page 8 - The EPA has failed to provide the reference or source used to determine that the extent of DNAPL zones is approximately 82,000 CY.

EPA RESPONSE: *The FS submitted by Beazer did not provide clear estimates of affected acreage or potential volumes of soil or sediment to be cleaned; therefore, EPA developed these estimates using data, maps, figures and tables provided by Beazer during the RI/FS to provide a certain degree of specificity based upon all the available Site information.*

7 Pages 8/9 - The EPA raises the concept of the "halo" effect stating that DNAPL related constituents " are not migrating in ground water" and that the " plume exists in ground water only very near the NAPL itself, like a halo, and is quickly attenuated in only a short distance". Beazer concurs with these conclusions and therefore does not understand why later on in the PRAP, the EPA uses DNAPL to justify the extensive removal and containment of thousands of cubic yards of soil without any corresponding risk justification.

EPA RESPONSE: *Creosote DNAPL is often mobile or readily mobilized. The DNAPL at the Site is mobile. EPA, USFWS, DNREC and others have witnessed flowing liquid creosote at this Site. Beazer's own contractors have witnessed DNAPL accumulations in wells "disappear." The actual cleanup goals include consolidating all DNAPL, with excavation considered complete once TPAH levels are below the soil or sediment cleanup goals listed in the PRAP.*

8. Page 9 - states that DNAPL or highly contaminated sediment is present through " virtually the entire length of Hershey Run " Beazer disagrees with this statement and to the best of Beazer's knowledge; the EPA has not disclosed the data and supporting information that were used to reach this conclusion

EPA RESPONSE: *EPA carefully reviewed the analytical data to which Beazer is referring, most of which was obtained from sediment samples taken from the 0-0.5 feet interval in Hershey Run, as well as the detailed boring logs and first-hand accounts that support EPA's position with regard to the channel and the overbank wetlands. This information may be found in the Administrative Record for the Site, in the RI/FS documents.*

9. Page 9 - The EPA makes a claim that DNAPL has been mobile and migrating for over 24 years. This appears to be counter intuitive to other statements made by the EPA that the material is quickly attenuated in the subsurface. Beazer expects that such hypothetical conclusions will be excluded from the PRAP unless factual evidence throughout the entire time interval, is presented to support this statement

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and believes that they are not correct. It is important to distinguish between NAPL, which does not attenuate in the subsurface below the water table, and a limited aqueous phase plume of sparsely soluble constituents, which are somewhat readily attenuated because in general it is the low-molecular-weight constituents that are sparsely soluble. It is those same constituents that tend to be degradable in the aqueous phase. This information may be found in the Administrative Record for the Site, in the RI/FS documents.*

10. Page 9 - The fish tissue survey referred to is a Hershey Run mummichog histopathology report (Harshberger, 2003). That report was not used as a line of evidence in the final ecological risk assessment (ERA) for the Site (EPA, 2003a), but is presented as such in the PRAP, citing as evidence of effects a reported 40% prevalence of liver tumors in fish collected from Hershey Run. To be more accurate, the Harshberger report only found a 30% prevalence of liver tumors (hepatocellular carcinomas), with precursor alterations in another 6% of the 30 fish sampled. The Harshberger report concludes that Hershey Run is "confirmed to be a hazardous waterway," but provides no context as to what exactly is meant by that statement with regard to the results presented. A fundamental problem with the histopathology report is that no fish from any reference locations were evaluated. Consequently, there is no way to contrast prevalence of tumors in mummichog from Hershey Run with typical background levels and, therefore, no way to put these reported results into a proper risk perspective.

EPA RESPONSE: *The 2003 report has been supplemented by a subsequent report, published in late 2004, in which numerous other waterways (or "reference locations") in the area are compared to Hershey Run with striking results: Hershey Run is indeed far worse off than any other waterway, and is clearly a "hazardous waterway." A copy of this report is included in the Administrative Record.*

11. Page10 - Beazer agrees with the EPA that the Site could not be used for residential purposes and therefore questions the EPA's rationale for issuing a goal to clean groundwater to drinking water quality. While Beazer understands it is the EPA's general expectation at Superfund sites to return groundwater to its beneficial use, for reasons presented in General Comment 4, Beazer believes it is both unnecessary and unachievable (not driven by risk), and given the cost to implement, should be eliminated as a remedial goal for the Site.

EPA RESPONSE: *EPA has considered Beazer's comments and does not believe that they are correct. Neither EPA's rationale nor the stated goal in the PRAP mention cleaning "groundwater to drinking water quality." EPA is aware that the Columbia's natural condition does not necessarily make it suitable for drinking without treatment, and would refer Beazer to the actual text of the PRAP which clearly refers to the Columbia aquifer as a state-designated "potential drinking water aquifer."*

12. Page 10 - Beazer disagrees with EPA's statement that " the risk from exposure to soil and sediment may be underestimated" and requests that such speculative statements be retracted While Beazer does not deny that potential risks may exist, many of the components of the human and ecological risk assessments are based on generally conservative assumptions, suggesting that actual risks are less than those estimated. With specific regard to surface soils, the EPA correctly states on Page 8:

    "Deposits of NAPL were observed in surficial soils of the Upland Area, primarily in the Process, Drip Tank, and Wood Storage Areas (Figure 4). Other smaller deposits were observed along the access road leading to the southwest corner of the uplands and in the South Ponds and K Areas. In surface soils of these areas, creosote was found in a dry weathered form, typical of creosote NAPL and tar-like material that has been significantly weathered and dried over time. As a result, the material appeared to be immobile and it possessed little detectable odor."

    Given this, one would expect risks due to dermal exposure to PAHs by trespassers to be overestimated, not underestimated.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions. EPA believes that Beazer is likely more familiar with creosote constituents, NAPL and PAHs in general than most citizens. As such, EPA expects that Beazer is familiar with the known contact hazards presented by a large number of the constituents in creosote. Since these constituents do not appear in the dermal exposure risk assessment scenarios (because they are known contact hazards and do not have associated risk parameters to estimate their potential for risk), any such scenario would therefore underestimate risk whenever actual creosote NAPL would be encountered (for example, NAPL pools in soils or NAPL releases from sediments).*

13. Page 13 - Beazer disagrees with the conclusion that plant community observations corroborate risks associated with creosote contamination in upland soil communities. The ERA for the Site (EPA 2003a) indicates that upland vegetation is adversely affected in areas of high PAH concentrations, but provides no quantitative data to support this assertion. Site surveys show high plant diversity in areas not directly affected by creosote, suggesting that

upland communities over much of the Site are unaffected, and effects that are observed may be due to hard matrix effects of creosote, not phytotoxicity.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe that they are correct. EPA's conclusions are based on a complete consideration of the Ecological Risk Assessment, which accorded the most significance to the evidence derived from the toxicity testing.*

14. Page 14 - The ERA synopsis notes that the distribution of PAH concentrations in soil and sediment did not generate a gradient of toxicity responses, which presented technical difficulties in the risk calculations. However, as Beazer has noted in previous submissions, there are statistical methods that can deal with dose-response data of the type observed in bioassays performed with Koppers sediment and soil For example, a point estimate approach can be applied to use regression statistics for all of the data in a concentration-response series to derive an effective concentration that corresponds to a selected response level and unlike a no-observed-adverse-effect level (NOAEL) or lowest-observed-adverse-effect level (LOAEL), is not constrained to be one of the tested concentrations. As noted, based on available data there is little difference in the areal extent of sediment or soil where PAH concentrations exceed effective concentration values versus the extent that exceeds EPA's RAOs based on NOAEL and LOAEL values Thus, while remedial decisions may be comparable, EPA should have considered alternative statistical approaches when determining effects thresholds.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and notes that the previous submittals mentioned in the comment were considered and responded to, with the result being that EPA remained confident with the conclusions of the Ecological Risk Assessment.*

15. Page 15- Table 1 lists southern leopard frogs (Rana pipiens) as the ecological receptor, and states that the weight of evidence concludes that "risk exists, effects levels consistent with other sediment contamination related risks." In fact, toxicity tests were performed using an exotic species, the African clawed frog, Xenopus laevis, as a test surrogate because of problems maintaining Rana pipiens in laboratory conditions. While not inappropriate to use surrogate species, the summary should note that the results are not derived directly from the selected ecological receptor. Furthermore, Beazer's review of the test data has shown consistently high mortality rates in control groups and in groups tested using reference location samples. This consistently high control and reference mortality indicates problems with the Xenopus bioassay and that this line of evidence should not be considered as sufficient to conclude that risk exists to amphibians at effect levels consistent with other sediment related risks.

EPA RESPONSE: *The PRAP describes the complete list of lines of evidence listed in the comment, and specifically addresses the weight of each line of evidence. A more complete discussion is presented in the Ecological Risk Assessment. The data support EPA's conclusions.*

16. Page 15 - Evaluation of potential effects of Site contaminants to fish populations was assessed on four lines of evidence in the ERA (EPA, 2003a). Greatest weight was given to an indirect effect, benthic macroinvertebrate toxicity, and Beazer is still unclear how this represents the best measurement of direct toxicity to fish. The second line of evidence used was short-term toxicity testing with mummichog (*Fundulus heteroclitus*). The tests were subject to high control mortality (33%), which renders this dataset unsuitable for quantitative use in risk characterization. As noted above, the fish histopathology analysis was not included as a line of evidence in the ERA, and technical problems indicated previously limit the

relevance of conclusions presented in the ERA report Based on these issues, Beazer does not understand how the ecological risk synopsis can conclude that PAHs pose ecological risks to fish, as stated in the last paragraph on page 15.

EPA RESPONSE: *The PRAP describes the complete list of lines of evidence listed in the comment, and specifically addresses the weight of each line of evidence. A more complete discussion is presented in the Ecological Risk Assessment. The data support EPA's conclusions.*

17. Page 15 - Beazer disagrees with the statement that "vegetation surveys conducted during the Remedial Investigation showed negative effects of contaminants on upland plants, particularly in areas of visible contamination." As noted above, the ERA (EPA 2003a) provides no quantitative data to support this assertion or evidence that effects are due to phytotoxicity, rather than a lack of pervious ground suitable for rooting due to hard matrix effects of creosote.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe that they are correct. The PRAP describes the complete list of lines of evidence listed in the comment, and specifically addresses the weight of each line of evidence. A more complete discussion is presented in the Ecological Risk Assessment. The data support EPA's conclusions.*

18. Page 15 - Beazer strongly believes that the statement, "In summary, it is concluded that PAHs pose ecological risks to upland, wetland, and aquatic communities at the Site, specifically to organisms low in the food chain (i.e., earthworms, insects, shelled organisms, fish and frog embryos, and both upland and aquatic plants)" grossly overstates the extent of risk to ecological communities by not sufficiently considering all available lines of evidence All conclusions regarding ecological risk are based on results of sediment and soil toxicity tests using Site media, as are the sediment and soil cleanup criteria Other lines of evidence, such as surveys of benthic invertebrate communities or wetland and upland plant communities do not support these conclusions. Furthermore, technical problems with fish and frog toxicity tests, as described above, limit the ability to use these lines of evidence in making conclusions of risk to fish and amphibian communities.

EPA RESPONSE: *The PRAP describes the complete list of lines of evidence listed in the comment, and specifically addresses the weight of each line of evidence. As discussed in both the PRAP and the Administrative Record, the toxicity data provided the clearest indication of ecological risk, and therefore were accorded more weight in the risk assessment. A more complete discussion of the lines of evidence, their respective weights in reaching a conclusion, and the technical issues encountered is presented in the Ecological Risk Assessment.*

19. Page 15 - The EPA recognizes in footnotes 2/3 that zinc (a non-Site-related constituent) poses an ecological risk at the Site but has not addressed zinc from a source control standpoint. Beazer believes that even if the wood treating constituents were addressed to EPA's satisfaction at the Site, that the Site would be not be completely protective of human health and the environment due to the presence of zinc from offsite sources. The EPA has failed to address how zinc impacts at the Site are to be addressed as part of the PRAP

EPA RESPONSE: *The PRAP notes that zinc in sediments generally coincides with high levels of total PAHs in sediments, and will be successfully addressed via containment along with the PAH-contaminated materials.*

20. Page 17 - As previously mentioned, the EPA's treatment of DNAPL is linked with the concept of restoring groundwater to drinking water quality as a new RAO while generating no further incremental protection of human and health and the environment offered by the selected remedy discussed later in the document. In fact, there are several other alternatives that would provide an "equivalent standard of performance" as provided under CERCLA 121(d)(4)(D). This provision allows for one alternative if a potable water ARAR is ultimately determined to be appropriate, a position with which Beazer disagrees, that is, a waiver of an ARAR (i.e., restoring groundwater to drinking water standards) if "the remedial action selected will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criteria or limitation, through use of another method or approach". As previously discussed, there are other DNAPL source control technologies, in concert with soil management options previously reviewed in the FS, that can achieve the same level of protection, provide the same level of performance and offer the same future reliability and thus can be considered "equivalent". Therefore, the RAO of restoring groundwater to drinking water standards should be eliminated from the PRAP.

EPA RESPONSE: *Please see previous responses regarding ground water cleanup and restoration of ground water to beneficial use to the maximum extent practicable.*

21. Page 18 - A number of the RAOs specified by EPA should be eliminated, or modified in a manner consistent with that specified in EPA's RI/FS guidance document (EPA, 1988). As noted in the guidance document:

"Remedial action objectives consist of medium-specific or operable unit-specific goals for protecting human health and the environment. The objectives should be as specific as possible but not so specific that the range of alternatives that can be developed is unduly limited."

"Remedial action objectives for protecting human receptors should express both a contaminant level and an exposure route, rather than contaminant levels alone, because protectiveness may be achieved by reducing exposure (such as capping an area, limiting access, or providing an alternate water supply) as well as by reducing contaminant levels."

Several of the RAO's provided by the EPA actually specify a remedial technology and/or "unduly limit" the range of alternatives considered or viable as remedial approaches Examples include:

- RAO-1, which excludes capping and institutional controls as viable remedy components by specifying " reducing levels of total PAH concentrations to below 150 mg/kg and 600 mg/kg in soil " to prevent current or future direct contact;
- RAO-3, which specifically requires RAO achievement "through removal and/or containment"; and
- RAO-6, which specifies groundwater restoration to its beneficial use, without recognition of the potential impracticability of achievement[1], nor recognition that the RAO is not risk driven.

FOOTNOTE*1 There are countless examples of similar sites where this has been demonstrated to be infeasible. Not only is it difficult to thoroughly characterize the presence and extent of subsurface DNAPL at a site as complex and large as the Koppers Site, but EPA recognizes that some residual may remain behind during the proposed deep upland excavation activities (page 2, paragraph 1) in areas where DNAPL is known to be present Beazer believes that the burden rests upon EPA to provide the technical basis for concluding that at the Kopper's Inc. Site, achievement of drinking water status in the Columbia Formation is feasible.

EPA RESPONSE: *EPA believes that the RAOs are appropriate and were developed in accordance with EPA guidance. Please see previous responses regarding ground water cleanup and restoration of ground water to beneficial use to the maximum extent practicable.*

22. Page 18 - The RAO-1 states that the cleanup number for soils is 600, but for soils where wetlands are to be created (as in EPA's preferred alternative), the clean up number shifts to 150 mg/kg. Beazer objects to this because it exceeds the actions "necessary for a protective remedy."

EPA RESPONSE: *Please see previous response regarding volumes and cleanup criteria. As explained previously, in areas where wetlands are to be created, the sediment cleanup criterion applies.*

23. Page 18 - The EPA states that the Feasibility Study was used to develop remedial alternatives, and directs the reader to the Administrative Record if additional information regarding alternative development is required. Noting that the EPA has created a new list of remedial alternatives in the PRAP, Beazer requests that the EPA provide a more specific reference(s) to Administrative Record materials, which may support EPA's development/selection of alternatives.

EPA RESPONSE: *The FS and numerous comments and meetings regarding the FS and FS Addendum are all well represented in the Administrative Record, and EPA believes that the PRAP clearly explains each included alternative.*

24. Page 19 - While Beazer understands that it is EPA's general expectation at Superfund sites to return groundwater to its beneficial use, there is sufficient Site-specific data to conclude that this is both unachievable (see general comment 4) and unnecessary (EPA does not believe the Site would be reasonably used for residential purposes and proposes institutional controls to "prevent residential use and the installation of drinking water wells on the property"). Returning the Columbia aquifer to drinking water status should be eliminated from the PRAP as a RAO and a Ground Management Zone (similar to the adjacent DuPont - Newport Superfund Site) should be assumed in perpetuity (similar to Alternatives 2 and 3),

EPA RESPONSE: *Please see previous response regarding ground water cleanup and restoration to beneficial use.*

25. Page 19 - Beazer agrees that land-use restrictions should be a component of each active remedial alternative considered. As noted previously, implementation of groundwater and future land use restrictions at the Site should preclude the need to implement extensive (and expensive) active remedial measures which attempt to cleanup the shallow Site groundwater to drinking water quality.

EPA RESPONSE: *Please see previous responses regarding potential future use and ground water cleanup and restoration to beneficial use to the maximum extent practicable.*

26. Page 20 - Beazer believes that the EPA has failed to provide the technical justification to support selection of the soil cover thickness (i.e., 2-foot soil cover with a burrow-inhibiting/layer)

EPA RESPONSE: *EPA has considered Beazer's assertions, and does not believe they are correct. EPA notes the following as necessary: a one-foot clean soil layer would be underlain by a small buffer of soil and a stone layer to inhibit organisms known to inhabit the Site and which burrow well below one foot. (If only one foot of cover were used, organisms could burrow right into the contaminated material below.)*

27. Page 23 - Beazer believes that the EPA's soil removal volumes may be underestimated, given: 1) EPA's proposal to remove 2 feet of surficial soil to protect trespassers and ecological receptors (compared to 1 foot removal assumed by Beazer in the FS Report) (BBL, 2003); and 2) EPA's proposal to continue in these areas to remove all soils containing total PAHs in excess of 150 mg/kg, to depths up to 30 feet (Beazer did not assume such extensive removal in the FS Addendum).

EPA RESPONSE: *Please see previous response regarding volumes and cleanup criteria.*

28. Page 23 - The cost description makes no reference to the estimated $8.5 million to be bourne by Wetlands developers (see Alternative 4 cost estimate), which is part of the total cost to implement the remedy (i.e. the cost to implement Alternative 4 would actually be $60.3 million). The EPA has failed to include these costs, which are critical for Beazer and the public to be able to evaluate its response to the PRAP.

EPA RESPONSE: *Please see previous response regarding these costs, which are not part of the remedy, but rather of a potential future use. As discussed earlier in this document, note that the original cost estimates in the 2003 FS Addendum (FS Alternative 10) split the cost of deeper soil excavations (beyond that required by the remedy) between the remedy and the "wetlands developer". EPA adopted this approach in order to be consistent for the purposes of comparison, but is not requiring the further excavations of materials to create a wetlands bank, as that is not part of the selected remedy. Rather, as stated in the PRAP, EPA's selected remedy is compatible with that potential future use, should such a use materialize in the future.*

29. Page 23/24 - The description of soil removal under Alternative 4 indicates that 115,000 cy of soil will be excavated "in order to protect trespassers and ecological receptors" (i.e., same as Alternative 3), and that excavation would continue in these areas until "the total PAH concentration was 150 mg/kg or below, with excavation depths potentially reaching as deep as 30 ft bgs in a few locations, though the average excavation depths is expected to be 5 to 15 ft." While the excavation volume is never specified, it is likely significant, and appears to be proposed to support "one possible reuse of the Site - wetland excavation". Beazer requests that the EPA clarify both assumptions.

EPA RESPONSE: *Please see previous responses regarding volumes and cleanup criteria, as well as the potential reuse of the site.*

30. Page 24 - Assumptions made by the EPA regarding the volume and ultimate disposition of excavated soil are not clearly described. While the text states 113,000 CY of soil would be excavated and consolidated into two onsite landfill, it also notes that 115,000 CY of surface soils will be excavated to protect trespassers and ecological receptors, with continued excavation as deep as 30 feet to achieve 150 mg/kg. The EPA has failed to clarify its assumptions of costs or volumes. In addition, Beazer does not believe that the onsite landfills have been costed to handle such a capacity.

EPA RESPONSE: *Please see previous response regarding volumes. In addition, in Beazer's response to EPA comments, Beazer stated that the volume capacity of the landfills as drawn* *was approximately 1,000,000 cubic yards. EPA does not anticipate approaching this capacity.*

31. Page 24 - The EPA has failed to provide an adequate description of the sediment removal volumes estimated from various portions of the Site, which apparently total 75,000 CY, once stabilized. The EPA must specify these volumes particularly as referenced in Alternative 4.

EPA RESPONSE: *EPA has considered Beazer's assertions, and does not believe they are correct. In both the text and the figures of the PRAP, the volumes were clearly stated and drawn, with assumptions regarding the potential need to add amendments for geotechnical purposes also clarified. Please refer again to this text and to Figure 6, "Hershey Run Marsh and West Central Marsh Volume."*

32. Page 24 - The PRAP text again notes that excavating of DNAPL at depths up to 30 feet is proposed, "In order to achieve the restoration of ground water " As noted previously, there is sufficient Site-specific data to conclude that restoring the Columbia aquifer to drinking water standards is unachievable, unnecessary (the EPA has noted in the PRAP that it does not believe the Site would be reasonably used for residential purposes, and proposes institutional controls to "prevent residential use and the installation of drinking water wells on the property"), and inconsistent with the decision documented in the ROD for the adjacent E I DuPont de Nemours & Co. Inc Pigment Plant Landfill Site (see general Comment 4).

EPA RESPONSE: *EPA has considered Beazer's comments and does not believe that they are correct. Neither EPA's rationale nor the stated goal in the PRAP mentions cleaning "groundwater to drinking water quality." EPA is aware that the Columbia's natural condition does not necessarily make it suitable for drinking without treatment, and would refer Beazer to the actual text of the PRAP which clearly refers to the Columbia aquifer as a state-designated "potential drinking water aquifer."*

33. Page 25 - The EPA has unnecessarily specified a passive DNAPL recovery system within the onsite consolidation areas, as "EPA believes that DNAPL recovery would successfully and significantly reduce the volume of mobile DNAPL at the Site" (see General Comment 3). Beazer believes that the EPA has failed to provide technical justification for its inclusion, given the following:

    a The proposed remedy currently includes construction of a barrier wall around the consolidation areas, keyed into an underlying confining unit and covered with a low permeability cover which should adequately contain any mobile DNAPL, and
    b Only two Site monitoring wells (i e MW-2 and MW-8, both with recorded DNAPL thickness of less than 0.01 foot in 2003) have ever historically had DNAPL accumulations, and data collected from these wells was not encouraging regarding the practicability of removing significant quantities of DNAPL.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe that they are correct. As has been discussed in numerous documents over the past several years, neither the data presented, nor literature of local geology reviewed support the claim of a continuous clay layer. The Columbia and Potomac Formations are fluvial in origin, and as such are laterally quite variable. They have been described in the literature as an "interconnected system," and as having variegated clays with interbedded silts, sands and gravel. While some of the boring logs for the Site describe the "clay," the lab analytical data for some of those same samples identify particle size distributions more consistent with silt or sand, not clay. The ground water data for the Site also indicate a connection between the Columbia and Potomac aquifers (e.g., similar flow direction, similar response to tidal* *fluctuations, and varying differences in hydraulic head). EPA understands that there may exist a competent clay layer functioning as an aquitard between these aquifers at other Sites, but at this Site, which is especially large in size, it is not surprising to find the lateral variability of these deposits occurring within the Site boundaries.*

The data indicate, and it is supported by the literature reviewed by EPA, that there is not likely a continuous clay layer beneath the Site. There are areas where lenses or stringers of clay with low permeability will inhibit downward flow of both ground water and NAPL, but due to the lateral variability and heterogeneity of the subsurface materials, the "clay layer" does not present the kind of vertical barrier to contaminant transport that the Beazer describes.

A passive NAPL recovery trench can work to recover product despite the heterogeneous subsurface lithology, whereas pumping NAPL from a well would be severely hampered by this heterogeneity. A well can only intersect a one-inch creosote-saturated sand seam for the diameter of the well screen, but a recovery trench will intersect the same sand seam for the entire length of the trench. Note that a one-inch sand seam 1/8th of a mile long would be roughly equivalent to a 7-foot diameter sand-filled pipe; a recovery trench built to intersect such a seam could recover copious amounts of NAPL. EPA did not propose NAPL recovery using wells because such attempts would not work at this Site. Please also note that the NAPL that had accumulated in the two wells cited did not simply disappear, but rather moved away from the wells.

34 Page 27 - In the "Evaluation of Alternatives", the EPA has rightfully recognized the importance of RAO achievement when comparing and selecting remedial Alternatives As noted in Specific Comment 21, a number of the RAOs specified by EPA are inappropriate, and if developed consistent with EPA guidance on RAO development (EPA, 1988), could very likely have resulted in selection of Alternative 3. Beazer requests that the EPA revise the RAOs in a manner consistent with EPA guidance and revise the comparative analysis accordingly to confirm that an appropriate remedy is selected for the Site

EPA RESPONSE: *EPA has considered Beazer's assertions and does not believe they are correct. The RAOs were developed in accordance with EPA guidance, and the selected remedy was proposed after careful consideration of all the Site-related data balanced against the nine criteria for remedy selection.*

35. Page 29 - Regarding EPA's failure to provide technical justification to support the conclusion that Alternative 4 will restore groundwater to its beneficial use, see previous comments.

EPA RESPONSE: *EPA has considered Beazer's assertions and does not believe they are correct. The RAOs were developed in accordance with EPA guidance, and the selected remedy was proposed after careful consideration of all the Site-related data balanced against the nine criteria for remedy selection.*

36. Page 29 - The EPA has concluded that for Alternative 2, natural recovery would not reduce the risks posed by sediments in lower Hershey River "because of the amount of contamination present." This statement is not supported by any data that Beazer is aware of, and ignores the potential benefits of source control activities (proposed as part of Alternative 2) at accelerating the natural recovery process (a concept supported by EPA's OSWER Directive titled Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites [EPA, 2002]).

As discussed in the FS Report (BBL, 2003) the presence of DNAPL noted during the investigation was generally limited to the centerline of the channel in the lower portion of Hershey Run and the majority of DNAPL observations were deeper than the 0- to 6-inch depth interval (i e bioavailable zone). Geochronologic-dating information collected from the Hershey Run Drainage Area indicates that deposition of new material is occurring at a rate between 0 24 and 0 36 inch per year. As such, the drainage basin is considered to be a net sediment deposition area, with clean sediment (assuming upland source control is completed as in Alternative 2) gradually providing a cover for impacted sediments (Section 3.4 of the RI Report [BBL, 2002]) In addition to the deposition of new material, the weathering of existing PAHs in sediments (BBL, 2002) would also continue to reduce concentrations over time. Again, Beazer believes that the EPA has failed to provide the technical justification for the statement regarding natural recovery, and requests that it be revised to more accurately reflect data collected during the RI/FS, giving due consideration to the potential benefits of upland source control as a remedy component

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe that they are correct. Source control does not "accelerate natural recovery." It stops ongoing releases, and where appropriate, may allow for natural recovery to then occur. As stated previously, Beazer has failed to recognize that NAPL throughout the sediments of Hershey Run is source material and thus qualifies as needing source control, and at such high concentrations as to be considered a source, will not naturally degrade in any reasonable timeframe. Please see previous response regarding "natural encapsulation" (the deposition of new material) and erosion.*

37. Page 31. As noted by the EPA, "The preamble to the NCP explains that for groundwater, remediation levels should generally be attained throughout the contaminated plume or at and beyond the edge of a waste management area when waste is left in place (55FR 8753)." (emphasis added) Consistent with the latter part of this statement, EPA recognized earlier in the PRAP that Site-related impacts to groundwater have only been noted in close proximity to source material As correctly stated on pages 8 and 9 of the PRAP·

"Groundwater analytical data have shown that creosote NAPL constituents are not migrating in ground water This is consistent with the low solubilities of creosote and PAHs Where constituents have been detected, borings have shown that NAPL is present in very close proximity. The plume exists in ground water only very near the DNAPL itself, like a halo, and is quickly attenuated in only a short distance."

Given this, Beazer disagrees with EPA's rationale for including a very extensive and costly subsurface soil excavation program in the proposed remedy.

EPA RESPONSE: *EPA has carefully considered Beazer's assertions, and does not believe that they are correct. As stated throughout the PRAP and in previous responses to comments submitted, the excavation of source material is expected to result in the eventual elimination of any ground water contamination. The source material itself is a principal threat waste and warrants remediation.*

38. Page 33 - Beazer believes that the EPA has understated some of the implementation challenges which will be posed by Alternative 4, including digging up to 30 feet deep (and below the water table) in soils, up to 13 feet deep in the marsh/Hershey Run sediments, and removing "all subsurface NAPL" to achieve drinking water standards in the Columbia aquifer Please either provide text down playing what we perceive as the potential complexities of performing these activities, or give them due consideration when selecting the final remedy

EPA RESPONSE: *EPA has considered Beazer's comments and does not believe that they are correct. Neither EPA's rationale nor the stated goal in the PRAP mentions cleaning "groundwater to drinking water quality." EPA is aware that the Columbia's natural condition does not necessarily make it suitable for drinking without treatment, and would refer Beazer to the actual text of the PRAP which clearly refers to the Columbia aquifer as a state-designated "potential drinking water aquifer." The PRAP does not specify "drinking water standards" as Beazer incorrectly asserts. EPA is aware of the technical challenges posed by excavation, and has considered these carefully in the PRAP and the ROD.*

39 Page 34 - As noted previously, Alternative 4 has failed to consider and include the additional $8.5 million that would be required by a wetlands developer to perform deep excavation and wetlands construction.

EPA RESPONSE: *EPA has considered Beazer's assertions, but does not believe that they are correct. Regarding matters of cost, EPA has prepared an extensive analyses of costs, which is attached hereto. Beazer's submittal to EPA of supplemental cost estimates or various components of the remedy were carefully reviewed and considered in EPA's discussion of the cost criterion. Note that PRAP Alternative 3 details what a 2-foot excavation of soil with backfill and cover would cost. Soil excavation for Alternative 3 totaled approximately $7.2M, while soil excavation in Alternative 4 totaled approximately $8.4M - while this is a significant difference, it is not as large a difference as suggested in the comment. As discussed earlier in this document, note that the original cost estimates in the 2003 FS Addendum (FS Alternative 10) split the cost of deeper soil excavations (beyond that required by the remedy) between the remedy and the "wetlands developer". EPA adopted this approach in order to be consistent for the purposes of comparison, but is not requiring the further excavations of materials to create a wetlands bank, as that is not part of the selected remedy. Rather, as stated in the PRAP, EPA's selected remedy is compatible with that potential future use, should such a use materialize in the future. The text of Alternative 4 clearly states that the additional $8.5 million is excluded because it is tied to a potential future use, and not part of the remedy.*

Table 1. Statistical Summary and COPC Selection for Risk Scenarios Evaluated
[HHRA Tables 1 – 16]

Table 1
Statistical Summary and COPC Selection for Construction Worker Exposed to Soils (0-18' bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dioxins								
2,3,7,8-TCDD Equiv	27	27	100	1 14E-04	8.55E-04	3 79E-04	7 34E-03	1 49E-03
Inorganics								
Aluminum	137	136	99 27	1 98E+03	1 44E+04	1 26E+04	3 65E+04	6 76E+03
Antimony	73	15	20 55	4 90E-01	1 99E+01	8 84E+00	1 21E+01	1 37E+01
Arsenic	123	112	91 06	8 60E-01	4.76E+00	3 88E+00	2 19E+01	3 19E+00
Barium	137	137	100	1.51E+01	2.37E+02	1 33E+02	1 65E+03	3 12E+02
Beryllium	131	129	98 47	2 60E-01	1 20E+00	1 03E+00	3 90E+00	7 48E-01
Cadmium	135	28	20 74	2 40E-01	2.07E+00	1 57E+00	1 23E+01	1 26E+00
Chromium	137	137	100	3 70E+00	2.46E+01	2.22E+01	1 19E+02	1 29E+01
Cobalt	130	119	91 54	6 10E-01	8 13E+00	6 11E+00	3 25E+01	5 53E+00
Copper	134	134	100	1 40E+00	2.31E+01	1 37E+01	5 28E+02	5 23E+01
Iron	137	137	100	4 43E+03	1 78E+04	1 66E+04	4 89E+04	6 44E+03
Lead[1]	137	137	100	1.80E+00	3 12E+01	1.47E+01	5.66E+02	7 35E+01
Manganese	137	137	100	4 06E+01	1 12E+03	3.62E+02	1 51E+04	2 27E+03
Mercury	122	35	28 69	5 00E-02	3 21E-01	1 26E-01	8 30E+00	9 61E-01
Nickel	131	130	99 24	3 40E+00	1 27E+01	1 14E+01	5.18E+01	6 85E+00
Selenium	117	15	12.82	8 60E-01	2.15E+00	1 89E+00	2 30E+00	7 20E-01
Silver	137	2	1 46	1 10E+00	4 35E+00	3 16E+00	1 50E+00	1.63E+00
Thallium	130	29	22.31	1 60E+00	5 01E+00	3 89E+00	4 44E+01	4 38E+00
Vanadium	137	136	99 27	7 60E+00	5 81E+01	4 49E+01	3 06E+02	5.72E+01
Zinc	133	133	100	5 20E+00	7 57E+01	4.31E+01	2.50E+03	2 28E+02
PCBs/Pesticides								
4,4'-DDD	24	1	4.17	3 80E-03	2 81E-02	4.73E-03	3 80E-03	6.66E-02
4,4'-DDE	24	3	12.5	1.40E-02	1 65E-02	4 23E-03	2 40E-01	4 91E-02
4,4'-DDT	24	5	20.83	2 90E-04	1 62E-02	4 37E-03	1 20E-01	3 44E-02
alpha-Chlordane[2]	24	1	4 17	1 80E-04	1.46E-02	2.33E-03	1 80E-04	3.44E-02
Dieldrin	24	5	20.83	2 20E-04	2 01E-02	3.61E-03	1 30E-02	5 65E-02
Endosulfan II[3]	24	2	8.33	4 50E-04	2 79E-02	4.15E-03	7 30E-04	6 67E-02
Endrin	24	1	4 17	1 10E-01	2 49E-02	4.81E-03	1 10E-01	5 91E-02
Endrin ketone[4]	24	1	4 17	2.90E-02	2.19E-02	4.56E-03	2.90E-02	5 76E-02
Heptachlor	24	1	4 17	5 30E-03	1.07E-02	2 22E-03	5 30E-03	2 93E-02
Heptachlor epoxide	24	2	8 33	1 00E-02	6 92E-03	2 12E-03	2 00E-02	1 92E-02
Methoxychlor	22	3	13 64	2 90E-01	9.87E-02	2.49E-02	9 20E-01	2 24E-01
PCB-1254	24	1	4 17	4 60E-01	2.99E-01	5 25E-02	4 60E-01	6 65E-01
PCB-1260	25	1	4	3 40E-01	2 86E-01	5 32E-02	3 40E-01	6 52E-01
Semivolatiles								
2-Methylnaphthalene	136	24	17 65	1 40E-01	2 03E+01	8 01E-01	6 10E+02	8 64E+01
Acenaphthene	136	28	20 59	1 80E-01	2 70E+01	8 73E-01	7 90E+02	1 16E+02
Acenaphthylene	136	17	12 5	5 90E-02	7 22E+00	7 43E-01	4 40E+01	2 65E+01
Anthracene	137	55	40 15	8 30E-02	3.84E+01	9 25E-01	2 60E+03	2 37E+02
Benzo(a)anthracene	137	87	63.5	1.10E-01	2 04E+01	1 56E+00	3 10E+02	4 63E+01
Benzo(a)pyrene	137	75	54.74	8.40E-02	1 65E+01	1.36E+00	2 40E+02	3 84E+01
Benzo(b)fluoranthene	137	86	62 77	8.50E-02	2.81E+01	2 01E+00	3 70E+02	5 94E+01
Benzo(g,h,i)perylene	137	67	48 91	8.40E-02	1 14E+01	1 18E+00	1 70E+02	2 75E+01
Benzo(k)fluoranthene	137	66	48 18	9.10E-02	1.17E+01	1 11E+00	1.10E+02	2 97E+01
bis(2-Ethylhexyl)phthalate	130	5	3 85	4 20E-02	7.43E+00	7 72E-01	7 90E-01	2 70E+01
Carbazole	135	38	28 15	9 60E-02	1.66E+01	7 76E-01	1 20E+03	1 07E+02
Chrysene	137	90	65 69	7.20E-02	2 17E+01	1 62E+00	2 60E+02	4 77E+01
Di-n-butylphthalate[5]	136	50	36 76	2 90E-02	7 36E+00	6 90E-01	5 30E-01	2 66E+01

Table 1
Statistical Summary and COPC Selection for Construction Worker Exposed to Soils (0-18' bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	1 35E-03	1 37E-03	Unknown	1 37E-03	3 80E-05	yes	yes
Inorganics							
Aluminum	1 54E+04	1 71E+04	Unknown	1 71E+04	2 00E+05	no	
Antimony	2 26E+01	7 70E+01	Unknown	1 21E+01	8 20E+01	no	
Arsenic	5 24E+00	5 61E+00	Unknown	5 61E+00	3.80E+00	yes	yes
Barium	2 81E+02	2 68E+02	Lognormal	2 68E+02	1 40E+04	no	
Beryllium	1 31E+00	1 30E+00	Unknown	1.30E+00	4 10E+02	no	
Cadmium	2 25E+00	2 81E+00	Unknown	2 81E+00	2 00E+02	no	
Chromium	2 65E+01	2.65E+01	Unknown	2.65E+01	3 10E+05	no	
Cobalt	8 93E+00	1.21E+01	Unknown	1 21E+01	1 20E+04	no	
Copper	3 06E+01	2 16E+01	Unknown	2 16E+01	8.20E+03	no	
Iron	1 87E+04	1 90E+04	Unknown	1.90E+04	6 10E+04	no	
Lead[1]	4 16E+01	2 87E+01	Unknown	2.87E+01	7 50E+02	no	
Manganese	1 44E+03	1 23E+03	Unknown	1 23E+03	2 90E+04	no	
Mercury	4 66E-01	2 31E-01	Unknown	2.31E-01	6 10E+01	no	
Nickel	1 37E+01	1 35E+01	Unknown	1.35E+01	4 10E+03	no	
Selenium	2 26E+00	2 59E+00	Unknown	2 30E+00	1.00E+03	no	
Silver	4 58E+00	8 31E+00	Unknown	1 50E+00	1 00E+03	no	
Thallium	5 65E+00	6.33E+00	Unknown	6 33E+00	1 40E+01	yes	yes
Vanadium	6 62E+01	6 18E+01	Unknown	6.18E+01	1.40E+03	no	
Zinc	1 08E+02	6 52E+01	Unknown	6.52E+01	6 10E+04	no	
PCBs/Pesticides							
4,4'-DDD	5 15E-02	4 80E-02	Unknown	3 80E-03	2.40E+01	no	
4,4'-DDE	3 37E-02	2 08E-02	Unknown	2.08E-02	1.70E+01	no	
4,4'-DDT	2 82E-02	3.33E-02	Unknown	3.33E-02	1 70E+01	no	
alpha-Chlordane[2]	2 66E-02	3.05E-02	Unknown	1.80E-04	1 60E+01	no	
Dieldrin	3 99E-02	2 92E-02	Unknown	1 30E-02	3 60E-01	no	
Endosulfan II[3]	5 13E-02	5 68E-02	Unknown	7 30E-04	1.20E+03	no	
Endrin	4 56E-02	4 28E-02	Unknown	4 28E-02	6.10E+01	no	
Endrin ketone[4]	4 21E-02	3 19E-02	Unknown	2 90E-02	6 10E+01	no	
Heptachlor	2 09E-02	1 38E-02	Unknown	5.30E-03	1 30E+00	no	
Heptachlor epoxide	1 37E-02	9 19E-03	Unknown	9 19E-03	6 30E-01	no	
Methoxychlor	1 81E-01	1 85E-01	Unknown	1 85E-01	1 00E+03	no	
PCB-1254	5 32E-01	6 41E-01	Unknown	4 60E-01	2 90E+00	no	
PCB-1260	5 09E-01	5 54E-01	Unknown	3 40E-01	2 90E+00	no	
Semivolatiles							
2-Methylnaphthalene	3 26E+01	1 01E+01	Unknown	1 01E+01	4.10E+03	no	
Acenaphthene	4 36E+01	1 35E+01	Unknown	1 35E+01	1 20E+04	no	
Acenaphthylene	1 10E+01	6 34E+00	Unknown	6 34E+00	NA	NA	yes
Anthracene	7 19E+01	1 95E+01	Unknown	1.95E+01	6 10E+04	no	
Benzo(a)anthracene	2 70E+01	5 62E+01	Unknown	5.62E+01	7 80E+00	yes	yes
Benzo(a)pyrene	2 20E+01	4 24E+01	Unknown	4 24E+01	7 80E-01	yes	yes
Benzo(b)fluoranthene	3 65E+01	1 02E+02	Unknown	1 02E+02	7 80E+00	yes	yes
Benzo(g,h,i)perylene	1 53E+01	2 43E+01	Unknown	2 43E+01	NA	NA	yes
Benzo(k)fluoranthene	1 60E+01	2 27E+01	Unknown	2.27E+01	7 80E+01	yes	yes
bis(2-Ethylhexyl)phthalate	1 14E+01	6 58E+00	Unknown	7 90E-01	4.10E+02	no	
Carbazole	3 19E+01	7 59E+00	Unknown	7 59E+00	2 90E+02	yes	yes
Chrysene	2.85E+01	6 54E+01	Unknown	6 54E+01	7 80E+02	no	
Di-n-butylphthalate	1 11E+01	7.14E+00	Unknown	5.30E-01	2 00E+04	no	

Table 1
Statistical Summary and COPC Selection for Construction Worker Exposed to Soils (0-18' bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dibenz(a,h)anthracene	136	45	33 09	7 40E-02	6 85E+00	8 02E-01	1 30E+02	2.30E+01
Dibenzofuran	137	30	21 9	2 70E-01	2 03E+01	8 53E-01	5 80E+02	8 37E+01
Diethylphthalate	135	1	0 74	1.00E-01	7.43E+00	7 80E-01	1 00E-01	2 66E+01
Fluoranthene	137	95	69 34	8 20E-02	5 36E+01	2 29E+00	1 20E+03	1 62E+02
Fluorene	137	31	22 63	6 60E-02	2 80E+01	8 54E-01	7 70E+02	1 17E+02
Indeno(1,2,3-c,d)pyrene	138	68	49 28	5 60E-02	1 22E+01	1 26E+00	1 10E+02	2 66E+01
Naphthalene	136	30	22 06	3 50E-02	5.92E+01	8 87E-01	3 00E+03	3 18E+02
Pentachlorophenol	136	6	4 41	1 30E-01	1 76E+01	1 80E+00	5 50E+00	6 58E+01
Phenanthrene	134	77	57.46	4 10E-02	7.08E+01	1.23E+00	2 10E+03	2.97E+02
Pyrene	137	95	69 34	4.10E-02	4.64E+01	2 19E+00	8 50E+02	1 28E+02
Volatiles								
1,1,2,2-Tetrachloroethane	143	13	9.09	1 00E-01	5 26E-02	1 02E-02	4 00E-01	1 51E-01
2-Butanone	130	21	16 15	2 00E-03	3 61E-02	7.76E-03	3 80E-02	1.45E-01
2-Hexanone	130	1	0 77	6 00E-03	3 56E-02	7 54E-03	6 00E-03	1 46E-01
Acetone	100	34	34	3 00E-03	9 03E-02	1 65E-02	2 10E+00	2 57E-01
Benzene	130	7	5 38	1 10E-02	3 36E-02	7 96E-03	5.30E-01	1 30E-01
Carbon Disulfide	130	5	3 85	4 00E-03	3.55E-02	7 51E-03	7 00E-03	1 46E-01
Ethylbenzene	130	19	14.62	1.00E-03	1 14E-01	8 71E-03	4 30E+00	5 51E-01
Styrene	130	9	6 92	5 00E-03	7.82E-02	8 24E-03	3 10E+00	3 94E-01
Tetrachloroethene	127	50	39 37	1 00E-03	3.82E-02	8 28E-03	7 40E-02	1 47E-01
Toluene	130	40	30 77	1 00E-03	1 10E-01	8 46E-03	5 70E+00	5 88E-01
Xylenes (total)	130	29	22 31	2 00E-03	4.86E-01	1 02E-02	2 40E+01	2 68E+00

Table 1
Statistical Summary and COPC Selection for Construction Worker Exposed to Soils (0-18' bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dibenz(a,h)anthracene	1 01E+01	7 15E+00	Unknown	7 15E+00	7 80E-01	yes	yes
Dibenzofuran	3 22E+01	1 11E+01	Unknown	1 11E+01	8 20E+02	no	
Diethylphthalate	1.12E+01	6 35E+00	Unknown	1 00E-01	1.60E+05	no	
Fluoranthene	7 66E+01	1 99E+02	Unknown	1 99E+02	8 20E+03	no	
Fluorene	4.45E+01	1 46E+01	Unknown	1 46E+01	8 20E+03	no	
Indeno(1,2,3-c,d)pyrene	1 60E+01	2 89E+01	Unknown	2.89E+01	7 80E+00	yes	yes
Naphthalene	1 04E+02	1 96E+01	Unknown	1 96E+01	4 10E+03	no	
Pentachlorophenol	2 70E+01	1 37E+01	Unknown	5 50E+00	4.80E+01	no	
Phenanthrene	1 13E+02	5 65E+01	Unknown	5 65E+01	NA	NA	yes
Pyrene	6 45E+01	1 83E+02	Unknown	1 83E+02	6 10E+03	no	
Volatiles							
1,1,2,2-Tetrachloroethane	7 35E-02	3 24E-02	Unknown	3 24E-02	2 90E+01	no	
2-Butanone	5 73E-02	1 54E-02	Unknown	1 54E-02	1 20E+05	no	
2-Hexanone	5 67E-02	1 43E-02	Unknown	6 00E-03	NA	NA	no
Acetone	1 33E-01	9 55E-02	Unknown	9 55E-02	2.00E+04	no	
Benzene	5 25E-02	1 55E-02	Unknown	1 55E-02	2 00E+02	no	
Carbon Disulfide	5 67E-02	1 42E-02	Unknown	7 00E-03	2 00E+04	no	
Ethylbenzene	1 94E-01	2 87E-02	Unknown	2.87E-02	2.00E+04	no	
Styrene	1 35E-01	2 04E-02	Lognormal	2 04E-02	4 10E+04	no	
Tetrachloroethene	5 98E-02	1 87E-02	Unknown	1 87E-02	1.10E+02	no	
Toluene	1 96E-01	2 92E-02	Unknown	2.92E-02	4.10E+04	no	
Xylenes (total)	8 76E-01	6 47E-02	Unknown	6 47E-02	4 10E+05	no	

This data set includes samples from the Process/Wood Storage and Drip Track areas
NA - Not available
[1] The screening level of 750 mg/kg is based on US EPA's adult blood lead uptake model under default exposure assumptions
[2] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark.
[3] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark.
[4] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endrin so that the Endrin RBC is applicable to its congeners as a provisional benchmark

Table 2
Statistical Summary and COPC Selection for Construction Worker Exposed to Soils and NAPL (0-18' bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dioxins								
2,3,7,8-TCDD Equiv	27	27	100	1 14E-04	8 55E-04	3 79E-04	7 34E-03	1 49E-03
Inorganics								
Aluminum	164	163	99 39	1 98E+03	1 43E+04	1 26E+04	3 65E+04	6 61E+03
Antimony	98	19	19 39	4 90E-01	1.52E+01	4 63E+00	1 21E+01	1 44E+01
Arsenic	150	139	92 67	8 60E-01	5 00E+00	4 00E+00	3 10E+01	3 90E+00
Barium	164	164	100	1 51E+01	2 43E+02	1 40E+02	1 65E+03	3 04E+02
Beryllium	152	150	98 68	2 60E-01	1 20E+00	1 02E+00	3 90E+00	7 53E-01
Cadmium	160	34	21.25	2 40E-01	1 81E+00	1.09E+00	1 23E+01	1 33E+00
Chromium	164	164	100	3.70E+00	2 67E+01	2 28E+01	2 44E+02	2 29E+01
Cobalt	157	145	92 36	6 10E-01	7 80E+00	5 92E+00	3 25E+01	5 42E+00
Copper	161	161	100	9 10E-01	2 42E+01	1 43E+01	5 28E+02	5 07E+01
Iron	164	164	100	4 43E+03	1 83E+04	1 69E+04	7 73E+04	8 34E+03
Lead[1]	164	164	100	1 80E+00	3 80E+01	1.60E+01	8 92E+02	9 77E+01
Manganese	164	164	100	3 52E+01	1 11E+03	3 88E+02	1 51E+04	2 14E+03
Mercury	140	51	36 43	1 90E-02	2 95E-01	1.16E-01	8 30E+00	9 00E-01
Nickel	157	156	99.36	3 40E+00	1 26E+01	1 13E+01	5 18E+01	6 59E+00
Selenium	144	22	15 28	8 50E-01	1 85E+00	1 47E+00	2 30E+00	9 13E-01
Silver	162	3	1 85	2 10E-01	3.70E+00	1.83E+00	1 50E+00	2 15E+00
Thallium	157	38	24 2	8 90E-01	4 30E+00	2 90E+00	4 44E+01	4 29E+00
Vanadium	164	163	99 39	7 60E+00	5 58E+01	4 39E+01	3 06E+02	5 33E+01
Zinc	156	156	100	5 20E+00	7 85E+01	4.66E+01	2 50E+03	2 14E+02
PCBs/Pesticides								
4,4'-DDD	24	1	4 17	3 80E-03	2.81E-02	4 73E-03	3 80E-03	6 66E-02
4,4'-DDE	24	3	12.5	1.40E-02	1.65E-02	4 23E-03	2 40E-01	4 91E-02
4,4'-DDT	24	5	20 83	2.90E-04	1.62E-02	4 37E-03	1 20E-01	3.44E-02
alpha-Chlordane[2]	24	1	4 17	1 80E-04	1.46E-02	2.33E-03	1.80E-04	3 44E-02
Dieldrin	24	5	20 83	2.20E-04	2 01E-02	3 61E-03	1 30E-02	5 65E-02
Endosulfan II[3]	24	2	8 33	4 50E-04	2.79E-02	4.15E-03	7 30E-04	6 67E-02
Endrin	24	1	4 17	1.10E-01	2 49E-02	4 81E-03	1 10E-01	5 91E-02
Endrin ketone[4]	24	1	4 17	2 90E-02	2 19E-02	4 56E-03	2 90E-02	5 76E-02
Heptachlor	24	1	4 17	5 30E-03	1 07E-02	2.22E-03	5 30E-03	2 93E-02
Heptachlor epoxide	24	2	8 33	1 00E-02	6 92E-03	2 12E-03	2 00E-02	1 92E-02
Methoxychlor	22	3	13 64	2 90E-01	9 87E-02	2.49E-02	9.20E-01	2 24E-01
PCB-1254	24	1	4 17	4 60E-01	2 99E-01	5 25E-02	4 60E-01	6 65E-01
PCB-1260	25	1	4	3 40E-01	2 86E-01	5.32E-02	3 40E-01	6 52E-01
Semivolatiles								
2,4-Dimethylphenol	163	1	0 61	1 20E+01	6 08E+00	6 57E-01	1.20E+01	2 43E+01
2-Methylnaphthalene	163	36	22.09	4 10E-02	1 84E+01	6 95E-01	6 10E+02	8 08E+01
4-Methylphenol	163	1	0.61	3 10E+01	6 20E+00	6.61E-01	3.10E+01	2 43E+01
Acenaphthene	163	45	27 61	4.60E-02	3 12E+01	7.30E-01	1 40E+03	1 52E+02
Acenaphthylene	163	37	22 7	5.90E-02	6.82E+00	7.15E-01	9 90E+01	2 53E+01

Table 2
Statistical Summary and COPC Selection for Construction Worker Exposed to Soils and NAPL (0-18' bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	1 35E-03	1 37E-03	Unknown	1 37E-03	3 80E-05	yes	yes
Inorganics							
Aluminum	1 51E+04	1 65E+04	Unknown	1 65E+04	2.00E+05	no	
Antimony	1 76E+01	5 80E+01	Unknown	1 21E+01	8 20E+01	no	
Arsenic	5 53E+00	5 71E+00	Unknown	5 71E+00	3 80E+00	yes	yes
Barium	2 83E+02	2 74E+02	Lognormal	2 74E+02	1.40E+04	no	
Beryllium	1 30E+00	1.29E+00	Unknown	1.29E+00	4 10E+02	no	
Cadmium	1 98E+00	3 42E+00	Unknown	3.42E+00	2.00E+02	no	
Chromium	2 96E+01	2 80E+01	Unknown	2 80E+01	3 10E+05	no	
Cobalt	8 51E+00	1 09E+01	Unknown	1 09E+01	1 20E+04	no	
Copper	3 08E+01	2 31E+01	Unknown	2 31E+01	8 20E+03	no	
Iron	1 94E+04	1 94E+04	Unknown	1.94E+04	6 10E+04	yes	yes
Lead[1]	5 07E+01	3 34E+01	Unknown	3 34E+01	7 50E+02	yes	yes
Manganese	1 39E+03	1 24E+03	Unknown	1 24E+03	2 90E+04	no	
Mercury	4 21E-01	2 28E-01	Unknown	2.28E-01	6 10E+01	no	
Nickel	1 34E+01	1 33E+01	Unknown	1.33E+01	4 10E+03	no	
Selenium	1 98E+00	2 33E+00	Unknown	2 30E+00	1 00E+03	no	
Silver	3 98E+00	1.17E+01	Unknown	1 50E+00	1.00E+03	no	
Thallium	4.87E+00	5 85E+00	Unknown	5.85E+00	1 40E+01	yes	yes
Vanadium	6 27E+01	5 85E+01	Unknown	5.85E+01	1 40E+03	no	
Zinc	1 07E+02	7 03E+01	Unknown	7.03E+01	6 10E+04	no	
PCBs/Pesticides							
4,4'-DDD	5 15E-02	4 80E-02	Unknown	3 80E-03	2.40E+01	no	
4,4'-DDE	3 37E-02	2.08E-02	Unknown	2.08E-02	1 70E+01	no	
4,4'-DDT	2 82E-02	3 33E-02	Unknown	3 33E-02	1 70E+01	no	
alpha-Chlordane[2]	2 66E-02	3 05E-02	Unknown	1 80E-04	1 60E+01	no	
Dieldrin	3 99E-02	2 92E-02	Unknown	1 30E-02	3 60E-01	no	
Endosulfan II[3]	5 13E-02	5 68E-02	Unknown	7.30E-04	1 20E+03	no	
Endrin	4 56E-02	4 28E-02	Unknown	4 28E-02	6 10E+01	no	
Endrin ketone[4]	4 21E-02	3 19E-02	Unknown	2 90E-02	6 10E+01	no	
Heptachlor	2 09E-02	1 38E-02	Unknown	5 30E-03	1 30E+00	no	
Heptachlor epoxide	1.37E-02	9 19E-03	Unknown	9.19E-03	6 30E-01	no	
Methoxychlor	1 81E-01	1 85E-01	Unknown	1 85E-01	1 00E+03	no	
PCB-1254	5 32E-01	6 41E-01	Unknown	4 60E-01	2 90E+00	no	
PCB-1260	5 09E-01	5 54E-01	Unknown	3 40E-01	2 90E+00	no	
Semivolatiles							
2,4-Dimethylphenol	9 23E+00	4 05E+00	Unknown	4.05E+00	4 10E+03	no	
2-Methylnaphthalene	2 88E+01	7 46E+00	Unknown	7 46E+00	4 10E+03	no	
4-Methylphenol	9 36E+00	4 17E+00	Unknown	4 17E+00	1 00E+03	no	
Acenaphthene	5 09E+01	1 07E+01	Unknown	1 07E+01	1 20E+04	no	
Acenaphthylene	1 01E+01	5 41E+00	Unknown	5 41E+00	NA	NA	yes

Table 2
Statistical Summary and COPC Selection for Construction Worker Exposed to Soils and NAPL (0-18' bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Anthracene	164	76	46 34	8 30E-02	3 96E+01	9 15E-01	2 60E+03	2.35E+02
Benzo(a)anthracene	164	112	68.29	6.70E-02	2 84E+01	1 68E+00	1.60E+03	1 31E+02
Benzo(a)pyrene	164	100	60 98	6.30E-02	2 00E+01	1 49E+00	7 40E+02	6 70E+01
Benzo(b)fluoranthene	164	111	67 68	8 50E-02	3 42E+01	2.34E+00	1 20E+03	1 07E+02
Benzo(g,h,i)perylene	164	90	54 88	4 70E-02	1 22E+01	1.28E+00	2 70E+02	3 26E+01
Benzo(k)fluoranthene	164	88	53 66	5 20E-02	1 23E+01	1 14E+00	3 20E+02	3 65E+01
bis(2-Ethylhexyl)phthalate	133	5	3 76	4.20E-02	7 28E+00	7.64E-01	7 90E-01	2.67E+01
Butylbenzylphthalate	164	2	1.22	6.50E-02	6 41E+00	6 71E-01	9 30E-02	2.44E+01
Carbazole	162	59	36 42	6.10E-02	1 85E+01	7.12E-01	1.20E+03	1 13E+02
Chrysene	164	116	70.73	4.60E-02	3 00E+01	1 82E+00	1 60E+03	1.31E+02
Di-n-butylphthalate	163	53	32.52	2.90E-02	6 43E+00	6 02E-01	5 30E-01	2.45E+01
Di-n-octylphthalate	164	1	0 61	4.30E-02	6.41E+00	6 72E-01	4 30E-02	2 44E+01
Dibenz(a,h)anthracene	163	64	39 26	7.40E-02	6 67E+00	8 23E-01	1 30E+02	2 22E+01
Dibenzofuran	164	45	27 44	8.50E-02	2 50E+01	7 45E-01	1 30E+03	1.26E+02
Diethylphthalate	162	2	1 23	6.40E-02	6 49E+00	6 81E-01	1 00E-01	2 46E+01
Fluoranthene	164	122	74 39	5.70E-02	9 98E+01	2 49E+00	8 60E+03	6 84E+02
Fluorene	164	44	26.83	5.40E-02	3 87E+01	7 40E-01	2 50E+03	2 21E+02
Indeno(1,2,3-c,d)pyrene	165	91	55.15	5.50E-02	1 35E+01	1.37E+00	3 40E+02	3 57E+01
Naphthalene	163	47	28 83	3.50E-02	5.09E+01	7 75E-01	3 00E+03	2 92E+02
Pentachlorophenol	163	15	9 2	4 20E-02	1 54E+01	1 47E+00	5 50E+00	6 07E+01
Phenanthrene	161	99	61.49	4.10E-02	1 28E+02	1 22E+00	1 10E+04	9 04E+02
Phenol	163	1	0 61	5.70E+01	6.36E+00	6.64E-01	5 70E+01	2 46E+01
Pyrene	164	121	73 78	4.10E-02	7.61E+01	2 45E+00	5 70E+03	4 57E+02
Volatiles								
1,1,2,2-Tetrachloroethane	152	13	8.55	1.00E-01	4.99E-02	9.90E-03	4.00E-01	1.47E-01
2-Butanone	139	21	15 11	2.00E-03	3.42E-02	7 65E-03	3 80E-02	1 41E-01
2-Hexanone	139	1	0 72	6.00E-03	3.37E-02	7 45E-03	6 00E-03	1 41E-01
Acetone	102	35	34 31	3.00E-03	9 08E-02	1 67E-02	2 10E+00	2 55E-01
Benzene	139	7	5.04	1.10E-02	3.18E-02	7 83E-03	5 30E-01	1 26E-01
Carbon Disulfide	139	5	3 6	4.00E-03	3.36E-02	7.42E-03	7 00E-03	1 41E-01
Ethylbenzene	139	19	13.67	1.00E-03	1.07E-01	8 52E-03	4 30E+00	5 33E-01
Styrene	139	9	6 47	5.00E-03	7.35E-02	8 09E-03	3 10E+00	3 81E-01
Tetrachloroethene	136	50	36.76	1.00E-03	3 60E-02	8.13E-03	7 40E-02	1.42E-01
Toluene	139	40	28.78	1.00E-03	1.03E-01	8 29E-03	5 70E+00	5 69E-01
Trichloroethene	139	1	0.72	2.00E-03	3 36E-02	7 39E-03	2.00E-03	1 41E-01
Xylenes (total)	139	29	20 86	2.00E-03	4.55E-01	9 83E-03	2 40E+01	2 59E+00

Table 2
Statistical Summary and COPC Selection for Construction Worker Exposed to Soils and NAPL (0-18' bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Anthracene	7.00E+01	1.58E+01	Unknown	1 58E+01	6 10E+04	no	
Benzo(a)anthracene	4.53E+01	5.92E+01	Unknown	5.92E+01	7 80E+00	yes	yes
Benzo(a)pyrene	2.87E+01	4.66E+01	Unknown	4 66E+01	7.80E-01	yes	yes
Benzo(b)fluoranthene	4.81E+01	1.12E+02	Unknown	1 12E+02	7 80E+00	yes	yes
Benzo(g,h,i)perylene	1.64E+01	2.45E+01	Unknown	2 45E+01	NA	NA	yes
Benzo(k)fluoranthene	1.71E+01	2.08E+01	Unknown	2 08E+01	7 80E+01	yes	yes
bis(2-Ethylhexyl)phthalate	1.11E+01	6.32E+00	Unknown	7.90E-01	4 10E+02	no	
Butylbenzylphthalate	9.57E+00	4.56E+00	Unknown	9.30E-02	4 10E+04	no	
Carbazole	3.33E+01	6.63E+00	Unknown	6.63E+00	2.90E+02	yes	yes
Chrysene	4.70E+01	7.33E+01	Unknown	7.33E+01	7 80E+02	yes	yes
Di-n-butylphthalate	9.61E+00	5.23E+00	Unknown	5.30E-01	2.00E+04	no	
Di-n-octylphthalate	9.57E+00	4.57E+00	Unknown	4 30E-02	4 10E+03	no	
Dibenz(a,h)anthracene	9.55E+00	6.58E+00	Unknown	6.58E+00	7.80E-01	yes	yes
Dibenzofuran	4.13E+01	8.65E+00	Unknown	8.65E+00	8.20E+02	yes	
Diethylphthalate	9.68E+00	4.70E+00	Unknown	1 00E-01	1 60E+05	no	
Fluoranthene	1.88E+02	2.09E+02	Unknown	2.09E+02	8 20E+03	yes	yes
Fluorene	6.73E+01	1.16E+01	Unknown	1.16E+01	8 20E+03	no	
Indeno(1,2,3-c,d)pyrene	1.81E+01	2.95E+01	Unknown	2.95E+01	7 80E+00	yes	yes
Naphthalene	8.88E+01	1.35E+01	Unknown	1 35E+01	4 10E+03	no	
Pentachlorophenol	2.33E+01	1.12E+01	Unknown	5.50E+00	4 80E+01	no	
Phenanthrene	2.46E+02	4.98E+01	Unknown	4.98E+01	NA	NA	yes
Phenol	9.55E+00	4.27E+00	Unknown	4 27E+00	1 20E+05	no	
Pyrene	1.35E+02	1.88E+02	Unknown	1.88E+02	6.10E+03	no	
Volatiles							
1,1,2,2-Tetrachloroethane	6.96E-02	2.95E-02	Unknown	2.95E-02	2 90E+01	no	
2-Butanone	5.40E-02	1.45E-02	Unknown	1 45E-02	1 00E+05	no	
2-Hexanone	5.35E-02	1.35E-02	Unknown	6.00E-03	NA	NA	no
Acetone	1.33E-01	9.83E-02	Unknown	9 83E-02	2.00E+04	no	
Benzene	4.95E-02	1.46E-02	Unknown	1 46E-02	2 00E+02	no	
Carbon Disulfide	5.34E-02	1.35E-02	Unknown	7 00E-03	2 00E+04	no	
Ethylbenzene	1.82E-01	2.60E-02	Unknown	2 60E-02	2 00E+04	no	
Styrene	1.27E-01	1.89E-02	Unknown	1.89E-02	4 10E+04	no	
Tetrachloroethene	5.63E-02	1.74E-02	Unknown	1 74E-02	1 10E+02	no	
Toluene	1.83E-01	2.64E-02	Unknown	2 64E-02	4 10E+04	no	
Trichloroethene	5.34E-02	1.35E-02	Unknown	2 00E-03	5 20E+02	no	
Xylenes (total)	*8.20E-01*	*5.55E-02*	*Unknown*	5 55E-02	4 10E+05	no	

This data set includes samples from the Process/Wood Storage and Drip Track areas
NA - Not available
[1] The screening level of 750 mg/kg is based on US EPA's adult blood lead uptake model under default exposure assumptions
[2] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark
[3] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark
[4] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Endrin so that the Endrin RBC is applicable to its congeners as a provisional benchmark

Table 3
Statistical Summary and COPC Selection for Industrial Worker Exposed to Surface Soils (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dioxins								
2,3,7,8-TCDD Equiv	12	12	100	1 48E-04	1 69E-03	9 77E-04	7 34E-03	1 98E-03
Inorganics								
Aluminum	43	43	100	2 07E+03	1 73E+04	1 45E+04	3 65E+04	9 54E+03
Antimony	24	10	41 67	6.50E-01	1.25E+01	3.24E+00	1 21E+01	1 41E+01
Arsenic	38	36	94 74	1 20E+00	6 31E+00	4 88E+00	2 19E+01	4 60E+00
Barium	43	43	100	2 11E+01	5.29E+02	3 62E+02	1 65E+03	4 15E+02
Beryllium	42	42	100	2 60E-01	1 72E+00	1 42E+00	3 90E+00	9 82E-01
Cadmium	42	23	54.76	2.40E-01	1 43E+00	9.56E-01	2 10E+00	1 04E+00
Chromium	43	43	100	3 70E+00	2 42E+01	1 99E+01	1.19E+02	1 93E+01
Cobalt	41	33	80 49	6 10E-01	6 45E+00	3 54E+00	1 20E+01	5 99E+00
Copper	42	42	100	5 30E+00	4 76E+01	2 52E+01	5 28E+02	8 82E+01
Iron	43	43	100	4 43E+03	1 59E+04	1 49E+04	2 82E+04	5 18E+03
Lead[1]	43	43	100	3 80E+00	6 20E+01	3 53E+01	4 77E+02	9 29E+01
Manganese	43	43	100	4 06E+01	2.55E+03	1 24E+03	9 81E+03	2 81E+03
Mercury	35	17	48 57	5 00E-02	6.45E-01	1.64E-01	8 30E+00	1 56E+00
Nickel	39	39	100	4 00E+00	1 23E+01	1 01E+01	5 18E+01	1 02E+01
Selenium	37	7	18 92	8 60E-01	1.73E+00	1 27E+00	2 30E+00	9 79E-01
Silver	43	2	4.65	1.10E+00	3 57E+00	1 65E+00	1 50E+00	2 21E+00
Thallium	42	19	45.24	1 60E+00	5.56E+00	3 23E+00	4 44E+01	7 44E+00
Vanadium	43	42	97 67	7 60E+00	8 94E+01	5.70E+01	3 06E+02	9 01E+01
Zinc	43	43	100	6.40E+00	9 92E+01	6 28E+01	8 74E+02	1 39E+02
PCBs/Pesticides								
4,4'-DDD	7	1	14.29	3 80E-03	8.71E-02	1.58E-02	3 80E-03	1 06E-01
4,4'-DDE	7	3	42 86	1 40E-02	4.72E-02	1 07E-02	2 40E-01	8 75E-02
4,4'-DDT	7	4	57 14	6 90E-03	4 64E-02	1 59E-02	1 20E-01	5 47E-02
alpha-Chlordane[2]	7	1	14 29	1 80E-04	4.53E-02	7 28E-03	1 80E-04	5 46E-02
Dieldrin	7	3	42.86	2 40E-03	6 11E-02	1 07E-02	1.30E-02	9 72E-02
Endosulfan II[3]	7	1	14 29	4 50E-04	8.78E-02	1.46E-02	4 50E-04	1 06E-01
Endrin	7	1	14 29	1 10E-01	7.59E-02	1 67E-02	1 10E-01	9 53E-02
Endrin ketone[3]	7	1	14.29	2 90E-02	6.57E-02	1 39E-02	2 90E-02	9 76E-02
Heptachlor	7	1	14 29	5 30E-03	3.19E-02	6.11E-03	5 30E-03	5 03E-02
Heptachlor epoxide	7	2	28.57	1 00E-02	1 90E-02	5 21E-03	2 00E-02	3 42E-02
Methoxychlor	7	3	42.86	2.90E-01	2 66E-01	7 02E-02	9 20E-01	3 57E-01
PCB-1260	8	1	12.5	3 40E-01	8.13E-01	1.96E-01	3.40E-01	9 94E-01

Table 3
Statistical Summary and COPC Selection for Industrial Worker Exposed to Surface Soils (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	2.71E-03	5.44E-03	Lognormal	5.44E-03	3.80E-05	yes	yes
Inorganics							
Aluminum	1.98E+04	2.21E+04	Normal/Lognormal	2.21E+04	2.00E+05	no	
Antimony	1.74E+01	1.20E+02	Unknown	1.21E+01	8.20E+01	no	
Arsenic	7.57E+00	8.56E+00	Lognormal	8.56E+00	3.80E+00	yes	yes
Barium	6.36E+02	8.53E+02	Lognormal	8.53E+02	1.40E+04	no	
Beryllium	1.98E+00	2.21E+00	Normal/Lognormal	2.21E+00	4.10E+02	no	
Cadmium	1.70E+00	2.30E+00	Unknown	2.10E+00	2.00E+02	no	
Chromium	2.92E+01	2.94E+01	Lognormal	2.94E+01	3.10E+05	no	
Cobalt	8.02E+00	2.17E+01	Unknown	1.20E+01	1.20E+04	no	
Copper	7.06E+01	5.89E+01	Lognormal	5.89E+01	8.20E+03	no	
Iron	1.73E+04	1.81E+04	Normal	1.73E+04	6.10E+04	no	
Lead[1]	8.58E+01	8.22E+01	Lognormal	8.22E+01	7.50E+02	no	
Manganese	3.27E+03	5.50E+03	Lognormal	5.50E+03	2.90E+04	no	
Mercury	1.09E+00	8.57E-01	Unknown	8.57E-01	6.10E+01	no	
Nickel	1.51E+01	1.44E+01	Unknown	1.44E+01	4.10E+03	no	
Selenium	2.00E+00	2.84E+00	Unknown	2.30E+00	1.00E+03	no	
Silver	4.14E+00	2.05E+01	Unknown	1.50E+00	1.00E+03	no	
Thallium	7.49E+00	8.56E+00	Unknown	8.56E+00	1.40E+01	yes	yes
Vanadium	1.13E+02	1.28E+02	Lognormal	1.28E+02	1.40E+03	no	
Zinc	1.35E+02	1.28E+02	Lognormal	1.28E+02	6.10E+04	no	
PCBs/Pesticides							
4,4'-DDD	1.65E-01	6.23E+02	Unknown	3.80E-03	2.40E+01	no	
4,4'-DDE	1.11E-01	8.03E+00	Lognormal	2.40E-01	1.70E+01	no	
4,4'-DDT	8.66E-02	7.59E+00	Normal/Lognormal	1.20E-01	1.70E+01	no	
alpha-Chlordane[2]	8.54E-02	3.69E+03	Normal/Lognormal	1.80E-04	1.60E+01	no	
Dieldrin	1.32E-01	4.36E+01	Lognormal	1.30E-02	3.60E-01	no	
Endosulfan II[3]	1.65E-01	4.37E+03	Normal/Lognormal	4.50E-04	1.20E+03	no	
Endrin	1.46E-01	1.72E+02	Normal/Lognormal	1.10E-01	6.10E+01	no	
Endrin ketone[4]	1.37E-01	5.35E+01	Lognormal	2.90E-02	6.10E+01	no	
Heptachlor	6.88E-02	1.87E+01	Lognormal	5.30E-03	1.30E+00	no	
Heptachlor epoxide	4.41E-02	1.78E+00	Lognormal	2.00E-02	6.30E-01	no	
Methoxychlor	5.28E-01	1.34E+02	Normal/Lognormal	9.20E-01	1.00E+03	no	
PCB-1260	1.48E+00	4.17E+02	Lognormal	3.40E-01	2.90E+00	no	

Table 3
Statistical Summary and COPC Selection for Industrial Worker Exposed to Surface Soils (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Semivolatiles								
Acenaphthene	43	7	16 28	5 00E-01	9.52E+00	2 37E+00	1 50E+02	2 40E+01
Acenaphthylene	43	12	27 91	6 20E-01	6 92E+00	2 68E+00	1 30E+01	9 71E+00
Anthracene	43	27	62 79	1 40E-01	7 33E+01	3 10E+00	2 60E+03	3 97E+02
Benzo(a)anthracene	43	40	93 02	3 80E-01	4.10E+01	1 50E+01	1 70E+02	4 52E+01
Benzo(a)pyrene	43	40	93 02	3 40E-01	3 48E+01	1 26E+01	2 40E+02	4 48E+01
Benzo(b)fluoranthene	43	40	93 02	9 30E-01	6 98E+01	2 51E+01	3 70E+02	8 00E+01
Benzo(g,h,i)perylene	43	39	90 7	3 40E-01	2.06E+01	8 98E+00	9 40E+01	2 07E+01
Benzo(k)fluoranthene	43	39	90 7	1 70E-01	2 28E+01	8 59E+00	1.10E+02	2.60E+01
Carbazole	43	20	46 51	9 80E-02	3 42E+01	2 29E+00	1 20E+03	1.82E+02
Chrysene	43	40	93 02	5 60E-01	4.73E+01	1.67E+01	2 60E+02	5 83E+01
Di-n-butylphthalate[5]	44	2	4 55	1 90E-01	7 33E+00	2 61E+00	2 10E-01	1 08E+01
Dibenz(a,h)anthracene	43	32	74 42	3 90E-01	7.52E+00	3 25E+00	2.20E+01	8 74E+00
Dibenzofuran	43	9	20 93	1 00E+00	1.11E+01	2 44E+00	2 30E+02	3 54E+01
Fluoranthene	43	41	95.35	9 40E-02	6 63E+01	2 12E+01	3 90E+02	9 33E+01
Fluorene	43	6	13 95	7 10E-01	1 81E+01	2 44E+00	5 20E+02	7 90E+01
Indeno(1,2,3-c,d)pyrene	44	41	93 18	3 00E-01	2 47E+01	1 03E+01	1 10E+02	2 48E+01
Naphthalene	43	10	23.26	4 70E-01	9 75E+00	2 55E+00	1.50E+02	2 40E+01
Pentachlorophenol	43	3	6 98	6 50E-01	1.65E+01	5 80E+00	2.30E+00	2 47E+01
Phenanthrene	43	37	86 05	1 30E-01	3 07E+01	4 02E+00	8 50E+02	1 30E+02
Pyrene	43	40	93 02	5 10E-01	6 74E+01	2 20E+01	4 10E+02	9 06E+01
Volatiles								
1,1,2,2-Tetrachloroethane	38	2	5 26	1 00E-01	1 63E-02	7 23E-03	3 00E-01	4 97E-02
2-Butanone	36	2	5 56	6 00E-03	6 90E-03	6 31E-03	3 80E-02	5 36E-03
Acetone	35	5	14.29	4 00E-03	1 27E-02	7.19E-03	1 50E-01	2 70E-02
Benzene	36	1	2.78	1 10E-02	6.24E-03	6 17E-03	1 10E-02	1 07E-03
Ethylbenzene	36	4	11 11	1 00E-03	1 13E-02	6.27E-03	2 00E-01	3 24E-02
Tetrachloroethene	36	25	69 44	4 00E-03	1 17E-02	8 88E-03	7 40E-02	1 27E-02
Toluene	36	16	44 44	1 00E-03	1.15E-02	7 09E-03	1 50E-01	2 43E-02
Xylenes (total)	36	6	16 67	3 30E-03	2 68E-02	6 99E-03	7 40E-01	1 22E-01

Table 3
Statistical Summary and COPC Selection for Industrial Worker Exposed to Surface Soils (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Semivolatiles							
Acenaphthene	1.57E+01	1 76E+01	Lognormal	1 76E+01	1.20E+04	no	
Acenaphthylene	9 41E+00	1 58E+01	Lognormal	1 30E+01	NA	NA	yes
Anthracene	*1 75E+02*	*6 96E+01*	*Lognormal*	*6 96E+01*	6 10E+04	no	
Benzo(a)anthracene	5 26E+01	2 13E+02	Unknown	1 70E+02	7 80E+00	yes	yes
Benzo(a)pyrene	4 63E+01	1.61E+02	Lognormal	1.61E+02	7 80E-01	yes	yes
Benzo(b)fluoranthene	9 04E+01	4 22E+02	Unknown	3 70E+02	7 80E+00	yes	yes
Benzo(g,h,i)perylene	2 59E+01	8 16E+01	Unknown	8 16E+01	NA	NA	yes
Benzo(k)fluoranthene	2 95E+01	1 11E+02	Unknown	1 10E+02	7 80E+01	yes	yes
Carbazole	8 11E+01	2 96E+01	Lognormal	2 96E+01	2 90E+02	yes	yes
Chrysene	6 23E+01	2.42E+02	Lognormal	2 42E+02	7 80E+02	no	
Di-n-butylphthalate	1.01E+01	1 60E+01	Lognormal	2 10E-01	2.00E+04	no	
Dibenz(a,h)anthracene	9 77E+00	1 99E+01	Lognormal	1 99E+01	7 80E-01	yes	yes
Dibenzofuran	2 02E+01	1 76E+01	Lognormal	1 76E+01	8 20E+02	no	
Fluoranthene	9 03E+01	4 11E+02	Lognormal	3 90E+02	8 20E+03	no	
Fluorene	3 84E+01	2 25E+01	Lognormal	2.25E+01	8 20E+03	no	
Indeno(1,2,3-c,d)pyrene	3 10E+01	1 11E+02	Unknown	1 10E+02	7 80E+00	yes	yes
Naphthalene	1 59E+01	1 96E+01	Lognormal	1 96E+01	4 10E+03	no	
Pentachlorophenol	2 28E+01	3 61E+01	Lognormal	2 30E+00	4 80E+01	no	
Phenanthrene	*6.42E+01*	*5 16E+01*	*Lognormal*	*5 16E+01*	*NA*	*NA*	yes
Pyrene	9 07E+01	3 90E+02	Lognormal	3 90E+02	6 10E+03	no	
Volatiles							
1,1,2,2-Tetrachloroethane	3 00E-02	1 28E-02	Unknown	1 28E-02	2 90E+01	no	
2-Butanone	8 42E-03	7 31E-03	Unknown	7 31E-03	1 00E+05	no	
Acetone	2 04E-02	1 25E-02	Unknown	1 25E-02	2.00E+04	no	
Benzene	6 54E-03	6 50E-03	Unknown	6 50E-03	2.00E+02	no	
Ethylbenzene	2 04E-02	9 97E-03	Unknown	9.97E-03	2 00E+04	no	
Tetrachloroethene	1 53E-02	1 39E-02	Unknown	1 39E-02	1.10E+02	no	
Toluene	1.84E-02	1 22E-02	Unknown	1 22E-02	4.10E+04	no	
Xylenes (total)	6.14E-02	1 37E-02	Unknown	1 37E-02	1.00E+05	no	

This data set includes samples from the Process/Wood Storage and Drip Track areas
NA - Not available
[1] The screening level of 750 mg/kg is based on US EPA's adult blood lead uptake model under default exposure assumptions
[2] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark
[3] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark
[4] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endrin so that the Endrin RBC is applicable to its congeners as a provisional benchmark

Table 4
Statistical Summary and COPC Selection for Industrial Worker Exposed to Surface Soils and NAPL (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dioxins								
2,3,7,8-TCDD Equiv	12	12	100	1 48E-04	1.69E-03	9 77E-04	7 34E-03	1 98E-03
Inorganics								
Aluminum	67	67	100	2 07E+03	1.59E+04	1 36E+04	3 65E+04	8 63E+03
Antimony	46	14	30 43	6 50E-01	7.23E+00	1 60E+00	1 21E+01	1 16E+01
Arsenic	62	60	96 77	1 20E+00	6.34E+00	4 86E+00	3 10E+01	5 34E+00
Barium	67	67	100	2 11E+01	4.47E+02	2 91E+02	1 65E+03	3 85E+02
Beryllium	60	60	100	2 60E-01	1 58E+00	1 28E+00	3 90E+00	9 61E-01
Cadmium	64	29	45 31	2 40E-01	1.09E+00	5 30E-01	2 10E+00	1 02E+00
Chromium	67	67	100	3 70E+00	2.93E+01	2 19E+01	2 44E+02	3 43E+01
Cobalt	65	56	86.15	6 10E-01	6.49E+00	4 14E+00	2 50E+01	5 52E+00
Copper	66	66	100	9 10E-01	4.19E+01	2 23E+01	5 28E+02	7 54E+01
Iron	67	67	100	4 43E+03	1.77E+04	1 59E+04	7 73E+04	1 00E+04
Lead[1]	67	67	100	2 30E+00	6.85E+01	3 25E+01	8 92E+02	1 31E+02
Manganese	67	67	100	4 06E+01	2.07E+03	9.90E+02	9 81E+03	2 48E+03
Mercury	50	31	62	2 10E-02	4.93E-01	1 33E-01	8 30E+00	1 32E+00
Nickel	62	62	100	4 00E+00	1.25E+01	1 06E+01	5 18E+01	8.68E+00
Selenium	61	13	21 31	8 50E-01	1.26E+00	8 66E-01	2 30E+00	9 80E-01
Silver	65	3	4 62	2 10E-01	2.40E+00	6 24E-01	1 50E+00	2 43E+00
Thallium	66	26	39.39	8 90E-01	3.85E+00	1.83E+00	4 44E+01	6 35E+00
Vanadium	67	66	98 51	7 60E+00	7.32E+01	5.00E+01	3 06E+02	7 64E+01
Zinc	66	66	100	6 40E+00	9.78E+01	6.61E+01	8 74E+02	1 25E+02
PCBs/Pesticides								
4,4'-DDD	7	1	14.29	3 80E-03	8.71E-02	1 58E-02	3.80E-03	1 06E-01
4,4'-DDE	7	3	42 86	1 40E-02	4.72E-02	1.07E-02	2.40E-01	8 75E-02
4,4'-DDT	7	4	57 14	6 90E-03	4.64E-02	1 59E-02	1 20E-01	5 47E-02
alpha-Chlordane[2]	7	1	14 29	1 80E-04	4.53E-02	7 28E-03	1 80E-04	5 46E-02
Dieldrin	7	3	42.86	2 40E-03	6.11E-02	1 07E-02	1 30E-02	9 72E-02
Endosulfan II[3]	7	1	14 29	4 50E-04	8.78E-02	1 46E-02	4 50E-04	1 06E-01
Endrin	7	1	14 29	1 10E-01	7.59E-02	1.67E-02	1 10E-01	9 53E-02
Endrin ketone[4]	7	1	14 29	2.90E-02	6.57E-02	1 39E-02	2 90E-02	9 76E-02
Heptachlor	7	1	14 29	5 30E-03	3.19E-02	6 11E-03	5 30E-03	5 03E-02
Heptachlor epoxide	7	2	28.57	1 00E-02	1.90E-02	5 21E-03	2.00E-02	3 42E-02
Methoxychlor	7	3	42 86	2 90E-01	2.66E-01	7 02E-02	9 20E-01	3 57E-01
PCB-1260	8	1	12.5	3 40E-01	8.13E-01	1 96E-01	3 40E-01	9 94E-01
Semivolatiles								
2,4-Dimethylphenol	67	1	1 49	1 20E+01	4.63E+00	1 24E+00	1 20E+01	8 51E+00
2-Methylnaphthalene	67	18	26 87	4 10E-02	1.00E+01	1.22E+00	2 20E+02	3 48E+01
4-Methylphenol	67	1	1.49	3.10E+01	4.91E+00	1.26E+00	3 10E+01	9 06E+00
Acenaphthene	67	22	32.84	4 60E-02	2.71E+01	1 14E+00	1 40E+03	1 71E+02
Acenaphthylene	67	31	46.27	1 10E-01	6.36E+00	1 66E+00	9 90E+01	1 42E+01

Table 4
Statistical Summary and COPC Selection for Industrial Worker Exposed to Surface Soils and NAPL (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	2.71E-03	5.44E-03	Lognormal	5.44E-03	3.80E-05	yes	yes
Inorganics							
Aluminum	1.76E+04	1.86E+04	Unknown	1.86E+04	2.00E+05	no	
Antimony	1.01E+01	1.83E+01	Unknown	1.21E+01	8.20E+01	no	
Arsenic	7.48E+00	7.70E+00	Unknown	7.70E+00	3.80E+00	yes	yes
Barium	5.25E+02	6.51E+02	Unknown	6.51E+02	1.40E+04	no	
Beryllium	1.79E+00	1.95E+00	Unknown	1.95E+00	4.10E+02	no	
Cadmium	1.31E+00	2.50E+00	Normal	1.31E+00	2.00E+02	no	
Chromium	3.63E+01	3.28E+01	Unknown	3.28E+01	3.10E+05	no	
Cobalt	7.63E+00	1.37E+01	Unknown	1.37E+01	1.20E+04	no	
Copper	5.74E+01	5.02E+01	Lognormal	5.02E+01	8.20E+03	no	
Iron	1.97E+04	1.94E+04	Unknown	1.94E+04	6.10E+04	yes	yes
Lead[1]	9.54E+01	8.31E+01	Unknown	8.31E+01	7.50E+02	yes	yes
Manganese	2.57E+03	3.46E+03	Unknown	3.46E+03	2.90E+04	no	
Mercury	8.08E-01	5.65E-01	Unknown	5.65E-01	6.10E+01	no	
Nickel	1.43E+01	1.39E+01	Unknown	1.39E+01	4.10E+03	no	
Selenium	1.47E+00	1.72E+00	Unknown	1.72E+00	1.00E+03	no	
Silver	2.91E+00	1.19E+01	Unknown	1.50E+00	1.00E+03	no	
Thallium	5.16E+00	5.40E+00	Unknown	5.40E+00	1.40E+01	yes	yes
Vanadium	8.88E+01	8.78E+01	Unknown	8.78E+01	1.40E+03	no	
Zinc	1.23E+02	1.15E+02	Unknown	1.15E+02	6.10E+04	no	
PCBs/Pesticides							
4,4'-DDD	1.65E-01	6.23E+02	Unknown	3.80E-03	2.40E+01	no	
4,4'-DDE	1.11E-01	8.03E+00	Lognormal	2.40E-01	1.70E+01	no	
4,4'-DDT	8.66E-02	7.59E+00	Normal/Lognormal	1.20E-01	1.70E+01	no	
alpha-Chlordane[2]	8.54E-02	3.69E+03	Normal/Lognormal	1.80E-04	1.60E+01	no	
Dieldrin	1.32E-01	4.36E+01	Lognormal	1.30E-02	3.60E-01	no	
Endosulfan II[3]	1.65E-01	4.37E+03	Normal/Lognormal	4.50E-04	1.20E+03	no	
Endrin	1.46E-01	1.72E+02	Normal/Lognormal	1.10E-01	6.10E+01	no	
Endrin ketone[4]	1.37E-01	5.35E+01	Lognormal	2.90E-02	6.10E+01	no	
Heptachlor	6.88E-02	1.87E+01	Lognormal	5.30E-03	1.30E+00	no	
Heptachlor epoxide	4.41E-02	1.78E+00	Lognormal	2.00E-02	6.30E-01	no	
Methoxychlor	5.28E-01	1.34E+02	Normal/Lognormal	9.20E-01	1.00E+03	no	
PCB-1260	1.48E+00	4.17E+02	Lognormal	3.40E-01	2.90E+00	no	
Semivolatiles							
2,4-Dimethylphenol	6.36E+00	8.47E+00	Unknown	8.47E+00	4.10E+03	no	
2-Methylnaphthalene	1.71E+01	1.40E+01	Unknown	1.40E+01	4.10E+03	no	
4-Methylphenol	6.76E+00	9.06E+00	Unknown	9.06E+00	1.00E+03	no	
Acenaphthene	6.21E+01	1.86E+01	Unknown	1.86E+01	1.20E+04	no	
Acenaphthylene	9.25E+00	1.21E+01	Unknown	1.21E+01	NA	NA	yes

Table 4
Statistical Summary and COPC Selection for Industrial Worker Exposed to Surface Soils and NAPL (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Anthracene	67	46	68 66	1 20E-01	6.55E+01	2.05E+00	2 60E+03	3 48E+02
Benzo(a)anthracene	67	63	94 03	6 70E-02	5 39E+01	8 46E+00	1 60E+03	1 96E+02
Benzo(a)pyrene	67	63	94 03	6 30E-02	3.74E+01	7.68E+00	7 40E+02	9 54E+01
Benzo(b)fluoranthene	67	63	94.03	1 60E-01	7 11E+01	1 57E+01	1 20E+03	1 57E+02
Benzo(g,h,i)perylene	67	60	89 55	4 70E-02	1 98E+01	5 73E+00	2 70E+02	3 63E+01
Benzo(k)fluoranthene	67	59	88.06	5 20E-02	2 09E+01	4 68E+00	3 20E+02	4 36E+01
Butylbenzylphthalate	68	2	2 94	6 50E-02	5 44E+00	1 29E+00	9 30E-02	9 97E+00
Carbazole	67	39	58 21	6 10E-02	3 33E+01	1 36E+00	1 20E+03	1 71E+02
Chrysene	67	64	95 52	4 60E-02	5.95E+01	1.02E+01	1 60E+03	1 98E+02
Di-n-butylphthalate	68	5	7.35	3 90E-02	5.43E+00	1 24E+00	2 10E-01	9 97E+00
Di-n-octylphthalate	68	1	1 47	4.30E-02	5.44E+00	1.30E+00	4 30E-02	9 97E+00
Dibenz(a,h)anthracene	67	50	74 63	2.90E-01	7.12E+00	2.25E+00	9 50E+01	1 33E+01
Dibenzofuran	67	22	32 84	8 50E-02	2.66E+01	1.27E+00	1 30E+03	1 61E+02
Diethylphthalate	68	1	1 47	6.40E-02	5.44E+00	1 31E+00	6.40E-02	9 97E+00
Fluoranthene	67	65	97 01	6 80E-02	1 77E+02	1 24E+01	8 60E+03	1 05E+03
Fluorene	67	17	25 37	5 40E-02	4.91E+01	1 25E+00	2 50E+03	3 11E+02
Indeno(1,2,3-c,d)pyrene	68	62	91 18	8.40E-02	2.39E+01	6.57E+00	3 40E+02	4 50E+01
Naphthalene	67	26	38 81	5 20E-02	1.00E+01	1.30E+00	2 40E+02	3 46E+01
Pentachlorophenol	67	11	16 42	6 50E-02	1.22E+01	2.58E+00	2 30E+00	2 32E+01
Phenanthrene	67	56	83 58	1 00E-01	1.85E+02	2 66E+00	1 10E+04	1 35E+03
Phenol	57	1	1 49	5 70E+01	5.30E+00	1 27E+00	5.70E+01	1 06E+01
Pyrene	67	64	95 52	6 10E-02	1.35E+02	1 33E+01	5 70E+03	6 95E+02
Volatiles								
1,1,2,2-Tetrachloroethane	47	2	4.26	1.00E-01	1.44E-02	7.02E-03	3 00E-01	4 47E-02
2-Butanone	45	2	4 44	6 00E-03	6.77E-03	6 28E-03	3.80E-02	4 79E-03
Acetone	37	6	16.22	4 00E-03	1.84E-02	7 86E-03	2.30E-01	4 44E-02
Benzene	45	1	2 22	1 10E-02	6.23E-03	6.17E-03	1 10E-02	9.86E-04
Ethylbenzene	45	4	8 89	1.00E-03	1.03E-02	6 26E-03	2.00E-01	2 89E-02
Tetrachloroethene	45	25	55 56	4 00E-03	1.06E-02	8 27E-03	7 40E-02	1 15E-02
Toluene	45	16	35.56	1 00E-03	1.05E-02	6.91E-03	1 50E-01	2 18E-02
Trichloroethene	45	1	2 22	2 00E-03	6.04E-03	5 95E-03	2 00E-03	9 03E-04
Xylenes (total)	45	6	13 33	3 30E-03	2.27E-02	6 83E-03	7 40E-01	1 09E-01

Table 4
Statistical Summary and COPC Selection for Industrial Worker Exposed to Surface Soils and NAPL (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Anthracene	1 37E+02	4 08E+01	Unknown	4.08E+01	6 10E+04	no	
Benzo(a)anthracene	9 39E+01	2 92E+02	Unknown	2.92E+02	7 80E+00	yes	yes
Benzo(a)pyrene	5 69E+01	2 02E+02	Unknown	2.02E+02	7 80E-01	yes	yes
Benzo(b)fluoranthene	1 03E+02	4 29E+02	Unknown	4.29E+02	7 80E+00	yes	yes
Benzo(g,h,i)perylene	2 72E+01	7 85E+01	Unknown	7.85E+01	NA	NA	yes
Benzo(k)fluoranthene	2 97E+01	9 95E+01	Unknown	9.95E+01	7 80E+01	yes	yes
Butylbenzylphthalate	7 46E+00	1 11E+01	Unknown	9.30E-02	4 10E+04	no	
Carbazole	6 81E+01	2 11E+01	Unknown	2.11E+01	2 90E+02	yes	yes
Chrysene	9 98E+01	3 27E+02	Unknown	3.27E+02	7 80E+02	yes	yes
Di-n-butylphthalate	7.45E+00	1 24E+01	Unknown	2.10E-01	2 00E+04	no	
Di-n-octylphthalate	7 46E+00	1 11E+01	Unknown	4.30E-02	4 10E+03	no	
Dibenz(a,h)anthracene	9 84E+00	1 55E+01	Unknown	1.55E+01	7.80E-01	yes	yes
Dibenzofuran	5 94E+01	1 55E+01	Unknown	1.55E+01	8 20E+02	yes	yes
Diethylphthalate	7 46E+00	1 09E+01	Unknown	6.40E-02	1 60E+05	no	
Fluoranthene	3 91E+02	6 59E+02	Unknown	6.59E+02	8 20E+03	yes	yes
Fluorene	1 12E+02	2 15E+01	Unknown	2.15E+01	8 20E+03	no	
Indeno(1,2,3-c,d)pyrene	3 31E+01	1 01E+02	Unknown	1.01E+02	7.80E+00	yes	yes
Naphthalene	1 71E+01	1 54E+01	Unknown	1.54E+01	4 10E+03	no	
Pentachlorophenol	1 70E+01	3 19E+01	Unknown	2.30E+00	4 80E+01	no	
Phenanthrene	4 59E+02	6 75E+01	Unknown	6.75E+01	NA	NA	yes
Phenol	7 47E+00	9 56E+00	Unknown	9.56E+00	1 20E+05	no	
Pyrene	2 76E+02	5 67E+02	Unknown	5.67E+02	6 10E+03	no	
Volatiles							
1,1,2,2-Tetrachloroethane	2.54E-02	1 11E-02	Unknown	1.11E-02	2 90E+01	no	
2-Butanone	7 97E-03	7 07E-03	Unknown	7.07E-03	1.00E+05	no	
Acetone	3 08E-02	1 71E-02	Unknown	1.71E-02	2.00E+04	no	
Benzene	6 48E-03	6 45E-03	Unknown	6.45E-03	2 00E+02	no	
Ethylbenzene	1 75E-02	8 98E-03	Unknown	8.98E-03	2 00E+04	no	
Tetrachloroethene	1 35E-02	1 20E-02	Unknown	1.20E-02	1 10E+02	no	
Toluene	1 59E-02	1 06E-02	Unknown	1.06E-02	4 10E+04	no	
Trichloroethene	6 27E-03	6 38E-03	Unknown	2.00E-03	5 20E+02	no	
Xylenes (total)	5 01E-02	1 15E-02	Unknown	1.15E-02	4 10E+05	no	

This data set includes samples from the Process/Wood Storage and Drip Track areas
NA - Not available
[1] The screening level of 750 mg/kg is based on US EPA's adult blood lead uptake model under default exposure assumptions
[2] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark.
[3] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark.
[4] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endrin so that the Endrin RBC is applicable to its congeners as a provisional benchmark

Table 5
Statistical Summary and COPC Selection of Constituents in Columbia Aquifer Groundwater*
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/L	Mean mg/L	Lognormal Mean mg/L	Maximum Detected mg/L	Standard Deviation mg/L
Inorganics								
Aluminum	2	2	100	2.52E-01	2.73E-01	2.72E-01	2.94E-01	2.97E-02
Antimony	10	2	20	5.70E-03	2.07E-03	1.12E-03	9.00E-03	2.90E-03
Arsenic	11	1	9.09	3.30E-03	1.14E-03	9.81E-04	3.30E-03	7.75E-04
Barium	11	11	100	2.90E-02	6.75E-02	5.32E-02	2.13E-01	5.65E-02
Cadmium	12	1	8.33	2.10E-03	5.70E-04	3.83E-04	2.10E-03	5.95E-04
Cobalt	12	8	66.67	8.70E-04	4.96E-03	1.94E-03	2.82E-02	8.13E-03
Copper	11	1	9.09	1.50E-03	8.20E-04	6.21E-04	1.50E-03	6.09E-04
Iron	9	6	66.67	6.07E-01	1.21E+00	2.83E-01	3.20E+00	1.32E+00
Lead	10	2	20	5.10E-03	1.48E-03	8.45E-04	5.40E-03	1.99E-03
Manganese	16	15	93.75	2.44E-02	5.17E-01	1.39E-01	1.86E+00	6.80E-01
Nickel	11	3	27.27	7.10E-03	3.19E-03	1.26E-03	1.22E-02	4.50E-03
Selenium	11	3	27.27	3.20E-03	2.64E-03	1.60E-03	1.17E-02	3.35E-03
Vanadium	13	2	15.38	2.90E-03	8.67E-04	5.45E-04	3.40E-03	1.05E-03
Zinc	3	2	66.67	8.80E-03	9.22E-03	5.92E-03	1.75E-02	8.08E-03
Pesticides								
4,4' DDD	3	1	33.33	1.40E-04	8.00E-05	7.05E-05	1.40E-04	5.20E-05
4,4-DDE	3	2	66.67	1.00E-05	2.47E-05	1.91E-05	1.40E-05	2.20E-05
4,4' DDT	3	1	33.33	5.00E-05	5.00E-05	5.00E-05	5.00E-05	0.00E+00
alpha-BHC	3	1	33.33	1.50E-06	1.72E-05	9.79E-06	1.50E-06	1.36E-05
Dieldrin	3	1	33.33	3.50E-05	4.50E-05	4.44E-05	3.50E-05	8.66E-06
Endosulfan II	3	1	33.33	2.90E-05	4.30E-05	4.17E-05	2.90E-05	1.21E-05
Endosulfan Sulfate	3	1	33.33	1.40E-05	3.80E-05	3.27E-05	1.40E-05	2.08E-05
Endrin	3	1	33.33	3.80E-05	4.60E-05	4.56E-05	3.80E-05	6.93E-06
gamma-Chlordane	3	1	33.33	1.60E-05	2.20E-05	2.15E-05	1.60E-05	5.20E-06
Heptachlor	3	1	33.33	1.80E-05	2.27E-05	2.24E-05	1.80E-05	4.04E-06
Heptachlor epoxide	3	1	33.33	6.60E-05	3.87E-05	3.46E-05	6.60E-05	2.37E-05
Semivolatiles								
Acenaphthene	17	1	5.88	3.00E-03	3.29E-03	2.15E-03	3.00E-03	2.18E-03
Benzo(a)anthracene	17	1	5.88	2.00E-03	3.47E-03	2.25E-03	2.00E-03	2.17E-03
Benzo(b)fluoranthene	17	1	5.88	1.00E-03	3.44E-03	2.31E-03	1.00E-03	2.18E-03
Benzo(k)fluoranthene	17	1	5.88	1.00E-03	3.59E-03	2.83E-03	1.00E-03	1.97E-03
bis(2-Ethylhexyl)phthalate	16	1	6.25	1.50E-02	4.22E-03	2.61E-03	1.50E-02	3.57E-03
Butylbenzylphthalate	17	1	5.88	1.00E-03	3.44E-03	2.31E-03	1.00E-03	2.18E-03
Chrysene	17	1	5.88	1.00E-03	3.59E-03	2.83E-03	1.00E-03	1.97E-03
Dibenzofuran	17	1	5.88	3.00E-03	3.47E-03	2.75E-03	3.00E-03	1.94E-03
Di-n-butylphthalate	17	1	5.88	1.00E-03	3.18E-03	2.02E-03	1.00E-03	2.25E-03
Fluoranthene	17	1	5.88	4.00E-03	3.53E-03	2.80E-03	4.00E-03	1.94E-03
Fluorene	17	1	5.88	4.00E-03	3.35E-03	2.19E-03	4.00E-03	2.18E-03
Naphthalene	17	1	5.88	2.00E-03	3.41E-03	2.68E-03	2.00E-03	1.97E-03
Phenanthrene	17	2	11.76	2.00E-03	3.85E-03	2.52E-03	1.10E-02	2.78E-03
Pyrene	17	1	5.88	1.00E-03	3.44E-03	2.31E-03	1.00E-03	2.18E-03
Volatiles								
Acetone	17	1	5.88	6.00E-03	4.62E-03	4.56E-03	6.00E-03	7.19E-04

Table 5
Statistical Summary and COPC Selection of Constituents in Columbia Aquifer Groundwater*
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/L	Lognormal 95% UCL mg/L	Distribution 99% Confidence	Exposure Point Concentration mg/L	Tap Water RBC mg/L	Is Maximum Greater than RBC?	Is Detection Frequency >5%?
Inorganics							
Aluminum	4.06E-01	4.21E-01	Unknown	2.94E-01	3.70E+00	no	
Antimony	3.75E-03	5.74E-03	Unknown	5.74E-03	1.50E-03	yes	yes
Arsenic	1.56E-03	1.68E-03	Lognormal	1.68E-03	4.50E-05	yes	yes
Barium	9.84E-02	1.12E-01	Lognormal	1.12E-01	2.60E-01	no	
Cadmium	8.79E-04	1.14E-03	Unknown	1.14E-03	1.80E-03	yes	yes
Cobalt	9.18E-03	2.22E-02	Lognormal	2.22E-02	2.20E-01	no	
Copper	1.15E-03	1.66E-03	Lognormal	1.50E-03	1.50E-01	no	
Iron	*2.03E+00*	*3.42E+03*	*Normal/Lognormal*	*3.20E+00*	*1.10E+00*	yes	yes
Lead†	2.63E-03	3.58E-03	Unknown	3.58E-03	NA	NA	no
Manganese	8.15E-01	4.43E+01	Lognormal	1.86E+00	7.30E-02	yes	yes
Nickel	5.65E-03	1.63E-02	Unknown	1.22E-02	7.30E-02	no	
Selenium	4.47E-03	6.30E-03	Lognormal	6.30E-03	1.80E-02	no	
Vanadium	1.38E-03	1.67E-03	Unknown	1.67E-03	2.60E-02	no	
Zinc	2.28E-02	1.62E+05	Normal/Lognormal	1.75E-02	1.10E+00	no	
Pesticides							
4,4'-DDD	1.68E-04	2.17E-03	Unknown	1.40E-04	2.80E-04	no	
4,4'-DDE	6.18E-05	2.11E-02	Normal/Lognormal	1.40E-05	2.00E-04	no	
4,4'-DDT	5.00E-05	5.00E-05	Unknown	5.00E-05	2.00E-04	no	
alpha-BHC	4.00E-05	1.42E+06	Unknown	1.50E-06	1.10E-05	no	
Dieldrin	5.96E-05	7.37E-05	Unknown	3.50E-05	4.20E-06	yes	yes
Endosulfan II[1]	6.34E-05	1.13E-04	Unknown	2.90E-05	2.20E-02	no	
Endosulfan Sulfate[1]	7.30E-05	6.22E-03	Unknown	1.40E-05	2.20E-02	no	
Endrin	5.77E-05	6.49E-05	Unknown	3.80E-05	1.10E-03	no	
gamma-Chlordane[2]	3.08E-05	4.39E-05	Unknown	1.60E-05	1.90E-04	no	
Heptachlor	2.95E-05	3.52E-05	Unknown	1.80E-05	2.30E-06	yes	yes
Heptachlor epoxide	7.86E-05	7.26E-04	Unknown	6.60E-05	1.20E-06	yes	yes
Semivolatiles							
Acenaphthene	4.22E-03	8.92E-03	Unknown	3.00E-03	2.20E-01	no	
Benzo(a)anthracene	4.39E-03	1.06E-02	Unknown	2.00E-03	9.20E-05	yes	yes
Benzo(b)fluoranthene	4.36E-03	8.97E-03	Unknown	1.00E-03	9.20E-05	yes	yes
Benzo(k)fluoranthene	4.42E-03	6.21E-03	Unknown	1.00E-03	9.20E-04	yes	yes
bis(2-Ethylhexyl)phthalate	5.78E-03	1.31E-02	Unknown	1.31E-02	4.80E-03	yes	yes
Butylbenzylphthalate	4.36E-03	8.97E-03	Unknown	1.00E-03	7.30E-01	no	
Chrysene	4.42E-03	6.21E-03	Unknown	1.00E-03	9.20E-03	no	
Dibenzofuran	4.29E-03	5.90E-03	Unknown	3.00E-03	2.40E-03	yes	yes
Di-n-butylphthalate	4.13E-03	8.58E-03	Unknown	1.00E-03	3.70E-01	no	
Fluoranthene	4.35E-03	6.05E-03	Unknown	4.00E-03	1.50E-01	no	
Fluorene	*4.28E-03*	*9.23E-03*	*Unknown*	*4.00E-03*	*1.50E-01*	no	
Naphthalene	4.25E-03	5.79E-03	Unknown	2.00E-03	7.30E-02	no	
Phenanthrene†	5.03E-03	1.04E-02	Unknown	1.04E-02	NA	NA	no
Pyrene	4.36E-03	8.97E-03	Unknown	1.00E-03	1.10E-01	no	
Volatiles							
Acetone	4.92E-03	4.97E-03	Unknown	4.97E-03	3.70E-01	no	

* Data set includes MW-1, MW-3, MW-9, and MW-15. Metals statistics are based on filtered samples

† Lead and phenanthrene were considered COPCs and not eliminated based on detection frequency because of their presence in other media

[1] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark

[2] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark

Table 6
*Statistical Summary and COPC Selection of Constituents in Columbia Aquifer Groundwater and NAPL**
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/L	Mean mg/L	Lognormal Mean mg/L	Maximum Detected mg/L	Standard Deviation mg/L
Dioxins								
2,3,7,8-TCDD Equiv	5	2	40	6 72E-06	2 37E-04	7 26E-06	1 17E-03	5 24E-04
Inorganics								
Aluminum	9	8	88 89	2 51E-02	6 07E-01	1 67E-01	9 24E-02	1 92E-01
Antimony	21	3	14 29	5 70E-03	1 51E-02	2 98E-03	1 51E-03	3 79E-03
Arsenic	25	7	28	2 20E-03	4 80E-03	1 62E-03	1 28E-03	1 21E-03
Barium	29	29	100	2 27E-02	2 34E-01	7 44E-02	5 86E-02	5 74E-02
Beryllium	17	1	5 88	2 30E-04	2 30E-04	3 55E-04	3 35E-04	1 25E-04
Cadmium	22	1	4 55	2 10E-03	2.10E-03	5 52E-04	3 90E-04	5 06E-04
Cobalt	27	23	85 19	8 70E-04	2 82E-02	9.03E-03	4 78E-03	8 30E-03
Copper	20	1	5	1 50E-03	1 50E-03	8.02E-04	6.01E-04	6 00E-04
Iron	27	24	88 89	6 07E-01	3.83E+01	1 50E+01	4 13E+00	1 41E+01
Lead	19	5	26 32	1 60E-03	5.40E-03	1 47E-03	9.48E-04	1 62E-03
Manganese	34	33	97.06	2.44E-02	9 74E+00	2.02E+00	5 61E-01	2.78E+00
Nickel	*21*	*9*	*42.86*	*1.80E-03*	*1.76E-02*	*5.05E-03*	*2 12E-03*	*6 19E-03*
Selenium	28	10	35 71	3 10E-03	3 30E-02	4.89E-03	2 28E-03	7 08E-03
Thallium	24	7	29 17	7 00E-03	1 94E-02	5 11E-03	3 66E-03	4 90E-03
Vanadium	25	8	32	9 30E-04	3 60E-03	9 98E-04	6 95E-04	9 68E-04
Zinc	7	6	85.71	7 50E-03	1 15E-01	3 05E-02	1 50E-02	3 92E-02
Pesticides								
4,4'-DDD	5	2	40	2 10E-05	6.22E-05	5 16E-05	1 40E-04	4 53E-05
4,4'-DDE	5	2	40	1 00E-05	4 48E-05	3.23E-05	1 40E-05	3 63E-05
4,4'-DDT	4	2	50	5 00E-05	5 75E-05	5.62E-05	8 00E-05	1 50E-05
alpha-BHC	5	1	20	1.50E-06	2.53E-05	1 64E-05	1.50E-06	1.72E-05
alpha-Chlordane[1]	*5*	*1*	*20*	*1 10E-04*	*4 20E-05*	*3 36E-05*	*1 10E-04*	*3.80E-05*
Dieldrin	5	1	20	3 50E-05	5.70E-05	5 35E-05	3 50E-05	2 49E-05
Endosulfan II[2]	5	1	20	2 90E-05	5 58E-05	5 15E-05	2 90E-05	2.63E-05
Endosulfan Sulfate[2]	5	1	20	1.40E-05	5.28E-05	4 45E-05	1.40E-05	3 06E-05
Endrin	5	1	20	3 80E-05	5 76E-05	5.44E-05	3.80E-05	2 43E-05
gamma-Chlordane[1]	5	1	20	1 60E-05	2.82E-05	2 63E-05	1 60E-05	1 28E-05
Heptachlor	5	1	20	1 80E-05	2 86E-05	2 69E-05	1.80E-05	1 23E-05
Heptachlor epoxide	5	1	20	6 60E-05	3 82E-05	3.49E-05	6.60E-05	1 89E-05
Semivolatiles								
2,4-Dimethylphenol	34	7	20.59	1 00E+00	1 30E+00	1 31E-02	1 50E+01	3.54E+00
2-Methylnaphthalene	34	12	35 29	5 60E-01	7 15E-01	2.00E-02	1.30E+01	2.24E+00
2-Methylphenol	34	7	20 59	4 70E-01	1 36E+00	1.19E-02	2 20E+01	4 46E+00
4-Methylphenol	34	9	26 47	1 80E-02	3 60E+00	1.89E-02	5 20E+01	1 14E+01
Acenaphthene	34	13	38 24	3 00E-03	5 12E-01	1 73E-02	1 00E+01	1 71E+00
Acenaphthylene	34	9	26.47	2 50E-02	4.21E-02	7.26E-03	5 80E-01	1 04E-01
Anthracene	34	9	26.47	2 20E-02	9.43E-02	7 83E-03	2 30E+00	3 92E-01
Benzo(a)anthracene	34	7	20.59	2 00E-03	8.00E-02	6 41E-03	2 10E+00	3 58E-01
Benzo(a)pyrene	34	3	8 82	1 30E-02	4 07E-02	6.34E-03	6 50E-01	1 15E-01
Benzo(b)fluoranthene	34	7	20.59	1.00E-03	5 05E-02	6.31E-03	1 00E+00	1 73E-01
Benzo(g,h,i)perylene	34	1	2 94	6 00E-03	3 44E-02	6 27E-03	6 00E-03	7 41E-02
Benzo(k)fluoranthene	34	3	8.82	1 00E-03	4 28E-02	7 87E-03	5 50E-01	1 04E-01
bis(2-Ethylhexyl)phthalate	33	1	3 03	1 50E-02	3.35E-02	6 96E-03	1 50E-02	6 86E-02

Table 6
Statistical Summary and COPC Selection of Constituents in Columbia Aquifer Groundwater and NAPL*
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/L	Lognormal 95% UCL mg/L	Distribution 99% Confidence	Exposure Point Concentration mg/L	Tap Water RBC mg/L	Is Maximum Greater than RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	7 36E-04	4.22E+05	Lognormal	1 17E-03	NA	NA	NA
Inorganics							
Aluminum	2 86E-01	8 66E-01	Normal/Lognormal	9.24E-02	3 70E+00	no	
Antimony	4 40E-03	6 06E-03	Unknown	1 51E-03	1 50E-03	yes	yes
Arsenic	2 03E-03	2 18E-03	Lognormal	1 28E-03	4 50E-05	yes	yes
Barium	9 25E-02	9.63E-02	Lognormal	5 86E-02	2.60E-01	no	
Beryllium	4 08E-04	4.20E-04	Unknown	3 35E-04	1 60E-05	yes	yes
Cadmium	7 38E-04	8 28E-04	Unknown	3 90E-04	1 80E-03	no	
Cobalt	1 18E-02	2 52E-02	Lognormal	4 78E-03	2 20E-01	no	
Copper	1 03E-03	1 25E-03	Unknown	6 01E-04	1 50E-01	no	
Iron	1 96E+01	1 09E+03	Unknown	4 13E+00	1 10E+00	yes	yes
Lead	2 11E-03	2.33E-03	Unknown	9 48E-04	NA	NA	yes
Manganese	2 83E+00	3 07E+01	Unknown	5 61E-01	7 30E-02	yes	yes
Nickel	7 38E-03	1.53E-02	Unknown	2.12E-03	7 30E-02	no	
Selenium	7 16E-03	9 20E-03	Lognormal	2 28E-03	1 80E-02	no	
Thallium	6 82E-03	7 23E-03	Unknown	3 66E-03	2 60E-04	yes	yes
Vanadium	1 33E-03	1 47E-03	Lognormal	6.95E-04	2 60E-02	no	
Zinc	5 93E-02	6 72E-01	Normal/Lognormal	1 50E-02	1 10E+00	no	
Pesticides							
4,4'-DDD	1 05E-04	2 14E-04	Normal/Lognormal	1.40E-04	2 80E-04	no	
4,4'-DDE	7 94E-05	5 12E-04	Normal/Lognormal	1 40E-05	2 00E-04	no	
4,4'-DDT	7 51E-05	8 19E-05	Unknown	8.00E-05	2 00E-04	no	
alpha-BHC	4 17E-05	3 65E-03	Normal/Lognormal	1.50E-06	1 10E-05	no	
alpha-Chlordane[1]	7 82E-05	1.34E-04	Unknown	1 10E-04	1 90E-04	no	yes
Dieldrin	8 07E-05	9 47E-05	Normal/Lognormal	3.50E-05	4 20E-06	yes	yes
Endosulfan II[2]	8 09E-05	1 04E-04	Normal/Lognormal	2 90E-05	2 20E-02	no	
Endosulfan Sulfate[2]	8 20E-05	2 16E-04	Normal/Lognormal	1 40E-05	2 20E-02	no	
Endrin	8 07E-05	9.19E-05	Normal/Lognormal	3 80E-05	1 10E-03	no	
gamma-Chlordane[1]	4 04E-05	4.93E-05	Normal/Lognormal	1 60E-05	1 90E-04	no	
Heptachlor	4 04E-05	4 68E-05	Normal/Lognormal	1 80E-05	2 30E-06	yes	yes
Heptachlor epoxide	5 63E-05	7 54E-05	Normal/Lognormal	6 60E-05	1.20E-06	yes	yes
Semivolatiles							
2,4-Dimethylphenol	2 33E+00	4 88E+01	Unknown	1 50E+01	7 30E-02	yes	yes
2-Methylnaphthalene	1 37E+00	8 72E+01	Unknown	1 30E+01	1 20E-02	yes	yes
2-Methylphenol	2 66E+00	2 39E+01	Unknown	2 20E+01	1 80E-01	yes	yes
4-Methylphenol	6 91E+00	1 13E+02	Unknown	5 20E+01	1 80E-02	yes	yes
Acenaphthene	1 01E+00	3 31E+01	Unknown	1 00E+01	2 20E-01	yes	yes
Acenaphthylene	7 25E-02	1 84E-01	Unknown	1 84E-01	NA	NA	yes
Anthracene	2 08E-01	3 06E-01	Unknown	3 06E-01	1 10E+00	yes	yes
Benzo(a)anthracene	1 84E-01	1 70E-01	Unknown	1 70E-01	9 20E-05	yes	yes
Benzo(a)pyrene	7 43E-02	1 33E-01	Unknown	1 33E-01	9 20E-06	yes	yes
Benzo(b)fluoranthene	1 01E-01	1 30E-01	Unknown	1 30E-01	9 20E-05	yes	yes
Benzo(g,h,i)perylene†	5 59E-02	1 29E-01	Unknown	6 00E-03	NA	NA	no
Benzo(k)fluoranthene	7 29E-02	1 05E-01	Unknown	1 05E-01	9 20E-04	yes	yes
bis(2-Ethylhexyl)phthalate†	5 37E-02	1 30E-01	Unknown	1 50E-02	4 80E-03	yes	no

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ENVIRONMENTAL STANDARDS

Table 6
Statistical Summary and COPC Selection of Constituents in Columbia Aquifer Groundwater and NAPL*
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/L	Mean mg/L	Lognormal Mean mg/L	Maximum Detected mg/L	Standard Deviation mg/L
Butylbenzylphthalate	34	1	2.94	1.00E-03	3.21E-02	6.36E-03	1.00E-03	6.72E-02
Carbazole	34	12	35.29	9.00E-02	1.56E-01	1.22E-02	1.80E+00	3.43E-01
Chrysene	34	7	20.59	1.00E-03	7.33E-02	8.00E-03	1.60E+00	2.75E-01
Di-n-butylphthalate	34	1	2.94	1.00E-03	3.10E-02	5.91E-03	1.00E-03	6.45E-02
Di-n-octylphthalate	34	1	2.94	1.00E-03	2.89E-02	6.21E-03	1.00E-03	5.83E-02
Dibenzofuran	34	13	38.24	3.00E-03	3.50E-01	1.74E-02	7.20E+00	1.23E+00
Fluoranthene	34	10	29.41	4.00E-03	3.46E-01	1.19E-02	9.90E+00	1.69E+00
Fluorene	34	13	38.24	4.00E-03	3.70E-01	1.42E-02	8.60E+00	1.46E+00
Indeno(1,2,3-c,d)pyrene	34	1	2.94	5.00E-03	2.80E-02	5.89E-03	5.00E-03	5.64E-02
Naphthalene	34	16	47.06	2.00E-03	4.91E+00	4.41E-02	6.00E+01	1.14E+01
Pentachlorophenol	34	11	32.35	1.40E-03	1.41E-02	1.02E-03	6.00E-02	4.34E-02
Phenanthrene	34	14	41.18	2.00E-03	7.92E-01	1.72E-02	2.10E+01	3.58E+00
Phenol	34	11	32.35	9.00E-03	4.85E+00	2.12E-02	5.80E+01	1.34E+01
Pyrene	34	10	29.41	1.00E-03	2.29E-01	9.04E-03	6.50E+00	1.11E+00
Volatiles								
1,1,2-Trichloroethane	40	1	2.5	5.30E-02	2.80E-03	5.76E-03	5.30E-02	1.08E-02
2-Hexanone	40	1	2.5	1.00E-02	3.90E-03	5.49E-03	1.00E-02	7.79E-03
4-Methyl-2-Pentanone	40	1	2.5	3.00E-03	3.99E-03	5.64E-03	3.00E-03	8.16E-03
Acetone	33	6	18.18	6.00E-03	8.35E-03	6.08E-03	2.00E-02	9.78E-03
Benzene	31	7	22.58	1.50E-02	8.63E-02	6.64E-03	9.20E-01	2.30E-01
Chlorobenzene	35	1	2.86	3.00E-03	4.69E-03	2.39E-03	3.00E-03	8.17E-03
Ethylbenzene	35	13	37.14	4.00E-03	4.90E-02	8.38E-03	4.10E-01	9.32E-02
Methylene Chloride	31	1	3.23	2.00E-03	4.68E-03	2.40E-03	2.00E-03	8.66E-03
Styrene	35	10	28.57	2.00E-03	3.29E-02	4.63E-03	5.20E-01	9.83E-02
Toluene	35	13	37.14	2.00E-03	1.17E-01	7.25E-03	1.50E+00	3.32E-01
Xylenes (total)	34	13	38.24	1.20E-02	1.77E-01	1.34E-02	1.90E+00	3.87E-01

Table 6

Statistical Summary and COPC Selection of Constituents in Columbia Aquifer Groundwater and NAPL*

Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/L	Lognormal 95% UCL mg/L	Distribution 99% Confidence	Exposure Point Concentration mg/L	Tap Water RBC mg/L	Is Maximum Greater than RBC?	Is Detection Frequency >5%?
Butylbenzylphthalate	5 16E-02	1.14E-01	Unknown	1 00E-03	7 30E-01	no	
Carbazole	2 56E-01	2 96E+00	Unknown	1 80E+00	3.30E-03	yes	yes
Chrysene	1 53E-01	1 32E-01	Unknown	1 32E-01	9 20E-03	yes	yes
Di-n-butylphthalate	4 98E-02	1 20E-01	Unknown	1 00E-03	3 70E-01	no	
Di-n-octylphthalate	4 59E-02	1 01E-01	Unknown	1 00E-03	7 30E-02	no	
Dibenzofuran	7 08E-01	5.69E+00	Unknown	5 69E+00	2 40E-03	yes	yes
Fluoranthene	8 39E-01	8.18E-01	Unknown	8 18E-01	1 50E-01	yes	yes
Fluorene	7 96E-01	8.19E+00	Unknown	8 19E+00	1 50E-01	yes	yes
Indeno(1,2,3-c,d)pyrene†	4 44E-02	1.01E-01	Unknown	5 00E-03	9 20E-05	yes	no
Naphthalene	8 23E+00	2 33E+04	Unknown	6 00E+01	7 30E-02	yes	yes
Pentachlorophenol	2 67E-02	1.88E-01	Unknown	6 00E-02	5 60E-04	yes	yes
Phenanthrene	1 83E+00	1.85E+01	Unknown	1 85E+01	NA	NA	yes
Phenol	8 76E+00	4.65E+02	Unknown	5 80E+01	2.20E+00	yes	yes
Pyrene	5 52E-01	6.37E-01	Unknown	6 37E-01	1 10E-01	yes	yes
Volatiles							
1,1,2-Trichloroethane	8 67E-03	8.60E-03	Unknown	8 60E-03	1 90E-04	yes	no
2-Hexanone	7 58E-03	6 43E-03	Unknown	6.43E-03	NA	NA	no
4-Methyl-2-Pentanone	7 83E-03	6.45E-03	Unknown	3 00E-03	2 90E-01	no	
Acetone	1 12E-02	9 78E-03	Unknown	9 78E-03	3 70E-01	no	
Benzene	1 56E-01	2.64E-01	Unknown	2 64E-01	3 60E-04	yes	yes
Chlorobenzene	7 03E-03	8.66E-03	Unknown	3 00E-03	3 50E-03	no	
Ethylbenzene	7 58E-02	1 79E-01	Unknown	1.79E-01	1 30E-01	yes	yes
Methylene Chloride	7 32E-03	8.02E-03	Unknown	2 00E-03	4 10E-03	no	
Styrene	6.11E-02	6.49E-02	Unknown	6.49E-02	1 60E-01	yes	yes
Toluene	2.12E-01	5.48E-01	Unknown	5 48E-01	7 50E-02	yes	yes
Xylenes (total)	2 90E-01	2.39E+00	Unknown	1.90E+00	1 20E+00	yes	yes

* Data set includes MW-1, MW-2, MW-3, MW-8, MW-9, and MW-15 Metals statistics are based on filtered samples

NA - Not available

† Benzo(ghi)perylene, bis(2-ethylhexyl)phthalate, and indeno(1,2,3-cd)pyrene were considered COPCs and not eliminated based on detection frequency because of their presence in other media.

[1] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark.

[2] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark.

Table 7

Statistical Summary and COPC Selection of Constituents in Potomac Aquifer Groundwater*

Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/L	Mean mg/L	Lognormal Mean mg/L	Maximum Detected mg/L	Standard Deviation mg/L	95% UCL mg/L	Lognormal 95% UCL mg/L	Distribution 99% Confidence	Exposure Point Concentration mg/L	Tap Water RBC mg/L	Is Maximum Greater than RBC?	Is Detection Frequency >5%?
Inorganics															
Antimony	3	2	66 67	2.10E-03	1.80E-03	1 69E-03	2 30E-03	7 00E-04	2 98E-03	1 28E-02	Normal/Lognormal	2 30E-03	1 50E-03	yes	yes
Barium	2	2	100	9.40E-03	9.80E-03	9 79E-03	1.02E-02	5 66E-04	1 23E-02	1 20E-02	Unknown	1 02E-02	2 60E-01	no	
Cobalt	3	1	33 33	1 20E-03	6.90E-04	6 10E-04	1 20E-03	4 42E-04	1 43E-03	1 70E-02	Unknown	1 20E-03	2 20E-01	no	
Iron	2	2	100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Unknown	[illegible]	[illegible]	no	
Lead	3	1	33 33	3.50E-03	1.50E-03	9 56E-04	3 50E-03	1 73E-03	4.42E-03	2 07E+02	Unknown	3 50E-03	NA	NA	yes
Manganese	3	3	100	2.90E-02	3 77E-02	3 65E-02	5 15E-02	1 21E-02	5 81E-02	9.30E-02	Normal/Lognormal	5 15E-02	7.30E-02	no	
Selenium	3	1	33.33	3 60E-03	1.70E-03	1 22E-03	3 60E-03	1.66E-03	4 51E-03	2 10E+01	Normal/Lognormal	3.60E-03	1.80E-02	no	
Pesticides															
4,4-DDD	2	1	50	2 90E 06	2 65E-05	[illegible]	[illegible]	[illegible]	[illegible]	1 06E+45	Unknown	2 90E 06	2 80E 04	no	
4,4'-DDT	2	1	50	1 70E-05	3.35E-05	2 92E-05	1 70E-05	2.33E-05	1 38E-04	3 40E+02	Unknown	1 70E-05	2 00E-04	no	
Endosulfan I[1]	2	1	50	3 10E-06	1 41E-05	8 80E-06	3.10E-06	1 55E-05	8 32E-05	5.70E+21	Unknown	3 10E-06	2 20E-02	no	
Endosulfan II[1]	2	1	50	5 70E-06	2.79E-05	1.69E-05	5.70E-06	3.13E-05	1.68E-04	1.77E+24	Unknown	5.70E-06	2.20E-02	no	
Heptachlor epoxide	2	2	100	5 90E-06	6.00E-06	6 00E-06	6 10E-06	1 41E-07	6 63E-06	6 50E-06	Unknown	6 10E-06	1 20E-06	yes	yes

* Data set includes MW-15 Metals statistics are based on filtered samples.

[1] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark.

AR000356

AR316020

ENVIRONMENTAL STANDARDS

Table 8
Statistical Summary and COPC Selection for Trespasser Exposed to Surface Soils (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dioxins								
2,3,7,8-TCDD Equiv	18	18	100	9 31E-05	1 75E-03	7 21E-04	7 34E-03	2 35E-03
Inorganics								
Aluminum	72	72	100	2 07E+03	1 48E+04	1.27E+04	3 65E+04	8 29E+03
Antimony	43	19	44.19	6 50E-01	9 35E+00	2 10E+00	1 21E+01	1 32E+01
Arsenic	66	64	96 97	1 20E+00	6 99E+00	5 54E+00	3 19E+01	5 39E+00
Barium	72	72	100	2 11E+01	3 85E+02	2 52E+02	1.65E+03	3 71E+02
Beryllium	68	68	100	2 60E-01	1 36E+00	1 11E+00	3 90E+00	9 07E-01
Cadmium	71	41	57 75	8 00E-02	1 40E+00	8 87E-01	3 40E+00	1 05E+00
Chromium	72	72	100	3 70E+00	2.33E+01	2 03E+01	1 19E+02	1 53E+01
Cobalt	69	61	88 41	6 10E-01	7.12E+00	4 50E+00	4 64E+01	7 11E+00
Copper	70	70	100	5 30E+00	3 93E+01	2.34E+01	5 28E+02	7 11E+01
Iron	72	72	100	4 43E+03	1 75E+04	1 65E+04	3 12E+04	5 40E+03
Lead[1]	72	72	100	3 80E+00	5 81E+01	3 86E+01	4 77E+02	7 45E+01
Manganese	72	72	100	4 06E+01	1 70E+03	6 78E+02	9 81E+03	2 45E+03
Mercury	59	31	52 54	5 00E-02	1 17E+00	2 10E-01	1 96E+01	3.09E+00
Nickel	67	67	100	4 00E+00	1.22E+01	1 08E+01	5.18E+01	7 96E+00
Selenium	65	14	21.54	8 60E-01	1.69E+00	1.23E+00	3 30E+00	9 92E-01
Silver[5]	72	2	2 78	1 10E+00	3 47E+00	1 50E+00	1 50E+00	2 26E+00
Thallium	68	22	32 35	1 60E+00	5 18E+00	3 30E+00	4 44E+01	6 19E+00
Vanadium	72	71	98 61	7 60E+00	7 05E+01	4.93E+01	3.06E+02	7 38E+01
Zinc	72	72	100	6 40E+00	9.35E+01	6 77E+01	8 74E+02	1 11E+02
PCBs/Pesticides								
4,4'-DDD	16	4	25	3 80E-03	7 88E-02	1 76E-02	1 00E-01	9 23E-02
4,4'-DDE	17	8	47 06	2 20E-04	2.55E-02	7 47E-03	2 40E-01	5 71E-02
4,4'-DDT	15	7	46.67	6 90E-03	2 79E-02	1.17E-02	1 20E-01	4 04E-02
alpha-Chlordane[2]	17	3	17 65	1 80E-04	3 45E-02	6 57E-03	2 80E-02	4 75E-02
Dieldrin	15	5	33.33	3 10E-04	6 10E-02	1 18E-02	2 70E-02	9 05E-02
Endosulfan II[3]	17	2	11 76	4 50E-04	6 45E-02	1.24E-02	4 70E-03	9 26E-02
Endrin	17	1	5 88	1 10E-01	5 99E-02	1 38E-02	1 10E-01	8 70E-02
Endrin ketone[4]	17	2	11 76	2 90E-02	5 73E-02	1 34E-02	4 70E-02	8 68E-02
gamma-Chlordane[2]	17	1	5 88	1 10E-04	3 35E-02	6 31E-03	1 10E-04	4 79E-02
Heptachlor	17	1	5 88	5 30E-03	2 80E-02	6 16E-03	5 30E-03	4 50E-02
Heptachlor epoxide	17	2	11 76	1 00E-02	2 27E-02	5 77E-03	2 00E-02	3 89E-02
Methoxychlor	16	5	31.25	4 20E-02	2 11E-01	6 59E-02	9 20E-01	3 35E-01
PCB-1254	17	1	5 88	4 02E-02	6 50E-01	1 47E-01	4 02E-02	9 23E-01
PCB-1260	18	4	22.22	8 30E-03	6 36E-01	1 50E-01	3 40E-01	8 96E-01
Semivolatiles								
2,4-Dimethylphenol	72	1	1.39	3 60E-02	1 75E+01	2 08E+00	3 60E-02	5 80E+01
2-Methylnaphthalene	72	16	22 22	9 80E-02	8 71E+01	2 39E+00	2 90E+03	3 90E+02
4-Methylphenol	72	2	2.78	7 20E-02	1 41E+01	2 06E+00	1 10E+02	4 33E+01
Acenaphthene	72	19	26.39	4.30E-02	1 14E+02	2.23E+00	3 10E+03	4 85E+02
Acenaphthylene	72	22	30 56	1 50E-01	1 37E+01	2 32E+00	8 20E+01	4 21E+01
Anthracene	72	47	65 28	5 30E-02	5 50E+02	4 12E+00	1 50E+04	2 24E+03
Benzo(a)anthracene	72	65	90 28	9 30E-02	8 87E+01	1 25E+01	1 20E+03	2 10E+02
Benzo(a)pyrene	72	64	88 89	8 10E-02	5 64E+01	9 87E+00	5 50E+02	1 10E+02
Benzo(b)fluoranthene	72	66	91 67	1 60E-01	9 74E+01	1 89E+01	7 50E+02	1 62E+02
Benzo(g,h,i)perylene	72	62	86 11	1 20E-01	2 87E+01	6 95E+00	2 40E+02	4 82E+01
Benzo(k)fluoranthene	72	62	86 11	4 60E-02	3 82E+01	6 64E+00	4 70E+02	7 66E+01
bis(2-Ethylhexyl)phthalate	70	4	5.71	6 70E-02	1 80E+01	2 17E+00	5 30E-01	5 88E+01

Table 8
Statistical Summary and COPC Selection for Trespasser Exposed to Surface Soils (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	2.72E-03	6.56E-03	Lognormal	6.56E-03	3.80E-05	yes	yes
Inorganics							
Aluminum	1.64E+04	1.70E+04	Unknown	1.70E+04	2.00E+05	no	
Antimony	1.27E+01	3.07E+01	Unknown	1.21E+01	8.20E+01	no	
Arsenic	8.10E+00	8.40E+00	Unknown	8.40E+00	3.80E+00	yes	yes
Barium	4.59E+02	5.08E+02	Unknown	5.08E+02	1.40E+04	no	
Beryllium	1.55E+00	1.59E+00	Unknown	1.59E+00	4.10E+02	no	
Cadmium	1.61E+00	2.20E+00	Unknown	2.20E+00	2.00E+02	no	
Chromium	2.63E+01	2.61E+01	Unknown	2.61E+01	3.10E+05	no	
Cobalt	8.55E+00	1.42E+01	Unknown	1.42E+01	1.20E+04	no	
Copper	5.35E+01	4.21E+01	Unknown	4.21E+01	8.20E+03	no	
Iron	1.85E+04	1.90E+04	Unknown	1.90E+04	6.10E+04	no	
Lead[1]	7.28E+01	6.91E+01	Unknown	6.91E+01	7.50E+02	no	
Manganese	2.18E+03	2.61E+03	Unknown	2.61E+03	2.90E+04	no	
Mercury	1.85E+00	1.37E+00	Unknown	1.37E+00	6.10E+01	no	
Nickel	1.38E+01	1.34E+01	Unknown	1.34E+01	4.10E+03	no	
Selenium	1.90E+00	2.50E+00	Unknown	2.50E+00	1.00E+03	no	
Silver	3.91E+00	1.59E+01	Unknown	1.50E+00	1.00E+03	no	
Thallium	6.43E+00	7.12E+00	Unknown	7.12E+00	1.40E+01	yes	yes
Vanadium	8.51E+01	8.23E+01	Unknown	8.23E+01	1.40E+03	no	
Zinc	1.15E+02	1.08E+02	Unknown	1.08E+02	6.10E+04	no	
PCBs/Pesticides							
4,4'-DDD	1.19E-01	2.43E+00	Unknown	1.00E-01	2.40E+01	no	
4,4'-DDE	4.97E-02	1.24E-01	Lognormal	1.24E-01	1.70E+01	no	
4,4'-DDT	4.62E-02	1.04E-01	Lognormal	1.04E-01	1.70E+01	no	
alpha-Chlordane[2]	5.46E-02	9.82E-01	Lognormal	2.80E-02	1.60E+01	no	
Dieldrin	1.02E-01	1.75E+00	Lognormal	2.70E-02	3.60E-01	no	
Endosulfan II[3]	1.04E-01	1.16E+00	Lognormal	4.70E-03	1.20E+03	no	
Endrin	9.67E-02	6.18E-01	Unknown	1.10E-01	6.10E+01	no	
Endrin ketone[4]	9.41E-02	5.26E-01	Unknown	4.70E-02	6.10E+01	no	
gamma-Chlordane[2]	5.37E-02	8.44E-01	Lognormal	1.10E-04	4.40E+00	no	
Heptachlor	4.70E-02	2.11E-01	Unknown	5.30E-03	1.30E+00	no	
Heptachlor epoxide	3.91E-02	1.27E-01	Lognormal	2.00E-02	6.30E-01	no	
Methoxychlor	3.58E-01	1.14E+00	Lognormal	9.20E-01	1.00E+03	no	
PCB-1254	1.04E+00	6.99E+00	Unknown	4.02E-02	2.90E+00	no	
PCB-1260	1.00E+00	7.51E+00	Lognormal	3.40E-01	2.90E+00	no	
Semivolatiles							
2,4-Dimethylphenol	2.90E+01	3.10E+01	Unknown	3.60E-02	4.10E+03	no	
2-Methylnaphthalene	1.64E+02	8.69E+01	Unknown	8.69E+01	4.10E+03	no	
4-Methylphenol	2.27E+01	2.65E+01	Unknown	2.65E+01	1.00E+03	no	
Acenaphthene	2.10E+02	1.20E+02	Unknown	1.20E+02	1.20E+04	no	
Acenaphthylene	2.20E+01	2.52E+01	Unknown	2.52E+01	NA	NA	yes
Anthracene	3.91E+02	8.14E+02	Unknown	8.14E+02	6.10E+04	no	
Benzo(a)anthracene	3.30E+02	5.64E+02	Unknown	5.64E+02	7.80E+00	yes	yes
Benzo(a)pyrene	7.81E+01	3.59E+02	Unknown	3.59E+02	7.80E-01	yes	yes
Benzo(b)fluoranthene	1.29E+02	8.56E+02	Unknown	7.50E+02	7.80E+00	yes	yes
Benzo(g,h,i)perylene	5.82E+01	1.32E+02	Unknown	1.32E+02	NA	NA	yes
Benzo(k)fluoranthene	5.33E+01	2.36E+02	Unknown	2.36E+02	7.80E+01	yes	yes
bis(2-Ethylhexyl)phthalate	2.98E+01	3.21E+01	Unknown	5.30E-01	4.10E+02	no	

Table 8
Statistical Summary and COPC Selection for Trespasser Exposed to Surface Soils (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Butylbenzylphthalate	73	4	5 48	4 70E-02	1 78E+01	2 13E+00	1 70E-01	5 77E+01
Carbazole	72	38	52 78	4 00E-02	2 65E+02	2 68E+00	8 70E+03	1 19E+03
Chrysene	72	65	90 28	1 60E-01	8 70E+01	1.32E+01	1 10E+03	1 92E+02
Dibenz(a,h)anthracene	72	49	68 06	6 30E-02	1 87E+01	3 03E+00	8 10E+01	5 76E+01
Dibenzofuran	72	22	30 56	5 40E-02	1 11E+02	2 35E+00	3.20E+03	4 71E+02
Di-n-butylphthalate	72	6	8 33	1 20E-01	1 81E+01	2 29E+00	5 80E-01	5 80E+01
Fluoranthene	72	68	94 44	9 40E-02	2 26E+02	1 75E+01	4 70E+03	7 30E+02
Fluorene	72	21	29 17	4.70E-02	1 95E+02	2 40E+00	5 60E+03	8 35E+02
Indeno(1,2,3-c,d)pyrene	73	65	89 04	5 80E-02	3 33E+01	7 86E+00	2.70E+02	5 42E+01
Naphthalene	72	25	34 72	6.20E-02	1 04E+02	2 41E+00	3 50E+03	4 74E+02
Pentachlorophenol	72	12	16 67	2 10E-01	4.04E+01	4 83E+00	1 20E+02	1 42E+02
Phenanthrene	69	56	81 16	1 30E-01	3 68E+02	4 74E+00	8 80E+03	1 52E+03
Phenol	72	1	1 39	7.70E+01	1 37E+01	2.08E+00	7 70E+01	4 24E+01
Pyrene	72	67	93 06	2.10E-01	2 12E+02	1 89E+01	3 60E+03	6 29E+02
Volatiles								
1,1,2,2-Tetrachloroethane	43	2	4 65	1 00E-01	1 52E-02	7 14E-03	3 00E-01	4 67E-02
2-Butanone	41	2	4 88	6 00E-03	6 85E-03	6.33E-03	3 80E-02	5 02E-03
Acetone	40	9	22 5	3.00E-03	1 28E-02	7 20E-03	1 50E-01	2.60E-02
Benzene	41	1	2 44	1.10E-02	6 27E-03	6 20E-03	1 10E-02	1 02E-03
Ethylbenzene	41	4	9 76	1.00E-03	1 07E-02	6 30E-03	2.00E-01	3 03E-02
Tetrachloroethene	41	28	68 29	4.00E-03	1 17E-02	8 73E-03	7 40E-02	1.27E-02
Toluene	41	17	41 46	1.00E-03	1.10E-02	7 08E-03	1 50E-01	2 28E-02
Xylenes (total)	41	7	17 07	3.30E-03	2 43E-02	6.90E-03	7 40E-01	1 15E-01

Table 8
Statistical Summary and COPC Selection for Trespasser Exposed to Surface Soils (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Butylbenzylphthalate	2 91E+01	3 44E+01	Unknown	1 70E-01	4 10E+04	no	
Carbazole	4 99E+02	2 99E+02	Unknown	2 99E+02	2 90E+02	yes	yes
Chrysene	1 25E+02	5 85E+02	Unknown	5 85E+02	7 80E+02	yes	yes
Dibenz(a,h)anthracene	3 00E+01	3.95E+01	Unknown	3 95E+01	7 80E-01	yes	yes
Dibenzofuran	2 04E+02	1 24E+02	Unknown	1 24E+02	8 20E+02	yes	yes
Di-n-butylphthalate	2 95E+01	3 15E+01	Unknown	5 80E-01	2 00E+04	no	
Fluoranthene	3.70E+02	1 52E+03	Unknown	1 52E+03	8 20E+03	no	
Fluorene	3.60E+02	2 29E+02	Unknown	2 29E+02	8 20E+03	no	
Indeno(1,2,3-c,d)pyrene	4 39E+01	1 90E+02	Unknown	1 90E+02	7.80E+00	yes	yes
Naphthalene	1.97E+02	1 22E+02	Unknown	1 22E+02	4.10E+03	no	
Pentachlorophenol	6 83E+01	6 62E+01	Unknown	6.62E+01	4.80E+01	yes	yes
Phenanthrene	6 74E+02	4 93E+02	Unknown	4 93E+02	NA	NA	yes
Phenol	2.20E+01	2 47E+01	Unknown	2 47E+01	1 20E+05	no	
Pyrene	3 36E+02	1 44E+03	Unknown	1 44E+03	6.10E+03	no	
Volatiles							
1,1,2,2-Tetrachloroethane	2.72E-02	1 18E-02	Unknown	1 18E-02	2 90E+01	no	
2-Butanone	8 17E-03	7 20E-03	Unknown	7 20E-03	1 00E+05	no	
Acetone	1 98E-02	1 28E-02	Unknown	1.28E-02	2.00E+04	no	
Benzene	6 54E-03	6 50E-03	Unknown	6 50E-03	2.00E+02	no	
Ethylbenzene	1.87E-02	9 40E-03	Unknown	9 40E-03	2 00E+04	no	
Tetrachloroethene	1 50E-02	1 38E-02	Unknown	1 38E-02	1 10E+02	no	
Toluene	1 70E-02	1 13E-02	Unknown	1 13E-02	4.10E+04	no	
Xylenes (total)	5 44E-02	1 23E-02	Unknown	1 23E-02	4 10E+05	no	

This data set includes samples from all on-site areas and Hershey Run sediment.
NA Not available
[1] The screening level of 750 mg/kg is based on US EPA's adult blood lead uptake model under default exposure assumptions
[2] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark.
[3] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark
[4] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Endrin so that the Endrin RBC is applicable to its congeners as a provisional benchmark.

Table 9
Statistical Summary and COPC Selection for Trespasser Exposed to Surface Soils and NAPL (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dioxins								
2,3,7,8-TCDD Equiv	18	18	100	9 31E-05	1 75E-03	7 21E-04	7 34E-03	2 35E-03
Inorganics								
Aluminum	114	114	100	2 07E+03	1 39E+04	1 22E+04	3 65E+04	7 35E+03
Antimony	82	25	30 49	6.50E-01	5 59E+00	1 37E+00	1 21E+01	1 04E+01
Arsenic	108	106	98 15	1.20E+00	6 63E+00	5 27E+00	3 19E+01	5 30E+00
Barium	114	114	100	2 04E+01	3 42E+02	2 25E+02	1 65E+03	3 29E+02
Beryllium	100	98	98	2 00E-01	1 23E+00	9 53E-01	3 90E+00	8 81E-01
Cadmium	110	50	45 45	8 00E-02	1 06E+00	5 35E-01	3 40E+00	1 00E+00
Chromium	114	114	100	3 70E+00	2 60E+01	2 13E+01	2 44E+02	2.67E+01
Cobalt	111	102	91 89	6 10E-01	6 84E+00	4.89E+00	4 64E+01	6 05E+00
Copper	112	112	100	9.10E-01	3 57E+01	2.10E+01	5 28E+02	6 16E+01
Iron	114	114	100	4 43E+03	1.83E+04	1.69E+04	7 73E+04	8 25E+03
Lead[1]	114	114	100	2 30E+00	6 23E+01	3 51E+01	8 92E+02	1 06E+02
Manganese	114	114	100	4 06E+01	1 40E+03	6 21E+02	9 81E+03	2 10E+03
Mercury	82	53	64 63	1 50E-02	8 88E-01	1 68E-01	1 96E+01	2 66E+00
Nickel	103	103	100	4.00E+00	1 24E+01	1 11E+01	5.18E+01	6 96E+00
Selenium	107	26	24 3	8.50E-01	1 25E+00	8 65E-01	3 30E+00	9 70E-01
Silver	112	3	2 68	2 10E-01	2 28E+00	5 98E-01	1 50E+00	2 41E+00
Thallium	110	32	29.09	8.40E-01	3 49E+00	1 75E+00	4 44E+01	5 33E+00
Vanadium	114	113	99 12	7 60E+00	6 00E+01	4 45E+01	3 06E+02	6 19E+01
Zinc	111	111	100	6 40E+00	9 38E+01	6 83E+01	8 74E+02	1 05E+02
PCBs/Pesticides								
4,4'-DDD	16	4	25	3 80E-03	7 88E-02	1 76E-02	1 00E-01	9.23E-02
4,4'-DDE	17	8	47 06	2.20E-04	2 55E-02	7 47E-03	2 40E-01	5 71E-02
4,4'-DDT	15	7	46.67	6.90E-03	2 79E-02	1 17E-02	1 20E-01	4.04E-02
alpha-Chlordane[2]	17	3	17 65	1 80E-04	3 45E-02	6 57E-03	2 80E-02	4.75E-02
Dieldrin	15	5	33 33	3 10E-04	6 10E-02	1 18E-02	2 70E-02	9 05E-02
Endosulfan II[3]	17	2	11 76	4 50E-04	6 45E-02	1 24E-02	4 70E-03	9.26E-02
Endrin	17	1	5 88	1 10E-01	5 99E-02	1 38E-02	1 10E-01	8.70E-02
Endrin ketone[4]	17	2	11 76	2 90E-02	5 73E-02	1 34E-02	4 70E-02	8 68E-02
gamma-Chlordane[2]	17	1	5.88	1 10E-04	3 35E-02	6 31E-03	1 10E-04	4 79E-02
Heptachlor	17	1	5 88	5.30E-03	2.80E-02	6 16E-03	5 30E-03	4.50E-02
Heptachlor epoxide	17	2	11 76	1.00E-02	2 27E-02	5 77E-03	2 00E-02	3 89E-02
Methoxychlor	16	5	31 25	4 20E-02	2 11E-01	6 59E-02	9 20E-01	3 35E-01
PCB-1254	17	1	5 88	4 02E-02	6.50E-01	1 47E-01	4 02E-02	9 23E-01
PCB-1260	18	4	22 22	8 30E-03	6 36E-01	1 50E-01	3 40E-01	8 96E-01
Semivolatiles								
2,4-Dimethylphenol	114	4	3.51	3 60E-02	1 18E+01	1 10E+00	1 20E+01	4 68E+01
2-Methylnaphthalene	114	33	28 95	4.10E-02	7 03E+01	1 29E+00	2 90E+03	3 40E+02
4-Methylphenol	114	6	5.26	4 20E-02	9 81E+00	1 09E+00	1 10E+02	3 52E+01
Acenaphthene	114	41	35 96	4 30E-02	1 09E+02	1 18E+00	3 10E+03	4 80E+02
Acenaphthylene	114	53	46 49	5 50E-02	1 11E+01	1 44E+00	1 30E+02	3 67E+01
Anthracene	114	80	70.18	4 60E-02	4 37E+02	2 28E+00	1 50E+04	1 97E+03
Benzo(a)anthracene	114	105	92 11	3 50E-02	8 82E+01	7 05E+00	1 60E+03	2 65E+02
Benzo(a)pyrene	114	103	90 35	4.00E-02	5.25E+01	6.19E+00	7 40E+02	1 28E+02
Benzo(b)fluoranthene	114	106	92 98	1.00E-01	9.14E+01	1 22E+01	1 20E+03	2 01E+02
Benzo(g,h,i)perylene	114	100	87 72	4 70E-02	2 54E+01	4 41E+00	2 70E+02	5 18E+01
Benzo(k)fluoranthene	114	95	83 33	4 60E-02	3 24E+01	3 70E+00	4 70E+02	8.02E+01
bis(2-Ethylhexyl)phthalate	78	4	5 13	6 70E-02	1 63E+01	1.93E+00	5 30E-01	5 59E+01
Butylbenzylphthalate	115	10	8 7	4 70E-02	1 22E+01	1 10E+00	1 70E-01	4 67E+01

Table 9
Statistical Summary and COPC Selection for Trespasser Exposed to Surface Soils and NAPL (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	2 72E-03	6 56E-03	Lognormal	6 56E-03	3 80E-05	yes	yes
Inorganics							
Aluminum	1 50E+04	1 52E+04	Unknown	1 52E+04	2 00E+05	no	
Antimony	7 50E+00	7.65E+00	Unknown	7 65E+00	8 20E+01	no	
Arsenic	7 48E+00	7.48E+00	Unknown	7 48E+00	3 80E+00	yes	yes
Barium	3 93E+02	4 24E+02	Unknown	4 24E+02	1 40E+04	no	
Beryllium	1 38E+00	1 47E+00	Unknown	1 47E+00	4 10E+02	no	
Cadmium	1 22E+00	1 96E+00	Unknown	1 96E+00	2 00E+02	no	
Chromium	3 02E+01	2 75E+01	Unknown	2 75E+01	3 10E+05	no	
Cobalt	7 80E+00	1 04E+01	Unknown	1 04E+01	1 20E+04	no	
Copper	4 55E+01	3.83E+01	Unknown	3 83E+01	8 20E+03	no	
Iron	1.95E+04	1 94E+04	Unknown	1 94E+04	6.10E+04	yes	yes
Lead[1]	7 89E+01	7 05E+01	Unknown	7 05E+01	7 50E+02	yes	yes
Manganese	1 73E+03	1 75E+03	Unknown	1 75E+03	2 90E+04	no	
Mercury	1 38E+00	8 50E-01	Unknown	8 50E-01	6 10E+01	no	
Nickel	1 35E+01	1.32E+01	Unknown	1 32E+01	4 10E+03	no	
Selenium	1 41E+00	1 58E+00	Unknown	1 58E+00	1 00E+03	no	
Silver[4]	2 66E+00	7 54E+00	Unknown	1 50E+00	1 00E+03	no	
Thallium	4 34E+00	4 50E+00	Unknown	4 50E+00	1 40E+01	yes	yes
Vanadium	6 97E+01	6 48E+01	Unknown	6 48E+01	1 40E+03	no	
Zinc[3]	1 10E+02	1.04E+02	Unknown	1 04E+02	6 10E+04	no	
PCBs/Pesticides							
4,4'-DDD	1 19E-01	2 43E+00	Unknown	1.00E-01	2.40E+01	no	
4,4'-DDE	4 97E-02	1.24E-01	Lognormal	1 24E-01	1.70E+01	no	
4,4'-DDT	4 62E-02	1 04E-01	Lognormal	1 04E-01	1 70E+01	no	
alpha-Chlordane[2]	5.46E-02	9 82E-01	Lognormal	2 80E-02	1 60E+01	no	
Dieldrin	1 02E-01	1 75E+00	Lognormal	2 70E-02	3 60E-01	no	
Endosulfan II[3]	1.04E-01	1 16E+00	Lognormal	4.70E-03	1.20E+03	no	
Endrin	9 67E-02	6 18E-01	Unknown	1 10E-01	6.10E+01	no	
Endrin ketone[4]	9 41E-02	5 26E-01	Unknown	4 70E-02	6 10E+01	no	
gamma-Chlordane[2]	5 37E-02	8 44E-01	Lognormal	1 10E-04	1 60E+01	no	
Heptachlor	4.70E-02	2.11E-01	Unknown	5 30E-03	1 30E+00	no	
Heptachlor epoxide	3 91E-02	1 27E-01	Lognormal	2 00E-02	6.30E-01	no	
Methoxychlor	3 58E-01	1 14E+00	Lognormal	9 20E-01	1 00E+03	no	
PCB-1254	1 04E+00	6 99E+00	Unknown	4 02E-02	2 90E+00	no	
PCB-1260	1 00E+00	7 51E+00	Lognormal	3.40E-01	2.90E+00	no	
Semivolatiles							
2,4-Dimethylphenol	1.91E+01	1 28E+01	Unknown	1 20E+01	4 10E+03	no	
2-Methylnaphthalene	1 24E+02	3 78E+01	Unknown	3 78E+01	4 10E+03	no	
4-Methylphenol	1.53E+01	1 24E+01	Unknown	1.24E+01	1.00E+03	no	
Acenaphthene	1 85E+02	5 73E+01	Unknown	5.73E+01	1.20E+04	no	
Acenaphthylene	1.68E+01	1 52E+01	Unknown	1.52E+01	NA	NA	yes
Anthracene	7 46E+02	2 82E+02	Unknown	2 82E+02	6.10E+04	no	
Benzo(a)anthracene	1.30E+02	5 00E+02	Unknown	5 00E+02	7.80E+00	yes	yes
Benzo(a)pyrene	7 24E+01	2 90E+02	Unknown	2.90E+02	7 80E-01	yes	yes
Benzo(b)fluoranthene	1 23E+02	6 26E+02	Unknown	6 26E+02	7 80E+00	yes	yes
Benzo(g,h,i)perylene	3 35E+01	1 05E+02	Unknown	1 05E+02	NA	NA	yes
Benzo(k)fluoranthene	4 50E+01	1 37E+02	Unknown	1 37E+02	7 80E+01	yes	yes
bis(2-Ethylhexyl)phthalate	2 69E+01	2 53E+01	Unknown	5 30E-01	4 10E+02	no	
Butylbenzylphthalate	1 95E+01	1 54E+01	Unknown	1 70E-01	4 10E+04	no	

ENVIRONMENTAL STANDARDS

AR301636

AR000362

Table 9
Statistical Summary and COPC Selection for Trespasser Exposed to Surface Soils and NAPL (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Carbazole	114	68	59 65	4 00E-02	2 16E+02	1 50E+00	8.70E+03	1 05E+03
Chrysene	114	107	93 86	4 60E-02	9 38E+01	8 15E+00	2.20E+03	2.91E+02
Di-n-butylphthalate	114	9	7 89	3 90E-02	1 23E+01	1 16E+00	5 80E-01	4 69E+01
Di-n-octylphthalate	115	1	0 87	4 30E-02	1.22E+01	1 17E+00	4 30E-02	4.67E+01
Dibenz(a,h)anthracene	114	80	70 18	6.30E-02	1.47E+01	2 03E+00	1 30E+02	4.82E+01
Dibenzofuran	114	41	35 96	5.40E-02	1.06E+02	1 33E+00	3 20E+03	4.69E+02
Diethylphthalate	115	2	1 74	6.40E-02	1 22E+01	1 16E+00	7 80E-02	4 67E+01
Fluoranthene	114	110	96 49	4 70E-02	3 05E+02	1 01E+01	9.20E+03	1.30E+03
Fluorene	114	38	33 33	4 70E-02	1 89E+02	1 30E+00	5.60E+03	8 38E+02
Indeno(1,2,3-c,d)pyrene	115	104	90 43	5 10E-02	3 01E+01	4 95E+00	3 50E+02	6 19E+01
Naphthalene	114	48	42 11	5 20E-02	8 40E+01	1 36E+00	3 50E+03	4 12E+02
Pentachlorophenol	114	22	19 3	6 50E-02	2.78E+01	2 45E+00	1 20E+02	1 15E+02
Phenanthrene	111	89	80 18	5 50E-02	4.74E+02	2 79E+00	1 60E+04	2 17E+03
Phenol	114	4	3 51	9 00E-02	9 53E+00	1 12E+00	7 70E+01	3 45E+01
Pyrene	114	109	95.61	6 10E-02	2 47E+02	1 12E+01	6 40E+03	9 31E+02
Volatiles								
1,1,2,2-Tetrachloroethane	56	2	3.57	1 00E-01	1 31E-02	6 93E-03	3 00E-01	4.10E-02
2-Butanone	54	2	3.7	6.00E-03	6 72E-03	6.32E-03	3 80E-02	4 37E-03
Acetone	42	10	23 81	3 00E-03	1.78E-02	7 78E-03	2 30E-01	4 21E-02
Benzene	54	1	1 85	1 10E-02	6.28E-03	6.22E-03	1 10E-02	9 30E-04
Chloroform	50	1	2	2.00E-03	6 02E-03	5.95E-03	2 00E-03	7 89E-04
Ethylbenzene	54	4	7 41	1 00E-03	9 64E-03	6 29E-03	2 00E-01	2.64E-02
Tetrachloroethene	54	28	51 85	4 00E-03	1 04E-02	8 06E-03	7 40E-02	1.13E-02
Toluene	54	17	31 48	1.00E-03	9 85E-03	6 88E-03	1 50E-01	1.99E-02
Trichloroethene	54	1	1 85	2 00E-03	6 12E-03	6 04E-03	2 00E-03	8 68E-04
Xylenes (total)	54	7	12 96	3 30E-03	2 00E-02	6 75E-03	7 40E-01	9.99E-02

Table 9

Statistical Summary and COPC Selection for Trespasser Exposed to Surface Soils and NAPL (0-12" bgs)

Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Carbazole	3 80E+02	1 09E+02	Unknown	1 09E+02	2 90E+02	yes	yes
Chrysene	1 39E+02	5 42E+02	Unknown	5 42E+02	7 80E+02	yes	yes
Di-n-butylphthalate	1 97E+01	1 51E+01	Unknown	5 80E-01	2 00E+04	no	
Di-n-octylphthalate	1 95E+01	1 39E+01	Unknown	4 30E-02	4.10E+03	no	
Dibenz(a,h)anthracene	2 22E+01	2 46E+01	Unknown	2 46E+01	7 80E-01	yes	yes
Dibenzofuran	1 80E+02	5 25E+01	Unknown	5 25E+01	8 20E+02	yes	yes
Diethylphthalate	1 95E+01	1 40E+01	Unknown	7 80E-02	1 60E+05	no	
Fluoranthene	5 08E+02	1 48E+03	Unknown	1 48E+03	8 20E+03	yes	yes
Fluorene	3 21E+02	8 91E+01	Unknown	8.91E+01	8 20E+03	no	
Indeno(1,2,3-c,d)pyrene	3 98E+01	1 51E+02	Unknown	1 51E+02	7 80E+00	yes	yes
Naphthalene	1 48E+02	5 01E+01	Unknown	5 01E+01	4 10E+03	no	
Pentachlorophenol	4 57E+01	3 44E+01	Unknown	3 44E+01	4 80E+01	yes	yes
Phenanthrene	8 18E+02	3.45E+02	Unknown	3 45E+02	NA	NA	yes
Phenol	1 49E+01	1 14E+01	Unknown	1 14E+01	1 20E+05	no	
Pyrene	3 92E+02	1 26E+03	Unknown	1 26E+03	6 10E+03	yes	yes
Volatiles							
1,1,2,2-Tetrachloroethane	2 23E-02	1 01E-02	Unknown	1 01E-02	2.90E+01	no	
2-Butanone	7 72E-03	6 97E-03	Unknown	6 97E-03	1 00E+05	no	
Acetone	2 88E-02	1 68E-02	Unknown	1.68E-02	2 00E+04	no	
Benzene	6 49E-03	6 46E-03	Unknown	6 46E-03	2 00E+02	no	
Chloroform	6 21E-03	6 31E-03	Unknown	2 00E-03	9 40E+02	no	
Ethylbenzene	1 57E-02	8 47E-03	Unknown	8.47E-03	2 00E+04	no	
Tetrachloroethene	1 30E-02	1 15E-02	Unknown	1 15E-02	1 10E+02	no	
Toluene	1 44E-02	9 76E-03	Unknown	9 76E-03	4 10E+04	no	
Trichloroethene	6 32E-03	6 41E-03	Unknown	2 00E-03	5 20E+02	no	
Xylenes (total)	4 28E-02	1 04E-02	Unknown	1 04E-02	4 10E+05	no	

This data set includes samples from all on-site areas and Hersh ... in sediment.

NA - Not available

[1] The screening level of 750 mg/kg is based on US EPA's adult ... d lead uptake model under default exposure assumptions.

[2] These compounds have no published RBC or RfD values Th... re sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark

[3] These compounds have no published RBC or RfD values Th... e sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark

[4] These compounds have no published RBC or RfD values The... re sufficiently close in toxicity to Endrin so that the Endrin RBC is applicable to its congeners as a provisional benchmark

Table 10
Statistical Summary and COPC Selection for Trespasser Exposed to Non-River Surface Water
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/L	Mean mg/L	Lognormal Mean mg/L	Maximum Detected mg/L	Standard Deviation mg/L
Dioxins								
2,3,7,8-TCDD Equiv	14	1	7.14	1.99E-06	2.43E-06	2.35E-06	1.99E-06	6.37E-07
Inorganics								
Aluminum	40	38	95	3.38E-02	7.07E-01	3.72E-01	3.90E+00	8.92E-01
Antimony	52	3	5.77	2.20E-03	2.25E-02	1.43E-02	5.80E-03	1.25E-02
Arsenic	45	11	24.44	1.40E-03	4.25E-03	3.84E-03	1.01E-02	1.85E-03
Barium	59	59	100	2.32E-02	9.13E-02	8.00E-02	3.47E-01	5.32E-02
Cadmium	54	1	1.85	1.40E-03	2.23E-03	1.88E-03	1.40E-03	7.29E-04
Chromium	55	26	47.27	7.00E-04	4.14E-03	3.14E-03	1.11E-02	2.49E-03
Cobalt	49	5	10.2	1.50E-03	2.02E-02	1.32E-02	1.31E-02	9.29E-03
Copper	53	29	54.72	1.30E-03	8.72E-03	7.33E-03	1.57E-02	4.11E-03
Iron	56	55	98.21	1.49E-01	3.65E+00	1.62E+00	3.42E+01	5.85E+00
Lead	58	22	37.93	2.00E-03	4.01E-03	2.54E-03	2.92E-02	5.41E-03
Manganese	59	59	100	8.90E-03	6.92E-01	2.76E-01	6.52E+00	1.08E+00
Mercury	58	1	1.72	1.30E-04	8.66E-05	7.08E-05	1.30E-04	3.31E-05
Nickel	51	1	1.96	8.00E-03	1.86E-02	1.59E-02	8.00E-03	4.86E-03
Thallium	55	4	7.27	7.60E-03	5.24E-03	4.78E-03	2.46E-02	3.03E-03
Vanadium	49	23	46.94	1.40E-03	1.64E-02	1.16E-02	2.88E-02	1.02E-02
Zinc	44	43	97.73	2.15E-02	7.17E-02	5.35E-02	4.70E-01	7.69E-02
PCBs/Pesticides								
alpha-Chlordane	14	5	35.71	5.00E-06	1.89E-05	1.63E-05	1.00E-05	8.59E-06
Endosulfan II	13	1	7.69	8.00E-06	4.68E-05	4.34E-05	8.00E-06	1.16E-05
gamma-Chlordane	14	1	7.14	1.00E-05	2.39E-05	2.34E-05	1.00E-05	4.01E-06
Methoxychlor	14	2	14.29	2.00E-05	2.17E-04	1.77E-04	2.40E-05	8.28E-05
PCB-1260	14	1	7.14	5.90E-04	5.06E-04	5.06E-04	5.90E-04	2.41E-05
Semivolatiles								
Acenaphthene	47	2	4.26	7.00E-03	6.87E-03	5.62E-03	7.70E-02	1.05E-02
Anthracene	47	2	4.26	3.00E-03	5.70E-03	5.39E-03	2.60E-02	3.13E-03
Benzo(a)anthracene	47	2	4.26	5.00E-03	6.45E-03	5.55E-03	5.90E-02	7.87E-03
Benzo(a)pyrene	47	2	4.26	3.00E-03	5.77E-03	5.40E-03	2.90E-02	3.56E-03
Benzo(b)fluoranthene	47	4	8.51	2.00E-03	6.35E-03	5.47E-03	5.40E-02	7.19E-03
Benzo(g,h,i)perylene	47	1	2.13	2.60E-02	5.74E-03	5.45E-03	2.60E-02	3.11E-03
Benzo(k)fluoranthene	47	2	4.26	3.00E-03	6.15E-03	5.46E-03	4.70E-02	6.14E-03
bis(2-Ethylhexyl)phthalate	46	1	2.17	3.00E-03	5.77E-03	5.41E-03	3.00E-03	3.52E-03
Chrysene	47	4	8.51	2.00E-03	7.01E-03	5.44E-03	9.00E-02	1.24E-02
Di-n-butylphthalate[1]	47	1	2.13	3.00E-03	5.76E-03	5.40E-03	3.00E-03	3.49E-03
Dibenzofuran	47	1	2.13	1.40E-02	5.49E-03	5.38E-03	1.40E-02	1.47E-03
Fluoranthene	47	4	8.51	3.00E-03	1.06E-02	5.78E-03	2.50E-01	3.57E-02
Fluorene	47	2	4.26	4.00E-03	5.55E-03	5.38E-03	1.80E-02	2.01E-03
Indeno(1,2,3-c,d)pyrene	47	1	2.13	2.80E-02	5.79E-03	5.46E-03	2.80E-02	3.39E-03
Naphthalene	47	1	2.13	1.70E-02	5.55E-03	5.40E-03	1.70E-02	1.86E-03
Phenanthrene	47	2	4.26	2.00E-03	6.02E-03	5.40E-03	4.20E-02	5.44E-03
Pyrene	47	4	8.51	2.00E-03	9.69E-03	5.67E-03	2.10E-01	2.99E-02
Volatiles								
Acetone	39	3	7.69	4.00E-03	4.97E-03	4.97E-03	5.00E-03	1.60E-04
Bromomethane	49	2	4.08	3.00E-03	4.98E-03	4.97E-03	6.00E-03	3.22E-04
Carbon Disulfide	49	1	2.04	2.10E-02	5.33E-03	5.15E-03	2.10E-02	2.29E-03
Chloromethane	48	2	4.17	1.70E-02	5.63E-03	5.29E-03	2.30E-02	3.09E-03
Toluene	49	1	2.04	2.00E-03	4.94E-03	4.91E-03	2.00E-03	4.29E-04

AR316029

ENVIRONMENTAL STANDARDS

Table 10
Statistical Summary and COPC Selection for Trespasser Exposed to Non-River Surface Water
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/L	Lognormal 95% UCL mg/L	Distribution 99% Confidence	Exposure Point Concentration mg/L	Adjusted Tap Water RBC* mg/L	Is Maximum Greater than RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	[illegible]	2.79E-06	Normal/Lognormal	1.99E-06	9.00E-09	yes	yes
Inorganics							
Aluminum	[illegible]	1.23E+00	Lognormal	1.23E+00	7.40E+01	no	
Antimony	[illegible]	5.00E-02	Unknown	5.80E-03	3.00E-02	no	
Arsenic	4.71E-03	4.95E-03	Unknown	4.95E-03	9.00E-04	yes	yes
Barium	[illegible]	1.03E-01	Unknown	1.03E-01	5.20E+00	no	
Cadmium	[illegible]	3.24E-03	Unknown	1.40E-03	3.60E-02	no	
Chromium	[illegible]	6.16E-03	Unknown	6.16E-03	1.10E+02	no	
Cobalt	2.24E-02	5.77E-02	Unknown	1.31E-02	4.40E+00	no	
Copper	[illegible]	1.14E-02	Unknown	1.14E-02	3.00E+00	no	
Iron	[illegible]	6.21E+00	Unknown	6.21E+00	2.20E+01	yes	yes
Lead	[illegible]	4.49E-03	Unknown	4.49E-03	NA	NA	yes
Manganese	[illegible]	1.36E+00	Unknown	1.36E+00	1.46E+00	yes	yes
Mercury	[illegible]	1.26E-04	Unknown	1.26E-04	2.20E-02	no	
Nickel	[illegible]	2.99E-02	Unknown	8.00E-03	1.46E+00	no	
Thallium	5.93E-03	5.77E-03	Unknown	5.77E-03	5.20E-03	yes	yes
Vanadium	[illegible]	2.61E-02	Unknown	2.61E-02	5.20E-01	no	
Zinc	[illegible]	8.52E-02	Lognormal	8.52E-02	2.20E+01	no	
PCBs/Pesticides							
alpha-Chlordane	[illegible]	2.95E-05	Unknown	1.00E-05	1.04E-03	no	
Endosulfan II	[illegible]	6.75E-05	Unknown	8.00E-06	4.40E-01	no	
gamma-Chlordane	[illegible]	2.74E-05	Unknown	1.00E-05	1.04E-03	no	
Methoxychlor	[illegible]	4.95E-04	Unknown	2.40E-05	3.60E-01	no	
PCB-1260	[illegible]	5.17E-04	Unknown	5.17E-04	1.46E-03	no	
Semivolatiles							
Acenaphthene	[illegible]	6.81E-03	Unknown	6.81E-03	4.40E+00	no	
Anthracene	[illegible]	6.00E-03	Unknown	6.00E-03	2.20E+01	no	
Benzo(a)anthracene	[illegible]	6.55E-03	Unknown	6.55E-03	1.84E-03	yes	no
Benzo(a)pyrene	[illegible]	6.06E-03	Unknown	6.06E-03	1.84E-04	yes	no
Benzo(b)fluoranthene	[illegible]	6.59E-03	Unknown	6.59E-03	1.84E-03	yes	yes
Benzo(g,h,i)perylene	[illegible]	6.02E-03	Unknown	6.02E-03	NA	NA	no
Benzo(k)fluoranthene	[illegible]	6.36E-03	Unknown	6.36E-03	1.84E-02	yes	no
bis(2-Ethylhexyl)phthalate	[illegible]	6.07E-03	Unknown	3.00E-03	9.60E-02	no	
Chrysene	[illegible]	6.87E-03	Unknown	6.87E-03	1.84E-01	no	
Di-n-butylphthalate	[illegible]	6.05E-03	Unknown	3.00E-03	7.40E+00	no	
Dibenzofuran	[illegible]	5.72E-03	Unknown	5.72E-03	3.00E-01	no	
Fluoranthene	[illegible]	8.18E-03	Unknown	8.18E-03	3.00E+00	no	
Fluorene	[illegible]	5.81E-03	Unknown	5.81E-03	3.00E+00	no	
Indeno(1,2,3-c,d)pyrene	[illegible]	6.06E-03	Unknown	6.06E-03	1.84E-03	yes	no
Naphthalene	[illegible]	5.80E-03	Unknown	5.80E-03	3.00E+01	no	
Phenanthrene	[illegible]	6.31E-03	Unknown	6.31E-03	NA	NA	no
Pyrene	[illegible]	7.86E-03	Unknown	7.86E-03	2.20E+01	no	
Volatiles							
Acetone	[illegible]	5.02E-03	Unknown	5.00E-03	7.40E+01	no	
Bromomethane	[illegible]	5.08E-03	Unknown	5.08E-03	1.74E-02	no	
Carbon Disulfide	[illegible]	5.53E-03	Unknown	5.53E-03	2.00E+00	no	
Chloromethane	[illegible]	5.91E-03	Unknown	5.91E-03	2.80E-02	no	
Toluene	[illegible]	5.11E-03	Unknown	2.00E-03	1.50E+00	no	

* See text for explanation of RBC adjustments.

Table 11
Statistical Summary and COPC Selection for Trespasser Exposed to Non-River Sediment (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dioxins								
2,3,7,8-TCDD Equiv	31	31	100	9 20E-05	6 77E-04	2.86E-04	6 22E-03	1 42E-03
Inorganics								
Aluminum	163	163	100	8 92E+02	1 93E+04	1 78E+04	3 39E+04	6 67E+03
Antimony	92	44	47 83	8 60E-01	9 58E+00	3.17E+00	9 20E+00	1 26E+01
Arsenic	141	135	95 74	1 70E+00	1 06E+01	8.83E+00	3 19E+01	6 40E+00
Barium	163	163	100	2 63E+01	4 21E+02	3 25E+02	3 06E+03	4.03E+02
Beryllium	145	138	95 17	3 80E-01	1 53E+00	1 44E+00	3 80E+00	4 89E-01
Cadmium	155	114	73 55	3 90E-01	2 72E+00	1 41E+00	2 59E+01	3 58E+00
Chromium	163	162	99 39	8 40E+00	5 42E+01	4 93E+01	1 36E+02	2 23E+01
Cobalt	148	145	97 97	3.60E+00	1 62E+01	1 50E+01	5 00E+01	5 95E+00
Copper	163	163	100	4 20E+00	6 64E+01	5 33E+01	1 88E+02	4 19E+01
Iron	163	163	100	2 20E+03	3.07E+04	2.92E+04	5 48E+04	8.30E+03
Lead[1]	163	163	100	4 50E+00	1 19E+02	7 82E+01	3 15E+03	2 52E+02
Manganese	163	163	100	5 76E+01	7 74E+02	5 54E+02	5 27E+03	7 72E+02
Mercury	149	128	85.91	4.60E-02	4 75E-01	2 68E-01	8 80E+00	1 13E+00
Nickel	162	161	99 38	8.00E+00	2.73E+01	2 49E+01	1 11E+02	1 22E+01
Selenium	151	40	26 49	1 40E+00	1 91E+00	1 48E+00	6 60E+00	1 18E+00
Silver	151	16	10 6	2.00E-01	3 23E+00	1 45E+00	5 80E+00	2 30E+00
Thallium	138	31	22 46	1 40E+00	3 74E+00	2 67E+00	3 26E+01	3.96E+00
Vanadium	163	163	100	4 50E+00	7 80E+01	6 77E+01	6 52E+02	7 07E+01
Zinc	163	163	100	3 54E+01	1 07E+03	5.78E+02	8 54E+03	1 35E+03
PCBs/Pesticides								
4,4'-DDD	43	30	69 77	3 70E-04	1.05E-01	1 18E-02	4 00E-01	3 21E-01
4,4'-DDE	43	32	74 42	1.50E-03	7.23E-02	1 05E-02	3 20E-01	3 06E-01
4,4'-DDT	43	16	37 21	1 80E-03	8 63E-02	1 47E-02	1 20E+00	2 16E-01
Aldrin	42	3	7 14	1 80E-03	5 86E-02	7.66E-03	1.20E-02	1 64E-01
alpha-Chlordane[2]	42	6	14.29	6 20E-04	5 93E-02	7 25E-03	4 30E-02	1.64E-01
Dieldrin	43	6	13 95	1 80E-03	9 81E-02	1.27E-02	2 90E-02	3 20E-01
Endosulfan II[3]	43	5	11 63	3 90E-03	1 06E-01	1 43E-02	5.80E-02	3.21E-01
Endosulfan Sulfate[3]	43	5	11 63	2.10E-04	1.13E-01	1 37E-02	3.80E-02	3 23E-01
Endrin	43	2	4 65	1 10E-02	1.15E-01	1 52E-02	2 20E-02	3 26E-01
Endrin aldehyde[4]	42	6	14 29	1 40E-03	1 12E-01	1 41E-02	2 00E-02	3 29E-01
Endrin ketone[4]	43	1	2 33	2 70E-02	1 30E-01	1 84E-02	2 70E-02	3 28E-01
gamma-Chlordane[2]	43	17	39 53	4 20E-04	6 61E-02	7 48E-03	5 30E-03	1.66E-01
Heptachlor	43	1	2 33	3 20E-03	6 61E-02	8 68E-03	3 20E-03	1 66E-01
Heptachlor epoxide	43	1	2 33	8 30E-04	6 64E-02	8.79E-03	8 30E-04	1 66E-01
Methoxychlor	38	3	7 89	1 60E-03	6 24E-01	6 74E-02	2.10E-02	1 74E+00
PCB-1254	43	13	30 23	1 80E-02	1 33E+00	2 22E-01	5 80E-01	3 27E+00
PCB-1260	43	10	23 26	1 20E-02	1 31E+00	1 87E-01	5 40E-01	3 27E+00
Semivolatiles								
1,2,4-Trichlorobenzene	162	2	1 23	1 60E-01	3 72E+01	1 05E+00	1 00E+00	2 36E+02
1 2-Dichlorobenzene	162	1	0 62	7 80E-02	3 72E+01	1 04E+00	7 80E-02	2.36E+02
2,4-Dichlorophenol	161	1	0 62	2 70E-01	3 75E+01	1 05E+00	2 70E-01	2.37E+02
2,4-Dimethylphenol	161	2	1 24	1 90E-01	3 75E+01	1 04E+00	3 80E+00	2 37E+02
2-Chlorophenol	161	2	1 24	1 70E-01	3 75E+01	1 05E+00	7 80E-01	2 37E+02
2-Methylnaphthalene	162	49	30 25	4 90E-02	1 03E+02	1 66E+00	3 20E+03	4.14E+02
2-Nitrophenol	161	1	0 62	3 20E-01	3 75E+01	1 05E+00	3 20E-01	2 37E+02
3,3'-Dichlorobenzidine	162	1	0 62	7 40E+00	3 73E+01	1.05E+00	7 40E+00	2 36E+02
Acenaphthene	162	66	40 74	6 90E-02	2 45E+02	2 12E+00	8 60E+03	1 01E+03
Acenaphthylene	162	41	25 31	7 70E-02	3 95E+01	1.15E+00	2.80E+02	2 37E+02
Anthracene	162	88	54 32	6 90E-02	2 98E+02	2.94E+00	1 20E+04	1 23E+03
Benzo(a)anthracene	162	123	75 93	7 20E-02	1 20E+02	2 92E+00	3.40E+03	4 27E+02
Benzo(a)pyrene	162	110	67 9	9 20E-02	5 90E+01	2.33E+00	7 50E+02	2 45E+02
Benzo(b)fluoranthene	162	124	76 54	6 70E-02	6 63E+01	3 39E+00	1 70E+03	2 09E+02
Benzo(g,h,i)perylene	162	96	59 26	7 50E-02	4 41E+01	1 71E+00	1 90E+02	2 36E+02
Benzo(k)fluoranthene	162	110	67 9	6 70E-02	3 93E+01	1 86E+00	8 20E+02	1 70E+02

Table 11
Statistical Summary and COPC Selection for Trespasser Exposed to Non-River Sediment (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-T[illegible]DD Equiv	1.11E-03	7.96E-04	Unknown	7.96E-04	3.80E-05	yes	yes
Inorganics							
Aluminum	2.01E+04	2.10E+04	Unknown	2.10E+04	2.00E+05	no	
Antimony	*1.18E+01*	*1.70E+01*	*Unknown*	*9.20E+00*	*8.20E+01*	*no*	
Arsenic	1.15E+01	1.19E+01	Unknown	1.19E+01	3.80E+00	yes	yes
Barium	4.73E+02	4.65E+02	Unknown	4.65E+02	1.40E+04	no	
Beryllium	1.60E+00	1.63E+00	Unknown	1.60E+00	4.10E+02	no	
Cadmium	3.19E+00	4.73E+00	Unknown	4.73E+00	2.00E+02	no	
Chromium	5.71E+01	5.88E+01	Unknown	5.71E+01	3.10E+05	no	
Cobalt	1.70E+01	1.74E+01	Unknown	1.74E+01	1.20E+04	no	
Copper	7.18E+01	7.67E+01	Unknown	7.67E+01	8.20E+03	no	
Iron	3.18E+04	3.29E+04	Unknown	3.29E+04	6.10E+04	no	
Lead[1]	1.51E+02	1.27E+02	Unknown	1.27E+02	7.50E+02	yes	yes
Manganese	8.75E+02	8.85E+02	Unknown	8.85E+02	2.90E+04	no	yes
Mercury	6.29E-01	4.27E-01	Unknown	4.27E-01	6.10E+01	no	
Nickel	2.89E+01	2.92E+01	Unknown	2.92E+01	4.10E+03	no	
Selenium	2.07E+00	2.30E+00	Unknown	2.07E+00	1.00E+03	no	
Silver	*3.54E+00*	*8.57E+00*	*Unknown*	*5.80E+00*	*1.00E+03*	*no*	
Thallium	4.30E+00	4.32E+00	Unknown	4.32E+00	1.40E+01	yes	yes
Vanadium	8.72E+01	8.10E+01	Unknown	8.72E+01	1.40E+03	no	
Zinc	1.24E+03	1.51E+03	Unknown	1.51E+03	6.10E+04	no	
PCBs/Pesticides							
4,4'-DD[illegible]	1.87E-01	2.17E-01	Unknown	2.17E-01	2.40E+01	no	
4,4'-DD[illegible]	1.51E-01	6.82E-02	Unknown	6.82E-02	1.70E+01	no	
4,4'-DD[illegible]	1.42E-01	1.44E-01	Unknown	1.44E-01	1.70E+01	no	
Aldrin	1.01E-01	1.08E-01	Unknown	1.20E-02	3.40E-01	no	
alpha-C[illegible]ane[2]	1.02E-01	1.41E-01	Unknown	4.30E-02	1.60E+01	no	
Dieldrin	1.80E-01	1.27E-01	Unknown	2.90E-02	3.60E-01	no	
Endosul[illegible][2]	1.88E-01	1.64E-01	Unknown	5.80E-02	1.20E+03	no	
Endosul[illegible]lfate[3]	1.96E-01	3.05E-01	Unknown	3.80E-02	1.20E+03	no	
Endrin	1.99E-01	2.04E-01	Unknown	2.20E-02	6.10E+01	no	
Endrin [illegible]yde[4]	*1.97E-01*	*1.96E-01*	Unknown	2.00E-02	*6.10E+01*	no	
Endrin [illegible]	2.14E-01	3.22E-01	Unknown	2.70E-02	6.10E+01	no	
gamma [illegible]lane[2]	1.09E-01	2.42E-01	Unknown	5.30E-03	1.60E+01	no	
Heptach[illegible]	1.09E-01	1.64E-01	Unknown	3.20E-03	1.30E+00	no	
Heptach[illegible]oxide	1.09E-01	1.73E-01	Unknown	8.30E-04	6.30E-01	no	
Methoxy[illegible]	1.10E+00	1.66E+00	Unknown	2.10E-02	1.00E+03	no	
PCB-125[illegible]	2.17E+00	3.60E+00	Unknown	5.80E-01	2.90E+00	no	
PCB-126[illegible]	2.15E+00	3.94E+00	Unknown	5.40E-01	2.90E+00	no	
Semivol[illegible]s							
1,2,4-Tri[illegible]robenzene	6.81E+01	6.88E+00	Unknown	1.00E+00	2.00E+03	no	
1,2-Dich[illegible]enzene	6.80E+01	6.92E+00	Unknown	7.80E-02	1.80E+04	no	
2,4-Dich[illegible]phenol	6.85E+01	6.93E+00	Unknown	2.70E-01	6.10E+02	no	
2,4-Dim[illegible]henol	6.85E+01	6.92E+00	Unknown	3.80E+00	4.10E+03	no	
2-Chlo[illegible]ol	6.85E+01	6.95E+00	Unknown	7.80E-01	1.00E+03	no	
2-Methy[illegible]thalene	1.57E+02	8.86E+01	Unknown	8.86E+01	4.10E+03	no	
2-Nitrop[illegible]	6.85E+01	6.93E+00	Unknown	3.20E-01	NA	NA	no
3,3'-Dich[illegible]benzidine	6.81E+01	6.90E+00	Unknown	6.90E+00	1.30E+00	yes	no
Acenaph[illegible]	3.76E+02	3.62E+02	Unknown	3.62E+02	1.20E+04	no	
Acenaph[illegible]	7.04E+01	9.47E+00	Unknown	9.47E+00	NA	no	
Anthrac[illegible]	4.58E+02	7.40E+02	Unknown	7.40E+02	6.10E+04	no	
Benzo(a)[illegible]racene	1.76E+02	3.20E+02	Unknown	3.20E+02	7.80E+00	yes	yes
Benzo(a)pyrene	9.09E+01	9.10E+01	Unknown	9.10E+01	7.80E-01	yes	yes
Benzo(b)[illegible]anthene	9.35E+01	1.65E+02	Unknown	1.65E+02	7.80E+00	yes	yes
Benzo(g,h,i)perylene	7.49E+01	3.42E+01	Unknown	3.42E+01	NA	no	
Benzo(k)[illegible]anthene	6.15E+01	5.51E+01	Unknown	5.51E+01	7.80E+01	yes	yes

Table 11
Statistical Summary and COPC Selection for Trespasser Exposed to Non-River Sediment (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
bis(2-Ethylhexyl)phthalate	131	29	22 14	6 00E-02	4 59E+01	1 17E+00	1 50E+00	2 62E+02
Butylbenzylphthalate	163	35	21 47	7 90E-02	3 70E+01	8 41E-01	1 20E+00	2 36E+02
Carbazole	162	58	35 8	4 60E-02	1 11E+02	1 85E+00	4 20E+03	4 63E+02
Chrysene	162	123	75 93	7 20E-02	9 34E+01	3 19E+00	2 10E+03	2 95E+02
Dibenz(a,h)anthracene	162	65	40 12	7.60E-02	3 87E+01	1 30E+00	4 20E+01	2.36E+02
Dibenzofuran	162	69	42.59	5 80E-02	1 77E+02	1 94E+00	5 80E+03	6 99E+02
Diethylphthalate	164	5	3 05	7 40E-02	3 68E+01	1.01E+00	2 30E-01	2 35E+02
Di-n-butylphthalate	164	38	23 17	8 20E-02	3 68E+01	9 16E-01	7 50E-01	2 35E+02
Fluoranthene	162	132	81 48	4 80E-02	4 97E+02	4 57E+00	1 70E+04	1.97E+03
Fluorene	162	74	45 68	6 20E-02	2 69E+02	2 45E+00	9 50E+03	1 07E+03
Indeno(1,2,3-c,d)pyrene	164	103	62 8	7 20E-02	4 62E+01	1 84E+00	2 40E+02	2 35E+02
Isophorone	162	1	0 62	9.00E-02	3 72E+01	1 04E+00	9 00E-02	2 36E+02
Naphthalene	162	58	35 8	7 40E-02	1 95E+02	1.76E+00	7 70E+03	9 54E+02
Nitrobenzene	162	1	0 62	2 90E-01	3 72E+01	1 05E+00	2 90E-01	2 36E+02
Pentachlorophenol	161	8	4 97	6 00E-02	9 38E+01	2 49E+00	2 20E+01	5 94E+02
Phenanthrene	162	104	64 2	8 40E-02	7 85E+02	3 41E+00	2 90E+04	3 34E+03
Phenol	159	1	0 63	1 50E+00	3 79E+01	1 07E+00	1 50E+00	2 39E+02
Pyrene	162	130	80 25	4.60E-02	3.31E+02	4.05E+00	1 20E+04	1 29E+03
Volatiles								
1,1,2,2-Tetrachloroethane	104	3	2 88	3 00E-01	6 89E-02	1 42E-02	1 00E+00	2 28E-01
2-Butanone	100	70	70	8 00E-03	8 40E-02	3 04E-02	1 10E+00	2 10E-01
Acetone	92	69	75	5 00E-03	2 86E-01	8 62E-02	1 00E+01	1 05E+00
Benzene	101	4	3 96	2 00E-03	5 36E-02	1 23E-02	1 10E-02	2 08E-01
Carbon Disulfide	101	4	3 96	4 00E-03	5 38E-02	1.25E-02	8 00E-03	2 08E-01
Ethylbenzene	101	17	16 83	2 00E-03	1 44E-01	1 52E-02	3.70E+00	5 56E-01
Methylene Chloride	59	1	1 69	6 40E-02	8 36E-02	1 45E-02	6 40E-02	2 69E-01
Styrene	101	5	4 95	5 00E-03	7 75E-02	1 27E-02	3.10E+00	3 63E-01
Tetrachloroethene	101	46	45 54	2 00E-03	5 36E-02	1 17E-02	3 30E-02	2.08E-01
Toluene	101	18	17 82	4 00E-03	8 97E-02	1 36E-02	2 70E+00	3 84E-01
Xylenes (total)	101	21	20 79	1 00E-03	6.57E-01	1 77E-02	3.50E+01	3 73E+00

Table 11
Statistical Summary and COPC Selection for Trespasser Exposed to Non-River Sediment (0-12" bgs)
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
bis(2-Ethylhexyl)phthalate	8 39E+01	1 34E+01	Unknown	1.50E+00	4 10E+02	no	
Butylbenzylphthalate	6 76E+01	8 19E+00	Unknown	1.20E+00	4 10E+04	no	
Carbazole	1 71E+02	1 02E+02	Unknown	1.02E+02	2 90E+02	yes	yes
Chrysene	1 32E+02	2 64E+02	Unknown	2.64E+02	7 80E+02	yes	yes
Dibenz(a,h)anthracene	6 95E+01	1 25E+01	Unknown	1.25E+01	7 80E-01	yes	yes
Dibenzofuran	2 68E+02	2 55E+02	Unknown	2.55E+02	8 20E+02	yes	yes
Diethylphthalate	6 72E+01	6 89E+00	Unknown	2.30E-01	1 60E+05	no	
Di-n-butylphthalate	6 72E+01	7 18E+00	Unknown	7.50E-01	2 00E+04	no	
Fluoranthene	7 54E+02	2 27E+03	Unknown	2.27E+03	8 20E+03	yes	yes
Fluorene	4 08E+02	5 67E+02	Unknown	5.67E+02	8 20E+03	yes	yes
Indeno(1,2,3-c,d)pyrene	7 67E+01	4 56E+01	Unknown	4 56E+01	7 80E+00	yes	yes
Isophorone	6 80E+01	6 91E+00	Unknown	9.00E-02	6 00E+03	no	
Naphthalene	3 19E+02	1 13E+02	Unknown	1.13E+02	4 10E+03	yes	
Nitrobenzene	6 80E+01	6 84E+00	Unknown	2.90E-01	1 00E+02	no	
Pentachlorophenol	1 71E+02	1 86E+01	Unknown	1.86E+01	4 80E+01	no	
Phenanthrene	1 22E+03	3 16E+03	Unknown	3.16E+03	NA	no	
Phenol	6 93E+01	7 17E+00	Unknown	1 50E+00	1 20E+05	no	
Pyrene	5 00E+02	1 17E+03	Unknown	1 17E+03	6 10E+03	yes	yes
Volatiles							
1,1,2,2-Tetrachloroethane	1 06E-01	4 10E-02	Unknown	4.10E-02	2 90E+01	no	
2-Butanone	1 19E-01	8 84E-02	Unknown	8.84E-02	1 00E+05	no	
Acetone	4 69E-01	4 72E-01	Unknown	4.72E-01	2 00E+04	no	
Benzene	8 82E-02	2.87E-02	Unknown	1.10E-02	2.00E+02	no	
Carbon Disulfide	8 84E-02	2 91E-02	Unknown	8.00E-03	2.00E+04	no	
Ethylbenzene	2 37E-01	6 78E-02	Unknown	6.78E-02	2 00E+04	no	
Methylene Chloride	1 43E-01	5 46E-02	Unknown	5.46E-02	7 60E+02	no	
Styrene	1.38E-01	3 22E-02	Unknown	3.22E-02	4 10E+04	no	
Tetrachloroethene	8 82E-02	2 94E-02	Unknown	2.94E-02	1 10E+02	no	
Toluene	1 54E-01	4 10E-02	Unknown	4.10E-02	4 10E+04	no	
Xylenes (total)	1 28E+00	1 59E-01	Unknown	1.59E-01	4.10E+05	no	

This data set includes samples from all on-site non-river sediment areas.
NA - Not available
[a] The screening level of 750 mg/kg is based on US EPA's adult blood lead uptake model under default exposure assumptions.
[2] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark.
[3] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endosulfan so that the Endosulfan RBC is applicable to its congeners as a provisional benchmark.
[4] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endrin so that the Endrin RBC is applicable to its congeners as a provisional benchmark.

Table 12

Statistical Summary and COPC Selection for Swimmer Exposed to Surface Water From Christina River

Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/L	Mean mg/L	Lognormal Mean mg/L	Maximum Detected mg/L	Standard Deviation mg/L	95% UCL mg/L	Lognormal 95% UCL mg/L	Distribution 99% Confidence	Exposure Point Concentration mg/L	Adjusted Tap Water RBC* mg/L	Is Maximum Greater than RBC?	Is Detection Frequency >5%?
Inorganics															
Aluminum	18	18	100	2.17E-01	7.81E-01	6.77E-01	1.60E+00	3.91E-01	9.42E-01	1.08E+00	Normal/Lognormal	1.08E+00	7.40E+01	no	
Barium	19	19	100	4.41E-02	6.45E-02	6.35E-02	8.18E-02	1.17E-02	6.92E-02	6.99E-02	Normal/Lognormal	6.99E-02	5.20E+00	no	
Chromium	17	14	82	5.50E-04	2.95E-03	2.65E-03	4.20E-03	1.26E-03	3.48E-03	4.01E-03	Normal/Lognormal	4.01E-03	1.10E+02	no	
Cobalt	19	7	37	8.80E-04	8.46E-03	2.17E-03	1.90E-03	1.15E-02	1.31E-02	5.32E-02	Unknown	1.90E-03	4.40E+00	no	
Copper	14	14	100	2.80E-03	3.89E-03	3.78E-03	6.30E-03	9.87E-04	4.35E-03	4.38E-03	Normal/Lognormal	4.38E-03	3.00E+00	no	
Iron	19	19	100	3.75E-01	1.49E+00	1.36E+00	2.68E+00	5.86E-01	1.72E+00	1.90E+00	Normal/Lognormal	1.90E+00	2.20E+01	no	
Lead	19	15	79	3.10E-03	3.85E-03	3.31E-03	1.18E-02	2.30E-03	4.76E-03	5.22E-03	Lognormal	5.22E-03	NA	NA	yes
Manganese	19	19	100	9.47E-02	1.75E-01	1.67E-01	2.91E-01	5.60E-02	1.97E-01	2.02E-01	Normal/Lognormal	2.02E-01	1.46E+00	no	
Mercury	19	1	5	3.60E-04	7.14E-05	2.68E-05	3.60E-04	1.19E-04	1.19E-04	1.75E-04	Unknown	1.75E-04	2.20E-02	no	
Nickel	7	1	14	2.70E-03	1.75E-02	1.50E-02	2.70E-03	6.54E-03	2.23E-02	5.13E-02	Unknown	2.70E-03	1.46E+00	no	
Vanadium	17	14	82	2.70E-03	5.72E-03	3.59E-03	4.70E-03	7.31E-03	8.82E-03	1.13E-02	Unknown	4.70E-03	5.20E-01	no	
Zinc	12	12	100	4.06E-02	6.59E-02	6.49E-02	7.90E-02	1.09E-02	7.15E-02	7.32E-02	Normal/Lognormal	7.32E-02	2.20E+01	no	
Semivolatiles															
bis(2-Ethylhexyl)phthalate	6	1	17	1.00E-03	4.53E-03	3.62E-03	1.00E-03	1.63E-03	5.68E-03	1.16E-02	Unknown	1.00E-03	9.60E-02	no	

* See text for explanation of RBC adjustments

NA - Not available

AR316035

AR000371

ENVIRONMENTAL STANDARDS

AR000372

Table 13

Statistical Summary and COPC Selection for Swimmer Exposed to Surface Water From White Clay Creek

Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/L	Mean mg/L	Lognormal Mean mg/L	Maximum Detected mg/L	Standard Deviation mg/L	95% UCL mg/L	Lognormal 95% UCL mg/L	Distribution 99% Confidence	Exposure Point Concentration mg/L	Adjusted Tap Water RBC* mg/L	Is Maximum Greater than RBC?	Is Detection Frequency >5%?
Inorganics															
Aluminum	4	4	100	2.31E-01	6.24E-01	5 49E-01	8 99E-01	3 15E-01	9.94E-01	3 32E+00	Normal/Lognormal	8 99E-01	7 40E+01	no	
Barium	9	9	100	3.45E-02	5 30E-02	5 11E-02	7 47E-02	1 53E-02	6.25E-02	6 57E-02	Normal/Lognormal	6 57E-02	5 20E+00	no	
Chromium	7	1	14	2 40E-03	3 95E-03	2 91E-03	2 40E-03	1 90E-03	5 34E-03	3 80E-02	Unknown	2 40E-03	1 10E+02	no	
Copper	9	9	100	3.10E-03	4.80E-03	4.58E-03	9.20E-03	1.78E-03	5.90E-03	5 97E-03	Lognormal	5 97E-03	3 00E+00	no	
Iron	9	9	100	1.95E-01	8.09E-01	6 24E-01	2 10E+00	6 18E-01	1 19E+00	1.85E+00	Normal/Lognormal	1 85E+00	2 20E+01	no	
Lead	9	2	22	4 80E-03	2.17E-03	1 84E-03	4 80E-03	1 51E-03	3 10E-03	3 49E-03	Unknown	3 49E-03	NA	NA	yes
Manganese	9	9	100	5.51E-02	1.40E-01	1 21E-01	2.83E-01	7 68E-02	1.88E-01	2 43E-01	Normal/Lognormal	2 43E-01	1 46E+00	no	
Vanadium	9	3	33	2 00E-03	1 76E-02	1 18E-0[illegible]	[illegible]	[illegible]	2 45E-02	9 31E-02	Unknown	3 20E-03	5 20E-01	no	
Zinc	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 55E-01	Lognormal	1 55E-01	2 20E+01	no	
Semivolatiles															
bis(2-Ethylhexyl)phthalate	7	1	14	8.00E-03	5.71E-03	5 64E-03	8 00E-03	1 07E-03	6 50E-03	6 55E-03	Lognormal	6 55E-03	9 60E-02	no	

* See text for explanation of RBC adjustments

NA - Not available

AR316036

Table 14
Statistical Summary and COPC Selection for Swimmer Exposed to River Sediments From Christina River
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dioxins								
2,3,7,8-TCDD Equiv	3	3	100	9.18E-05	1.01E-04	1.01E-04	1.16E-04	1.27E-05
Inorganics								
Aluminum	37	37	100	1.19E+03	1.46E+04	1.25E+04	2.47E+04	5.70E+03
Antimony	23	4	17	2.40E-01	4.26E+00	5.87E-01	1.40E+00	1.02E+01
Arsenic	33	33	100	2.20E+00	7.72E+00	7.01E+00	1.74E+01	3.53E+00
Barium	37	37	100	1.29E+01	2.08E+02	1.46E+02	1.24E+03	2.26E+02
Beryllium	29	28	97	2.90E-01	1.13E+00	1.01E+00	2.10E+00	5.28E-01
Cadmium	34	16	47	4.60E-01	2.07E+00	6.07E-01	2.23E+01	4.13E+00
Chromium	37	37	100	6.90E+00	4.24E+01	3.64E+01	1.50E+02	2.38E+01
Cobalt	29	29	100	3.40E+00	1.12E+01	1.05E+01	1.66E+01	3.33E+00
Copper	35	35	100	7.20E+00	2.84E+01	2.29E+01	6.64E+01	1.85E+01
Iron	37	37	100	4.46E+03	2.38E+04	2.18E+04	3.39E+04	7.67E+03
Lead[1]	37	37	100	6.60E+00	4.86E+01	3.18E+01	2.20E+02	4.66E+01
Manganese	37	37	100	7.57E+01	6.39E+02	5.23E+02	1.30E+03	3.48E+02
Mercury	34	28	82	1.40E-02	1.69E-01	9.54E-02	6.30E-01	1.67E-01
Nickel	37	37	100	3.00E+00	1.93E+01	1.77E+01	2.77E+01	6.18E+00
Selenium	35	12	34	3.40E-01	1.11E+00	7.56E-01	1.90E+00	8.83E-01
Thallium	28	3	11	1.26E+00	2.08E+00	1.23E+00	3.50E+00	1.97E+00
Vanadium	37	37	100	7.30E+00	4.08E+01	3.74E+01	5.78E+01	1.29E+01
Zinc	37	37	100	4.02E+01	4.46E+02	2.28E+02	3.09E+03	6.25E+02
PCBs/Pesticides								
4,4'-DDD	25	14	56	9.50E-05	1.90E-01	3.33E-03	3.80E+00	7.63E-01
4,4'-DDE	15	12	80	2.70E-04	7.58E-02	2.33E-03	1.10E+00	2.83E-01
4,4'-DDT	20	8	40	4.10E-05	1.25E+00	3.33E-03	2.40E+01	5.36E+00
alpha-BHC	28	2	7	6.30E-05	2.83E-02	1.91E-03	1.30E-03	1.16E-01
alpha-Chlordane[2]	28	11	39	1.80E-04	7.61E-03	1.74E-03	1.70E-02	2.90E-02
delta-BHC[3]	25	3	12	2.10E-04	7.45E-03	1.44E-03	4.10E-04	3.07E-02
Dieldrin	14	4	29	3.50E-04	2.36E-02	2.69E-03	4.40E-03	7.96E-02
Endrin aldehyde[4]	25	6	24	9.30E-05	3.82E-02	2.67E-03	3.70E-03	1.31E-01
Endrin ketone[4]	28	3	11	2.20E-04	6.67E-02	3.49E-03	1.40E-03	2.86E-01
gamma-Chlordane[2]	28	21	75	8.30E-05	7.35E-03	8.74E-04	1.90E-02	2.92E-02
Heptachlor epoxide	23	2	9	3.70E-05	3.41E-02	1.98E-03	1.50E-03	1.27E-01
Methoxychlor	28	9	32	1.20E-04	6.48E-02	5.68E-03	2.20E-03	2.91E-01
PCB-1254	28	6	21	3.80E-02	2.13E-01	5.19E-02	1.30E+00	6.04E-01
PCB-1260	28	8	29	3.60E-03	1.70E-01	3.85E-02	3.30E-01	5.68E-01

Table 14
Statistical Summary and COPC Selection for Swimmer Exposed to River Sediments From Christina River
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC* mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	1 22E-04	1 30E-04	Normal/Lognormal	1 16E-04	3 80E-05	yes	yes
Inorganics							
Aluminum	1 62E+04	2 06E+04	Unknown	2 06E+04	2 00E+06	no	
Antimony	7 91E+00	8 82E+00	Unknown	1 40E+00	8 20E+01	no	
Arsenic	8 77E+00	9 03E+00	Normal/Lognormal	9 03E+00	3 80E+00	yes	yes
Barium	2 71E+02	2 96E+02	Lognormal	2 96E+02	1 40E+04	no	
Beryllium	1 30E+00	1 38E+00	Normal/Lognormal	1 38E+00	4 10E+02	no	
Cadmium	3 27E+00	5 98E+00	Lognormal	5 98E+00	2 00E+02	no	
Chromium	4 90E+01	5 37E+01	Unknown	5.37E+01	3 10E+05	no	
Cobalt	1 23E+01	1 31E+01	Normal	1 31E+01	1 20E+04	no	
Copper	3 38E+01	3 69E+01	Lognormal	3.69E+01	8 20E+03	no	
Iron	2 60E+04	2 88E+04	Unknown	2 88E+04	6 10E+04	no	
Lead[1]	6 16E+01	7 31E+01	Lognormal	7 31E+01	7 50E+02	no	
Manganese	7 36E+02	8 77E+02	Normal	8 77E+02	2 90E+04	no	
Mercury	2 18E-01	3.35E-01	Lognormal	3 35E-01	6 10E+01	no	
Nickel	2 10E+01	2 36E+01	Unknown	2 36E+01	4 10E+03	no	
Selenium	1 37E+00	1 85E+00	Unknown	1 85E+00	1 00E+03	no	
Thallium	2 72E+00	4 09E+00	Unknown	3.50E+00	1 40E+01	no	
Vanadium	4 44E+01	4 94E+01	Unknown	4 94E+01	1 40E+03	no	
Zinc	6 20E+02	7 08E+02	Lognormal	7 08E+02	6 10E+04	no	
PCBs/Pesticides							
4,4'-DDD	4 52E-01	6 66E-01	Unknown	6 66E-01	2.40E+01	no	
4,4'-DDE	2 05E-01	2.65E-01	Unknown	2.65E-01	1 70E+01	no	
4,4'-DDT	3 32E+00	2 27E+01	Unknown	2.27E+01	1 70E+01	yes	yes
alpha-BHC	6 55E-02	1 73E-02	Unknown	1 30E-03	9 10E-01	no	
alpha-Chlordane[2]	1 70E-02	6 49E-03	Unknown	6.49E-03	1.60E+01	no	
delta-BHC[3]	1 80E-02	4 86E-03	Unknown	4 10E-04	9 10E-01	no	
Dieldrin	6 13E-02	5.00E-02	Unknown	4 40E-03	3 60E-01	no	
Endrin aldehyde[4]	8 31E-02	6 71E-02	Unknown	3 70E-03	6 10E+01	no	
Endrin ketone[4]	1 59E-01	3 60E-02	Unknown	1 40E-03	6 10E+01	no	
gamma-Chlordane[2]	1 67E-02	1 15E-02	Lognormal	1 15E-02	1 60E+01	no	
Heptachlor epoxide	7 97E-02	3 93E-02	Unknown	1 50E-03	6 30E-01	no	
Methoxychlor	1 59E-01	1 91E-01	Unknown	2.20E-03	1 00E+03	no	
PCB-1254	4 08E-01	2.33E-01	Unknown	2 33E-01	2 90E+00	no	
PCB-1260	3 52E-01	1 89E-01	Unknown	1 89E-01	2 90E+00	no	

Table 14
Statistical Summary and COPC Selection for Swimmer Exposed to River Sediments From Christina River
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Semivolatiles								
1,2,4-Trichlorobenzene	38	1	3	4 00E-01	4 78E-01	3 68E-01	4 00E-01	5 74E-01
2-Methylnaphthalene	38	1	3	5 00E-02	4 71E-01	3 50E-01	5 00E-02	5 78E-01
4-Methylphenol	38	1	3	7 10E-02	4 72E-01	3 54E-01	7 10E-02	5 77E-01
Acenaphthene	38	5	13	6 00E-02	4 61E-01	3 35E-01	8 80E-01	5.84E-01
Anthracene	38	4	11	8 20E-02	4 55E-01	3 25E-01	1 30E-01	5 85E-01
Benzo(a)anthracene	38	23	61	6 80E-02	4 33E-01	2 61E-01	1 60E+00	6 30E-01
Benzo(a)pyrene	38	19	50	3 30E-02	3.93E-01	2 45E-01	3 30E-01	5 98E-01
Benzo(b)fluoranthene	38	23	61	4 90E-02	4 35E-01	2.88E-01	9 50E-01	5 95E-01
Benzo(g,h,i)perylene	38	12	32	6 70E-02	4.21E-01	2 71E-01	2 50E-01	5 98E-01
Benzo(k)fluoranthene	38	12	32	4 70E-02	4 09E-01	2 51E-01	3 10E-01	5.99E-01
bis(2-Ethylhexyl)phthalate	28	17	61	5 90E-02	8 03E-01	4 34E-01	3 50E+00	9 62E-01
Butylbenzylphthalate	38	8	21	6.50E-02	4 39E-01	2 85E-01	1.20E-01	5 95E-01
Chrysene	34	19	56	5 40E-02	4 58E-01	3 00E-01	1 30E+00	6 33E-01
Di-n-butylphthalate	37	12	32	3 70E-02	4 10E-01	2 42E-01	1 60E-01	6.10E-01
Dibenz(a,h)anthracene	38	1	3	7 00E-02	4 71E-01	3 53E-01	7 00E-02	5 78E-01
Dibenzofuran	38	1	3	6 50E-02	4.71E-01	3 52E-01	6 50E-02	5 78E-01
Diethylphthalate	38	1	3	9 40E-01	5.03E-01	3 86E-01	9.40E-01	5 78E-01
Fluoranthene	38	25	66	6.10E-02	6 08E-01	3 43E-01	5.70E+00	1 03E+00
Fluorene	38	6	16	4.80E-02	4 60E-01	3 10E-01	1 30E+00	6 02E-01
Indeno(1,2,3-c,d)pyrene	37	12	32	5 70E-02	4 16E-01	2.67E-01	3 60E-01	6 04E-01
Naphthalene	38	5	13	6 20E-02	4 66E-01	3 26E-01	7 50E-01	5 87E-01
Pentachlorophenol	38	2	5	6 50E-02	1 16E+00	8.23E-01	1.30E-01	1 45E+00
Phenanthrene	38	22	58	6 00E-02	5 58E-01	2 78E-01	6 00E+00	1.09E+00
Pyrene	38	24	63	8 50E-02	5 80E-01	3 52E-01	4.80E+00	9 13E-01
Volatiles								
1,1,2,2-Tetrachloroethane	17	5	29	2 00E-01	8 93E-02	2 46E-02	4 00E-01	1 38E-01
2-Butanone	12	5	42	1 60E-02	1 86E-02	1 35E-02	6 30E-02	1.75E-02
Acetone	11	6	55	1 50E-01	2 40E-01	6 64E-02	9 10E-01	3 37E-01

Table 14
Statistical Summary and COPC Selection for Swimmer Exposed to River Sediments From Christina River
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC* mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Semivolatiles							
1,2,4-Trichlorobenzene	6.36E-01	5.24E-01	Unknown	4.00E-01	2.00E+03	no	
2-Methylnaphthalene	6.30E-01	5.44E-01	Unknown	5.00E-02	4.10E+03	no	
4-Methylphenol	6.31E-01	5.34E-01	Unknown	7.10E-02	1.00E+03	no	
Acenaphthene	6.22E-01	5.34E-01	Unknown	5.34E-01	1.20E+04	no	
Anthracene	6.16E-01	5.32E-01	Unknown	1.30E-01	6.10E+04	no	
Benzo(a)anthracene	6.06E-01	5.51E-01	Lognormal	5.51E-01	7.80E+00	no	
Benzo(a)pyrene	5.58E-01	4.88E-01	Unknown	3.30E-01	7.80E-01	no	
Benzo(b)fluoranthene	5.99E-01	5.43E-01	Lognormal	5.43E-01	7.80E+00	no	
Benzo(g,h,i)perylene	5.85E-01	5.20E-01	Unknown	2.50E-01	NA	NA	yes
Benzo(k)fluoranthene	5.74E-01	5.41E-01	Unknown	3.10E-01	7.80E+01	no	
bis(2-Ethylhexyl)phthalate	1.11E+00	1.44E+00	Lognormal	1.44E+00	4.10E+02	no	
Butylbenzylphthalate	6.03E-01	5.68E-01	Unknown	1.20E-01	4.10E+04	no	
Chrysene	6.42E-01	5.72E-01	Unknown	5.72E-01	7.80E+02	no	
Di-n-butylphthalate	5.80E-01	5.65E-01	Lognormal	1.60E-01	2.00E+04	no	
Dibenz(a,h)anthracene	6.30E-01	5.34E-01	Unknown	7.00E-02	7.80E-01	no	
Dibenzofuran	6.30E-01	5.36E-01	Unknown	6.50E-02	8.20E+02	no	
Diethylphthalate	6.61E-01	5.60E-01	Unknown	5.60E-01	1.60E+05	no	
Fluoranthene	8.92E-01	7.56E-01	Unknown	7.56E-01	8.20E+03	no	
Fluorene	6.25E-01	5.81E-01	Unknown	5.81E-01	8.20E+03	no	
Indeno(1,2,3-c,d)pyrene	5.85E-01	5.15E-01	Unknown	3.60E-01	7.80E+00	no	
Naphthalene	6.28E-01	5.76E-01	Unknown	5.76E-01	4.10E+03	no	
Pentachlorophenol	1.56E+00	1.47E+00	Unknown	1.30E-01	4.80E+01	no	
Phenanthrene	8.58E-01	6.65E-01	Unknown	6.65E-01	NA	NA	yes
Pyrene	8.32E-01	6.92E-01	Unknown	6.92E-01	6.10E+03	no	
Volatiles							
1,1,2,2-Tetrachloroethane	1.48E-01	4.06E-01	Unknown	4.00E-01	2.90E+01	no	
2-Butanone	2.76E-02	3.35E-02	Lognormal	3.35E-02	1.20E+05	no	
Acetone	4.24E-01	1.01E+01	Lognormal	9.10E-01	2.00E+04	no	

* Since the only sediment exposure route evaluated for the swimmer scenario was dermal contact, comparison of maximum concentrations to the industrial soil RBC were most appropriate

NA - Not available

[1] *The screening level of 750 mg/kg is based on US EPA's adult blood lead uptake model under default exposure assumptions*

[2] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark

[3] This compound has no published RBC or RfD value. It is sufficiently close in toxicity to alpha-BHC so that the alpha-BHC RBC is applicable to its congener as a provisional benchmark.

[4] These compounds have no published RBC or RfD values. They are sufficiently close in toxicity to Endrin so that the Endrin RBC is applicable to its congeners as a provisional benchmark.

Table 15
Statistical Summary and COPC Selection for Swimmer Exposed to River Sediments From White Clay Creek Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Dioxins								
2,3,7,8-TCDD Equiv	2	2	100	1.35E-04	1.65E-04	1.63E-04	1.95E-04	4.22E-05
Inorganics								
Aluminum	17	17	100	3.35E+03	1.47E+04	1.23E+04	2.67E+04	7.44E+03
Arsenic	14	11	79	1.20E+00	4.50E+00	3.83E+00	8.30E+00	2.25E+00
Barium	17	17	100	3.63E+01	1.81E+02	1.37E+02	6.67E+02	1.52E+02
Beryllium	15	15	100	2.80E-01	1.02E+00	9.19E-01	1.60E+00	4.24E-01
Cadmium	17	6	35	4.20E-01	1.67E+00	8.05E-01	3.70E+00	1.23E+00
Chromium	17	17	100	1.04E+01	3.24E+01	2.88E+01	5.21E+01	1.44E+01
Cobalt	17	17	100	3.00E+00	1.25E+01	1.08E+01	2.26E+01	5.93E+00
Copper	17	17	100	4.50E+00	2.08E+01	1.68E+01	5.00E+01	1.30E+01
Iron	17	17	100	7.65E+03	2.09E+04	1.91E+04	3.11E+04	7.88E+03
Lead[1]	17	17	100	6.80E+00	2.99E+01	2.32E+01	7.92E+01	2.19E+01
Manganese	17	17	100	1.34E+02	4.33E+02	3.74E+02	1.01E+03	2.37E+02
Mercury	17	9	53	2.90E-02	1.05E-01	9.08E-02	2.40E-01	5.83E-02
Nickel	16	16	100	4.20E+00	1.85E+01	1.63E+01	2.77E+01	7.61E+00
Thallium	13	2	15	4.00E+00	4.86E+00	4.85E+00	4.20E+00	3.40E-01
Vanadium	17	17	100	1.31E+01	4.35E+01	3.83E+01	6.71E+01	1.89E+01
Zinc	17	17	100	7.34E+01	4.11E+02	2.95E+02	1.21E+03	3.54E+02
PCBs/Pesticides								
4,4'-DDD	6	6	100	3.20E-05	4.59E-03	9.84E-04	2.30E-02	9.04E-03
4,4'-DDE	6	5	83	5.40E-04	2.21E-03	1.34E-03	6.60E-03	2.48E-03
4,4'-DDT	6	3	50	6.40E-04	3.03E-02	4.22E-03	1.70E-01	6.84E-02
alpha-Chlordane[2]	6	4	67	1.80E-04	8.83E-04	6.33E-04	9.10E-04	7.13E-04
delta-BHC[3]	6	1	17	1.90E-04	1.27E-03	1.04E-03	1.90E-04	6.03E-04
Dieldrin	6	2	33	8.30E-05	1.94E-03	9.26E-04	1.30E-04	1.54E-03
Endrin aldehyde[4]	6	2	33	2.00E-04	1.66E-03	1.06E-03	2.30E-04	1.20E-03
gamma-Chlordane[2]	6	4	67	2.00E-04	8.05E-04	5.49E-04	6.30E-04	7.42E-04
Heptachlor epoxide	6	1	17	4.60E-04	1.24E-03	1.12E-03	4.60E-04	5.23E-04
Methoxychlor	6	3	50	3.20E-04	8.48E-03	3.04E-03	1.00E-03	8.78E-03
Semivolatiles								
Benzo(a)anthracene	17	5	29	2.30E-01	5.25E-01	4.28E-01	4.30E-01	4.03E-01
Benzo(a)pyrene	17	1	6	7.30E-01	5.49E-01	4.71E-01	7.30E-01	3.59E-01
Benzo(b)fluoranthene	*17*	*8*	*47*	*4.60E-02*	*4.89E-01*	*3.77E-01*	*8.30E-01*	*3.90E-01*
Benzo(g,h,i)perylene	17	1	6	2.60E-01	5.54E-01	4.60E-01	2.60E-01	3.93E-01
Benzo(k)fluoranthene	17	1	6	1.10E-01	5.65E-01	4.61E-01	1.10E-01	3.94E-01
bis(2-Ethylhexyl)phthalate	14	3	21	2.20E-01	5.91E-01	4.85E-01	3.90E-01	4.23E-01
Chrysene	17	4	24	1.50E-01	5.26E-01	4.20E-01	4.30E-01	4.07E-01
Di-n-butylphthalate	17	3	18	1.60E-01	5.45E-01	4.41E-01	3.70E-01	4.02E-01
Fluoranthene	17	8	47	4.80E-02	5.42E-01	4.49E-01	1.10E+00	2.89E-01
Indeno(1,2,3-c,d)pyrene	17	1	6	2.40E-01	5.52E-01	4.58E-01	2.40E-01	3.94E-01
Naphthalene	17	1	6	4.00E-01	5.85E-01	5.04E-01	4.00E-01	3.76E-01
Phenanthrene	17	7	41	1.80E-01	4.84E-01	3.92E-01	6.40E-01	3.81E-01
Pyrene	17	8	47	4.10E-02	5.43E-01	4.01E-01	8.00E-01	3.89E-01

Table 15

Statistical Summary and COPC Selection for Swimmer Exposed to River Sediments From White Clay Creek

Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins							
2,3,7,8-TCDD Equiv	3.54E-04	8.36E-04	Unknown	1.95E-04	3.80E-05	yes	yes
Inorganics							
Aluminum	1.79E+04	2.28E+04	Normal/Lognormal	2.28E+04	2.00E+06	no	
Arsenic	5.57E+00	7.10E+00	Normal/Lognormal	7.10E+00	3.80E+00	yes	yes
Barium	2.45E+02	2.91E+02	Lognormal	2.91E+02	1.40E+04	no	
Beryllium	1.21E+00	1.40E+00	Normal/Lognormal	1.40E+00	4.10E+02	no	
Cadmium	2.19E+00	1.59E+01	Unknown	3.70E+00	2.00E+02	no	
Chromium	3.85E+01	4.38E+01	Normal/Lognormal	4.38E+01	3.10E+05	no	
Cobalt	1.50E+01	1.81E+01	Normal/Lognormal	1.81E+01	1.20E+04	no	
Copper	2.63E+01	3.22E+01	Normal/Lognormal	3.22E+01	8.20E+03	no	
Iron	2.42E+04	2.71E+04	Normal	2.71E+04	6.10E+04	no	
Lead[1]	3.91E+01	4.74E+01	Normal/Lognormal	4.74E+01	7.50E+02	no	
Manganese	5.34E+02	5.98E+02	Normal/Lognormal	5.98E+02	2.90E+04	no	
Mercury	1.30E-01	1.47E-01	Lognormal	1.47E-01	6.10E+01	no	
Nickel	2.18E+01	2.64E+01	Normal	2.64E+01	4.10E+03	no	
Thallium	5.03E+00	5.05E+00	Unknown	4.20E+00	1.40E+01	no	
Vanadium	5.15E+01	6.09E+01	Normal	6.09E+01	1.40E+03	no	
Zinc	5.61E+02	6.93E+02	Lognormal	6.93E+02	6.10E+04	no	
PCBs/Pesticides							
4,4'-DDD	1.20E-02	1.89E+01	Lognormal	2.30E-02	2.40E+01	no	
4,4'-DDE	4.25E-03	1.82E-02	Normal/Lognormal	6.60E-03	1.70E+01	no	
4,4'-DDT	8.66E-02	1.50E+01	Lognormal	1.70E-01	1.70E+01	no	
alpha-Chlordane[2]	1.47E-03	5.24E-03	Normal/Lognormal	9.10E-04	1.60E+01	no	
delta-BHC[3]	1.77E-03	6.08E-03	Normal	1.90E-04	9.10E-01	no	
Dieldrin	3.20E-03	6.68E-01	Normal/Lognormal	1.30E-04	3.60E-01	no	
Endrin aldehyde[4]	2.65E-03	3.71E-02	Normal/Lognormal	2.30E-04	6.10E+01	no	
gamma-Chlordane[2]	1.42E-03	4.96E-03	Normal/Lognormal	6.30E-04	1.60E+01	no	
Heptachlor epoxide	1.67E-03	2.35E-03	Normal/Lognormal	4.60E-04	6.30E-01	no	
Methoxychlor	1.57E-02	7.37E+00	Normal/Lognormal	1.00E-03	1.00E+03	no	
Semivolatiles							
Benzo(a)anthracene	6.96E-01	7.27E-01	Lognormal	4.30E-01	7.80E+00	no	
Benzo(a)pyrene	7.01E-01	7.33E-01	Lognormal	7.30E-01	7.80E-01	no	
Benzo(b)fluoranthene	6.54E-01	8.16E-01	Lognormal	8.16E-01	7.80E+00	no	
Benzo(g,h,i)perylene	7.20E-01	7.62E-01	Lognormal	2.60E-01	NA	NA	yes
Benzo(k)fluoranthene	7.32E-01	8.39E-01	Lognormal	1.10E-01	7.80E+01	no	
bis(2-Ethylhexyl)phthalate	7.92E-01	8.85E-01	Lognormal	3.90E-01	4.10E+02	no	
Chrysene	6.98E-01	7.62E-01	Lognormal	4.30E-01	7.80E+02	no	
Di-n-butylphthalate	7.15E-01	7.85E-01	Lognormal	3.70E-01	2.00E+04	no	
Fluoranthene	6.65E-01	9.05E-01	Normal/Lognormal	9.05E-01	8.20E+03	no	
Indeno(1,2,3-c,d)pyrene	7.19E-01	7.63E-01	Lognormal	2.40E-01	7.80E+00	no	
Naphthalene	7.45E-01	7.75E-01	Lognormal	4.00E-01	4.10E+03	no	
Phenanthrene	6.46E-01	6.79E-01	Lognormal	6.40E-01	NA	NA	yes
Pyrene	7.08E-01	1.17E+00	Normal	8.00E-01	6.10E+03	no	

Table 15
Statistical Summary and COPC Selection for Swimmer Exposed to River Sediments From White Clay Creek
Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Volatiles								
2-Butanone	13	3	23	1 00E-02	1 07E-02	9 56E-03	2 60E-02	6 31E-03
Acetone	11	5	45	1 00E-02	3 59E-02	1 85E-02	1 50E-01	4 52E-02
Carbon Disulfide	13	1	8	5 00E-03	7 77E-03	7 63E-03	5 00E-03	1 52E-03
Tetrachloroethene	13	4	31	1 00E-03	7 88E-03	6 93E-03	1 30E-02	3 04E-03
Toluene	13	1	8	1 00E-02	8.15E-03	8 05E-03	1 00E-02	1 39E-03

Table 15
Statistical Summary and COPC Selection for Swimmer Exposed to River Sediments From White Clay Creek
Former Koppers Company, Inc., Newport, DE

Analyte	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Industrial Soil RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Volatiles							
2-Butanone	1 38E-02	1 38E-02	Unknown	1.38E-02	1 20E+05	no	
Acetone	6 06E-02	1 27E-01	Lognormal	1 27E-01	2 00E+04	no	
Carbon Disulfide	8 52E-03	8.66E-03	Normal/Lognormal	5.00E-03	2 00E+04	no	
Tetrachloroethene	9 38E-03	1 32E-02	Normal	1 30E-02	1 10E+02	no	
Toluene	8 84E-03	8 91E-03	Normal/Lognormal	8 91E-03	4 10E+04	no	

* Since the only sediment exposure route evaluated for the swimmer scenario was dermal contact, comparison of maximum concentrations to the industrial soil RBC were most appropriate

NA - Not available

[1] The screening level of 750 mg/kg is based on US EPA's adult blood lead uptake model under default exposure assumptions

[2] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Chlordane so that the Chlordane RBC is applicable to its congeners as a provisional benchmark.

[3] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to alpha-BHC so that the alpha-BHC RBC is applicable to its congeners as a provisional benchmark.

[4] These compounds have no published RBC or RfD values They are sufficiently close in toxicity to Endrin so that the Endrin RBC is applicable to its congeners as a provisional benchmark.

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Table 16

Statistical Summary* and COPC Selection for Angler Ingesting Locally Caught Fish

Former Koppers Company, Inc., Newport, DE

Analyte	Total # of Samples	Hits	Hit Frequency %	Minimum Detected mg/kg	Mean mg/kg	Lognormal Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Fish RBC mg/kg	Is Maximum >RBC?	Is Detection Frequency >5%?
Dioxins															
2,3,7,8-TCDD Equiv	3	3	100	8 02E-07	8 89E-07	8 86E-07	9 90E-07	9 46E-08	1 05E-06	1 10E-06	Normal/Lognormal	9 90E-07	2 10E-08	yes	yes
Inorganics															
Aluminum	[illegible]	[illegible]	100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2 59E+00	4 51E+00	Normal/Lognormal	2 23E+00	1 40E+02	no	
Arsenic	3	3	100	3 33E-01	5 40E-01	5 17E-01	6 59E-01	1 80E-01	8.43E-01	2 13E+00	Normal/Lognormal	6 59E-01	2 10E-03	yes	yes
Barium	3	3	100	9.41E-02	1.05E-01	1.04E-01	1.27E-01	1.86E-02	1.37E-01	1.53E-01	Normal/Lognormal	1.27E-01	9.50E+00	no	
Chromium	3	3	100	9 52E-02	1 13E-01	1 13E-01	1 26E-01	1 60E-02	1 40E-01	1 55E-01	Normal/Lognormal	1.26E-01	2 00E+02	no	
Copper	3	3	100	4 60E-01	4 98E-01	4 97E-01	5 18E-01	3 30E-02	5 54E-01	5.65E-01	Normal/Lognormal	5 18E-01	5 40E+00	no	
Iron	3	3	100	4 20E+00	4 93E+00	4 89E+00	5 80E+00	8 09E-01	6 30E+00	7 03E+00	Normal/Lognormal	5 80E+00	4 10E+01	no	
Lead	3	3	100	1 10E-01	1 19E-01	1 18E-01	1 27E-01	8.55E-03	1 33E-01	1 36E-01	Normal/Lognormal	1 27E-01	NA	NA	yes
Mercury	3	3	100	1 11E-01	1 69E-01	1 59E-01	2 54E-01	7 51E-02	2 95E-01	9 09E-01	Normal/Lognormal	2 54E-01	4 10E-02	yes	yes
Nickel	3	1	33 33	1 74E-01	9 95E-02	8 75E-02	1 74E-01	6 49E-02	2 09E-01	2 79E+00	Normal/Lognormal	1 74E-01	2 70E+00	no	
Selenium	3	3	100	3 69E-01	3 95E-01	3 95E-01	4 28E-01	3.02E-02	4 46E-01	4 56E-01	Normal/Lognormal	4 28E-01	6 80E-01	no	
Zinc	3	3	100	4.47E+00	4.64E+00	4.64E+00	4.85E+00	1.92E-01	4.96E+00	5.00E+00	Normal/Lognormal	4.85E+00	4.10E+01	no	
PCBs/Pesticides															
Aroclor 1254	3	3	100	3 40E-01	3 77E-01	3 75E-01	4 20E-01	4 04E-02	4 45E-01	4 65E-01	Normal/Lognormal	4 20E-01	1 60E-03	yes	yes
Aroclor 1260	3	3	100	1 40E-01	1 93E-01	1 89E-01	2 40E-01	5 03E-02	2.78E-01	4 15E-01	Normal/Lognormal	2 40E-01	1 60E-03	yes	yes
4,4'-DDD	3	3	100	2.40E-02	3 23E-02	3 13E-02	4 40E-02	1 04E-02	4 99E-02	8 26E-02	Normal/Lognormal	4 40E-02	1 30E-02	yes	yes
4,4'-DDE	3	3	100	6 90E-02	9 37E-02	9 03E-02	1 30E-01	3 21E-02	1 48E-01	2 63E-01	Normal/Lognormal	1 30E-01	9 30E-03	yes	yes
Volatiles															
Tetrachloroethene	3	2	66 67	9 00E-04	2 30E-03	1 65E-03	1 00E-03	2 34E-03	6.24E-03	1 32E+01	Normal/Lognormal	1 00E-03	6 10E-02	no	

*Statistics were calculated on a wet-weight basis from data derived from edible fish tissue samples collected in White Clay Creek

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Table 17

Exposure Pathway Analysis

Former Koppers Company, Inc., Newport, DE

Media	Potential Exposure Point	Potential Exposure Route	Potentially Exposed Population	Selected for Analysis	Data Set to be Used	Exposure Assumptions
Soil, Non-river Sediment	On-site	Dermal contact Ingestion Inhalation	Construction Worker	Yes	Soil and NAPL Data combined	Occupational
	On-site	Dermal contact w/ Ingestion	Industrial Worker	Yes	Soil and NAPL Data combined	Occupational
	On-site	Dermal contact w/ Ingestion	Adolescent Trespasser	Yes	Soil and Non-River Sediment separately	Recreational
	On-site	Dermal contact Ingestion Inhalation	Future On-site Residence	No - Not conducive to residential development	N/A	N/A
River Sediment	On-site	Dermal contact	Adolescent Swimmer	Yes	Christina River, White Clay Creek sediment	Recreational
Non-river Surface Water	On-site	Dermal contact	Adolescent Trespasser	Yes	Non-river, Hershey Run surface water	Recreational
River Surface Water	On-site	Dermal contact Ingestion	Adolescent Swimmer	Yes	Christina River, White Clay Creek surface water	Recreational
Ground Water	On-site	Dermal contact Ingestion Inhalation	Industrial Worker	Yes	Columbia, Potomac aquifer ground water	Occupational
	Future Residential Drinking Water	Ingestion Dermal contact Inhalation	Future On-site Residence	No - Not conducive to residential development	N/A	N/A

Table 17

Exposure Pathway Analysis

Former Koppers Company, Inc., Newport, DE

Media	Potential Exposure Point	Potential Exposure Route	Potentially Exposed Population	Selected for Analysis	Data Set to be Used	Exposure Assumptions
Air						
	On-site	Inhalation	Construction Worker	Yes	Soil/NAPL Data	Occupational
	On-site	Inhalation	Industrial Worker	No - wet conditions preclude volatilization	N/A	N/A
	On-site	Inhalation	Trespasser	No - wet conditions - preclude volatilization	N/A	N/A
	On-site	Inhalation	Resident	No - Not conducive to residential development	N/A	N/A
Fish Tissue						
	On-site	Ingestion	Local Fisherperson	Yes	Edible fish filet data	Recreational

N/A Not Applicable

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Table 3. RME Exposure Parameters Used in the Assessment of Potential Intakes
[HHRA Table 19]

Table 19

Reasonable Maximum Exposure Parameters Used in the Assessment of Potential Intakes

Former Koppers Company, Inc., Newport, DE

Receptor/Pathway/Route	Contact Rate	Exposure Frequency and Duration	Absorption	Body Weight	Averaging Time
Future Construction Worker					
Soil/NAPL					
Dermal	Total surface area. 20,000 cm^2 (5) Fraction surface area available 9 1% (2) Exposed surface area: (face, hands) 1820 cm^2	120 days/year (1) 1 year (1) Adherence 0 11 mg/cm^2 (4)	0 01 for inorganics (7) 0.10 for semivolatiles (7) 0 10 for pesticides/PCBs (7)	70 kg (3)	For noncarcinogenic effects Exposure is averaged over 1-year period, exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Oral	Ingestion Rate 50 mg/day (6)	120 days/year (1) 1 year (1)		70 kg (3)	For noncarcinogenic effects· Exposure is averaged over 1-year period, exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Inhalation	Inhalation Rate: 20 m^3/day (6)	120 days/year (1) 1 year (1)	Retention Factors Volatiles - 1 0 or 0 5 (11) Dusts - 0.75 (9) Fraction of PM_{15} respirable - 0 84	70 kg (3)	For noncarcinogenic effects Exposure is averaged over 1-year period, exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Future Industrial Worker					
Soil/NAPL					
Dermal	Total surface area 20,000 cm^2 (5) Fraction surface area available 9.1% (2) Exposed surface area (face, hands) 1820 cm^2	134 days/year (8) 25 years (6) Adherence 0 11 mg/cm^2 (4)	0 01 for inorganics (7) 0 10 for semivolatiles (7) 0 10 for pesticides/PCBs (7)	70 kg (3)	For noncarcinogenic effects Exposure is averaged over 25-year period, exposure is of chronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime

Table 19

Reasonable Maximum Exposure Parameters Used in the Assessment of Potential Intakes

Former Koppers Company, Inc., Newport, DE

Receptor/Pathway/Route	Contact Rate	Exposure Frequency and Duration	Absorption	Body Weight	Averaging Time
Oral	Ingestion Rate 50 mg/day (6)	134 days/year (8) 25 years (6)		70 kg (3)	For noncarcinogenic effects Exposure is averaged over 25-year period, exposure is of chronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Ground water					
Dermal (while showering)	Total surface area 20,000 cm^2 (5) Fraction surface area available 100% (1) Exposed surface area 20,000 cm^2	15 min/shower (5) 250 showers/year (10) 25 years (6)	chemical specific (5)	70 kg (3)	For noncarcinogenic effects: Exposure is averaged over 25-year period, exposure is of chronic duration For carcinogenic effects. Exposure is averaged over a 70-year lifetime
Oral	Ingestion Rate 1 L/day (6)	250 days/year (10) 25 years (6)		70 kg (3)	For noncarcinogenic effects. Exposure is averaged over 25-year period, exposure is of chronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Inhalation (while showering)	Air Exchange Rate: 0.5 /hr (10) Ventilation Rate. 15 L/min (10) Shower Room Air Volume: 6 m^3 (10)	Duration in Shower Room 5 min (2) 15 min/shower (4) 250 showers/year (10) 25 years (6)	chemical specific (5)	70 kg (3)	For noncarcinogenic effects Exposure is averaged over 25-year period, exposure is of chronic duration For carcinogenic effects: Exposure is averaged over a 70-year lifetime
Adolescent Trespasser (Ages 12-18)					
Soil/SNAPL					
Dermal	Total Skin Surface Area 15758 cm^2 (4) Fraction surface area available 27.8% (2) Exposed surface area (Face, arms, hands, legs) 4381 cm^2	24 events/year (1) 6 years (1) Adherence. 0.025mg/cm^2 (4)	0.01 for inorganics (7) 0.10 for semivolatiles (7) 0.10 for pesticides/PCBs (7)	56 kg (4)	For noncarcinogenic effects Exposure is averaged over 6-year period; exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime

Table 19

Reasonable Maximum Exposure Parameters Used in the Assessment of Potential Intakes

Former Koppers Company, Inc., Newport, DE

Receptor/Pathway/Route	Contact Rate	Exposure Frequency and Duration	Absorption	Body Weight	Averaging Time
Oral	Ingestion Rate: 100 mg/event (6)	24 events/year (1) 6 years (1)		56 kg (4)	For noncarcinogenic effects Exposure is averaged over 6-year period, exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Sediment					
Dermal	Total Skin Surface Area 15758 cm² (4) Fraction surface area available 7% (2) Exposed surface area. (Face, arms, hands, legs) 1103 cm²	10 events/year (1) 6 years (1) Adherence: 0.025mg/cm² (4)	0.01 for inorganics (7) 0.10 for semivolatiles (7) 0.10 for pesticides/PCBs (7)	56 kg (4)	For noncarcinogenic effects Exposure is averaged over 6-year period, exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Oral	Ingestion Rate: 100 mg/event (6)	10 events/year (1) 6 years (1)		56 kg (4)	For noncarcinogenic effects Exposure is averaged over 6-year period; exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Non-river surface water					
Dermal what about ingestion?	Exposed surface area (Lower legs) 207 cm² (5)	1.0 hr/event (5) 24 events/year (1) 6 years (1)	chemical specific (5)	56 kg (4)	For noncarcinogenic effects. Exposure is averaged over 6-year period, exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Adolescent Swimmer (Ages 12-18)					
River surface water*					
Dermal	Total Skin Surface Area 15758 cm² (4) Fraction surface area available 100% (1)	1.0 hr/event (5) 24 events/year (1) 6 years (1)	0.01 for inorganics (7) 0.10 for semivolatiles (7) 0.10 for pesticides/PCBs (7)	56 kg (4)	For noncarcinogenic effects Exposure is averaged over 6-year period, exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime

Table 19

Reasonable Maximum Exposure Parameters Used in the Assessment of Potential Intakes
Former Koppers Company, Inc., Newport, DE

Receptor/Pathway/Route	Contact Rate	Exposure Frequency and Duration	Absorption	Body Weight	Averaging Time
Oral	Ingestion Rate 50 ml/hr (3)	1 0 hr/event (5) 24 events/year (1) 6 years (1)		56 kg (4)	For noncarcinogenic effects Exposure is averaged over 6-year period; exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
River sediment					
Dermal	Total Skin Surface Area 15758 cm^2 (4) Fraction surface area available 7% (2) Exposed surface area (feet) 1103 cm^2	24 events/year (1) 6 years (1) Adherence 0 63 mg/cm^2 (4)	0 01 for inorganics (7) 0.10 for semivolatiles (7) 0 10 for pesticides/PCBs (7)	56 kg (4)	For noncarcinogenic effects Exposure is averaged over 6-year period, exposure is of subchronic duration For carcinogenic effects Exposure is averaged over a 70-year lifetime
Adult Fisherperson					
Locally caught fish					
Oral	Ingestion Rate: 25 g/day (2)	365 events/year (3) 25 years (1)		70 kg (3)	For noncarcinogenic effects Exposure is averaged over 25-year period, exposure is of chronic duration For carcinogenic effects. Exposure is averaged over a 70-year lifetime

* These exposure routes could not be evaluated as lead was the only COPC selected and lead does not have published toxicity values.

(1) Best Professional Judgement
(2) US EPA 1996, Exposures Factors Handbook
(3) US EPA, 1989, RAGS Part A
(4) *Calculated based on data in US EPA 1996, Exposure Factors Handbook*
(5) US EPA, 1992, Dermal Exposure Assessment
(6)US EPA 1991, Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors
(7) US EPA 1995, Region III
(8) Calculated based on Michigan Dept. of Natural Resources 1995, Operational Memorandum #14, Rev 2
(9) International Commission on Radiological Protection
(10) Foster and Chrostowski, "Inhalation Exposures to Volatile Organic Contaminants in the Shower"
(11) Depending on whether toxicity benchmark (RfD or CSF) is based on administered or absorbed dose

Table 21

Summary of Toxicity Indices

Former Koppers Company, Inc, Newport, DE

Chemical	Oral Chronic RfD mg/kg-day	Soure	Inhalation Chronic RfD mg/kg-day	Soure	GI Tract Absorption Factor	Dermal Chronic RfD[1] mg/kg-day	Oral Subchronic RfD mg/kg-day	Soure	Inhalation Subchronic RfD mg/kg-day	Source	Dermal Subchronic RfD[1] mg/kg-day	Oral CSF 1/(mg/kg-day)	Source	Inhalation CSF 1/(mg/kg-day)	Source	Dermal CSF[1] 1/(mg/kg-day)
Dioxins																
2,3,7,8-TCDD	NA		NA		0 5	NA	NA		NA		NA	1 50E+05	H	1 50E+05	H	3 00E+05
Inorganics																
Antimony	4 00E-04	IRIS	NA		0.01	4 00E-06	4.00E-04	H	NA		4 00E-06	NA		NA		NA
Arsenic	3 00E-04	IRIS	NA		0 95	2.85E-04	3.00E-04	H	NA		2 85E-04	1 50E+00	IRIS	1 51E+01	IRIS	1 58E+00
Beryllium	2 00E-03	IRIS	5.70E-06	IRIS	0 1	2 00E-04	5 00E-03	H	NA		5 00E-04	4 30E+00	IRIS	8 40E+00	IRIS	4 30E+01
Cadmium-Water	5.00E-04	IRIS	5 71E-05	W	0 6	3.00E-04	NA		NA		NA	NA		6.30E+00	IRIS	NA
Copper	4 00E-02	H	NA		0 6	2 40E-02	3 71E-02	H	NA		2 23E-02	NA		NA		NA
Iron	3 00E-01	E	NA		0 5	1 50E-01	NA		NA		NA	NA		NA		NA
Lead	NA		NA		NA	NA	NA		NA		NA	NA		NA		NA
Manganese-water	1 40E-01	IRIS	1.43E-05	IRIS	NA	NA	NA		NA		NA	NA		NA		NA
Manganese-soils	2 00E-02	IRIS	1 43E-05	IRIS	0 05	1.00E-03	1 40E-01	H	NA		7 00E-03	NA		NA		NA
Mercury	NA		8 60E-05	IRIS	0 07	NA	3.00E-04	H	8 57E-05	HE	2 10E-05	NA		NA		NA
Thallium	7.00E-05	O	NA		0 8	5 60E-05	NA		NA		NA	NA		NA		NA
PCBs/Pesticides																
alpha-Chlordane	5.00E-04	IRIS	2 00E-04	IRIS	0 3	1 50E-04	6 00E-05	H	NA		1 80E-05	3 50E-01	IRIS	3 50E-01	IRIS	1 17E+00
Aroclor 1254	2 00E-05	IRIS	NA		0 9	1 80E-05	5 00E-05	H	NA		4.50E-05	2 00E+00	IRIS	2 00E+00	IRIS	2 22E+00
Aroclor 1260	2 00E-05	IRIS	NA		0 9	1 80E-05	NA	H	NA		NA	2.00E+00	IRIS	2 00E+00	IRIS	2 22E+00
4,4'-DDD	NA		NA		0.7	NA	NA		NA		NA	2.40E-01	IRIS	NA		3.43E-01
4,4'-DDE	NA		NA		0 7	NA	NA		NA		NA	3 40E-01	IRIS	NA		4 86E-01
4,4'-DDT	5 00E-04	IRIS	NA		0 7	3 50E-04	5 00E-04	H	NA		3.50E-04	3 40E-01	IRIS	3 40E-01	IRIS	4 86E-01
Dieldrin	5.00E-05	IRIS	NA		0 3	1 50E-05	5 00E-05	H	NA		1.50E-05	1 60E+01	IRIS	1 60E+01	IRIS	5 33E+01
Heptachlor	5.00E-04	IRIS	NA		0 3	1 50E-04	5 00E-04	H	NA		1 50E-04	4 50E+00	IRIS	4 50E+00	IRIS	1 50E+01
Heptachlor epoxide	1 30E-05	IRIS	NA		0 3	3 90E-06	1 30E-05	H	NA		3 90E-06	9 10E+00	IRIS	9 10E+00	IRIS	3 03E+01
Semivolatiles																
2,4-Dimethylphenol	2.00E-02	IRIS	NA		0 7	1 40E-02	2 00E-01	H	NA		1 40E-01	NA		NA		NA
2-Methylnaphthalene	2.00E-02	O	NA		0 7	1 40E-02	NA		NA		NA	NA		NA		NA
2-Methylphenol	5 00E-02	IRIS	NA		0 7	3.50E-02	5 00E-01	H	NA		3.50E-01	NA		NA		NA
4-Methylphenol	5 00E-03	H	NA		0 7	3 50E-03	5 00E-03	H	NA		3 50E-03	NA		NA		NA
Acenaphthene	6.00E-02	IRIS	NA		0 7	4 20E-02	6 00E-01	H	NA		4 20E-01	NA		NA		NA

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Table 21

Summary of Toxicity Indices

Former Koppers Company, Inc, Newport, DE

Chemical	Oral Chronic RfD mg/kg-day	Sourc	Inhalation Chronic RfD mg/kg-day	Sourc	GI Tract Absorption Factor	Dermal Chronic RfD(1) mg/kg-day	Oral Subchronic RfD mg/kg-day	Sourc	Inhalation Subchronic RfD mg/kg-day	Source	Dermal Subchronic RfD(1) mg/kg-day	Oral CSF 1/(mg/kg-day)	Source	Inhalation CSF 1/(mg/kg-day)	Source	Dermal CSF(1) 1/(mg/kg-day)
Acenaphthylene	NA		NA		NA	NA	NA		NA		NA	NA		NA		NA
Anthracene	3 00E-01	IRIS	NA		0 7	2 10E-01	3 00E+00	H	NA		2 10E+00	NA		NA		NA
Benzo(a)anthracene	NA		NA		NA	NA	NA		NA		NA	7 30E-01	E	NA		NA
Benzo(a)pyrene	NA		NA		NA	NA	NA		NA		NA	7 30E+00	IRIS	3 10E+00	E	NA
Benzo(b)fluoranthene	NA		NA		NA	NA	NA		NA		NA	7 30E-01	E	NA		NA
Benzo(g,h,i)perylene	NA		NA		NA	NA	NA		NA		NA	NA		NA		NA
Benzo(k)fluoranthene	NA		NA		NA	NA	NA		NA		NA	7 30E-02	E	NA		NA
Bis(2-ethylhexyl) phthalate	2.00E-02	IRIS	NA		0 7	1 40E-02	NA		NA		NA	1 40E-02	IRIS	1 40E-02	E	2 00E-02
Carbazole	NA		NA		NA	NA	NA		NA		NA	2 00E-02	H	NA		NA
Chrysene	NA		NA		NA	NA	NA		NA		NA	7 30E-03	E	NA		NA
Dibenz(a,h)anthracene	NA		NA		NA	NA	NA		NA		NA	7.30E+00	E	NA		NA
Dibenzofuran	4.00E-03	E	NA		0.7	2 80E-03	NA		NA		NA	NA		NA		NA
Fluoranthene	4 00E-02	IRIS	NA		0 7	2.80E-02	4.00E-01	H	NA		2 80E-01	NA		NA		NA
Fluorene	4.00E-02	IRIS	NA		0 7	2.80E-02	4 00E-01	H	NA		2 80E-01	NA		NA		NA
Indeno(1,2,3-cd)pyrene	NA		NA		NA	NA	NA		NA		NA	7 30E-01	E	NA		NA
Naphthalene	2 00E-02	IRIS	9 00E-04	IRIS	0 7	1.40E-02	NA		NA		NA	NA		NA		NA
Pentachlorophenol	3 00E-02	IRIS	NA		0 7	2.10E-02	3 00E-02	H	NA		2.10E-02	1 20E-01	IRIS	NA		1 71E-01
Phenanthrene	NA		NA		NA	NA	NA		NA		NA	NA		NA		NA
Phenol	6 00E-01	IRIS	NA		0 7	4 20E-01	6.00E-01	H	NA		4 20E-01	NA		NA		NA
Pyrene	3.00E-02	IRIS	NA		0 7	2 10E-02	3 00E-01	H	NA		2 10E-01	NA		NA		NA
Volatiles																
Benzene	3 00E-03	E	1 70E-03	E	0.95	2.85E-03	NA		NA		NA	2 90E-02	IRIS	2.90E-02	IRIS	3 05E-02
Ethylbenzene	1 00E-01	IRIS	2 90E-01	IRIS	0.95	9.50E-02	NA		NA		NA	NA		NA		NA
Styrene	2 00E-01	IRIS	2.86E-01	IRIS	0.95	1 90E-01	8.57E-01	HE	8 57E-01	HE	NA	NA		NA		NA
Toluene	2 00E-01	IRIS	1 14E-01	IRIS	0 95	1.90E-01	2.00E+00	H	NA		1.90E+00	NA		NA		NA
Xylenes (total)	2 00E+00	IRIS	NA		0 87	1 74E+00	NA		NA		NA	NA		NA		NA

(1) - Published oral toxictiy values were adjusted for gastrointestinal absorption to convert to dermal toxicity values

H - values are published in HEAST, 1997

HE - values are published in HEAST, 1997 as RfC values and are converted by ESI to RfD values

H2 - values are published in Table 2 - Alternate Methods in HEAST, 1997

IRIS - values are available in IRIS, 1999

NA - published value not available/not applicable

Reg III - Region III Risk Based Concentration Tables - 10/98

AR316056

AR000390

Table 5. Summary of Hazard and Estimated Potential Risk Calculations for the Risk Scenarios Evaluated
[HHRA Tables 23 - 26]

AR316057

Table 23

Summary of Hazard and Estimated Potential Risk Calculations for the Construction Worker

Former Koppers Company, Inc., Newport, DE

Source/Pathway	Potentially Exposed Population	Total Hazard Index	Total Estimated Potential Cancer Risk	Table Referenced	with Dioxin Risk Removed
Central Tendency					
Dermal Exposure to Soil	Construction Workers	0.00003	9E-08	27	
Ingestion of Soil	Construction Workers	0 0003	8E-08	28	
Inhalation of Ambient Air and Dust	Construction Workers	NA	3E-08	29	
	Total	0 0003	2E-07		
Reasonable Maximum					
Dermal Exposure to Soil	Construction Workers	0 0001	4E-07	30	8E-10
Ingestion of Soil	Construction Workers	0 003	8E-07	31	3E-07
Inhalation of Ambient Air and Dust	Construction Workers	NA	8E-08	32	4E-08
	Total·	0.003	1E-06		3.41E-07
Central Tendency w/NAPL					
Dermal Exposure to Soil	Construction Workers	0 00003	9E-08	33	
Ingestion of Soil	Construction Workers	0.0003	8E-08	34	
Inhalation of Ambient Air and Dust	Construction Workers	NA	3E-08	35	
	Total	0.0003	2E-07		
Reasonable Maximum w/NAPL					
Dermal Exposure to Soil	Construction Workers	0.0001	4E-07	36	8E-10
Ingestion of Soil	Construction Workers	0.003	2E-06	37	1E-06
Inhalation of Ambient Air and Dust	Construction Workers	NA	1E-07	38·	7E-08
	Total:	0 003	2E-06		1.07E-06

Table 24
Summary of Hazard and Estimated Potential Risk Calculations for the Industrial Worker
Former Koppers Company, Inc., Newport, DE

Source/Pathway	Potentially Exposed Population	Total Hazard Index	Total Estimated Potential Cancer Risk	Table Referenced	With Dioxin Risk Removed
Central Tendency					
Dermal Exposure to Soil	Industrial Workers	0 00009	4E-06	39	
Ingestion of Soil	Industrial Workers	0 0002	1E-06	40	
	Total·	0 0003	5E-06		
* **Reasonable Maximum**					
Dermal Exposure to Soil	Industrial Workers	0.0019	6E-05	41	5E-08
Ingestion of Soil	Industrial Workers	0.040	2E-04	42	2E-04
	Total·	0 04	3E-04		2E-04
Central Tendency w/NAPL					
Dermal Exposure to Soil	Industrial Workers	0 00008	4E-06	43	
Ingestion of Soil	Industrial Workers	0 0002	1E-06	44	
	Total.	0 0003	5E-06		
* **Reasonable Maximum w/NAPL**					
Dermal Exposure to Soil	Industrial Workers	0.003	6E-05	45	5E-05
Ingestion of Soil	Industrial Workers	0 05	3E-04	46	2E-04
	Total:	0 05	3E-04		2.5E-04
Columbia Aquifer - Central Tendency					
Dermal Exposure to Ground Water	Industrial Workers	0.61	8E-06	47	
Ingestion of Ground Water	Industrial Workers	0 25	5E-06	48	
Inhalation of VOC Vapors	Industrial Workers	NA	2E-10	49	
	Total.	0 86	1E-05		
* **Columbia Aquifer - Reasonable Maximum**					
Dermal Exposure to Ground Water	Industrial Workers	0 73	4E-05	50	SAME
Ingestion of Ground Water	Industrial Workers	0 52	2E-05	51	"
Inhalation of VOC Vapors	Industrial Workers	NA	1E-09	52	"
	Total:	1 2	6E-05		"

(no dioxin already)

AR000393

AR316059
ENVIRONMENTAL STANDARDS

Table 24
Summary of Hazard and Estimated Potential Risk Calculations for the Industrial Worker
Former Koppers Company, Inc., Newport, DE

Source/Pathway	Potentially Exposed Population	Total Hazard Index	Total Estimated Potential Cancer Risk	Table Referenced	with Dioxin Risk Removed
Columbia Aquifer - Central Tendency with MW-2 and MW-8					
Dermal Exposure to Ground Water	Industrial Workers	44 9	1E+00	53	
Ingestion of Ground Water	Industrial Workers	104.5	1E-01	54	
Inhalation of VOC Vapors	Industrial Workers	0 0000009	1E-06	55	
	Total	149 35	1E+00		
Columbia Aquifer - Reasonable Maximum with MW-2 and MW-8 (NAPL)					
Dermal Exposure to Ground Water	Industrial Workers	115	1E+00	56	1E-03
Ingestion of Ground Water	Industrial Workers	170	5E-01	57	4E-03
Inhalation of VOC Vapors	Industrial Workers	0 0033	7E-06	58	3E-08
	Total	284.86	1E+00		5E-03
Potomac Aquifer - Central Tendency					
Dermal Exposure to Ground Water	Industrial Workers	0 07	4E-07	59	
Ingestion of Ground Water	Industrial Workers	0.06	4E-08	60	
Inhalation of VOC Vapors	Industrial Workers	NA	4E-12	61	
	Total	0 13	5E-07		
Potomac Aquifer - Reasonable Maximum					
Dermal Exposure to Ground Water	Industrial Workers	0 08	2E-06	62	same
Ingestion of Ground Water	Industrial Workers	0 06	2E-07	63	"
Inhalation of VOC Vapors	Industrial Workers	NA	3E-11	64	"
	Total	0 14	2E-06		"

(no dioxin already)

AR316060

ENVIRONMENTAL STANDARDS

Table 25
Summary of Hazard and Estimated Potential Risk Calculations for the Adolescent Trespasser
Former Koppers Company, Inc., Newport, DE

Source/Pathway	Potentially Exposed Population	Total Hazard Index	Total Estimated Potential Cancer Risk	Table Referenced	With Dioxin Risk Removed
Central Tendency					
Dermal Exposure to Soil	Adolescent Trespassers	0.00002	6E-07	65	
Ingestion of Soil	Adolescent Trespassers	0 00005	5E-07	66	
	Total:	0 0001	1E-06		
Reasonable Maximum					
Dermal Exposure to Soil	Adolescent Trespassers	0 00008	2E-06	67	1 E-08
Ingestion of Soil	Adolescent Trespassers	0.004	5E-05	68	4E-05
	Total:	0.004	5E-05		4E-05
Central Tendency w/NAPL					
Dermal Exposure to Soil	Adolescent Trespassers	0.00002	6E-07	69	
Ingestion of Soil	Adolescent Trespassers	0 00005	4E-07	70	
	Total:	0 00007	1E-06		
Reasonable Maximum w/NAPL					
Dermal Exposure to Soil	Adolescent Trespassers	0.00005	2E-06	71	8E-09
Ingestion of Soil	Adolescent Trespassers	0 004	4E-05	72	3E-05
	Total:	0 004	4E-05		3E-05
Central Tendency					
Dermal Exposure to Non-River Surface Water	Adolescent Trespassers	0.0000002	2E-05	73	
	Total:	0.0000002	2E-05		
Reasonable Maximum					
Dermal Exposure to Non-River Surface Water	Adolescent Trespassers	0 0000008	6E-05	74 (mislabeled as "CTE")	
	Total:	0 0000008	6E-05		3.26E-11
Central Tendency					
Dermal Exposure to Non-River Sediment	Adolescent Trespassers	0.000007	8E-09	75	
Ingestion of Non-River Sediment	Adolescent Trespassers	0.00004	5E-08	76	
	Total:	0.00005	6E-08		
Reasonable Maximum					
Dermal Exposure to Non-River Sediment	Adolescent Trespassers	0 00002	3E-08	77	2E-10
Ingestion of Non-River Sediment	Adolescent Trespassers	0 003	5E-06	78	5E-06
	Total:	0 003	5E-06		5E-06 (insignificant change)

Table 26

Summary of Hazard and Estimated Potential Risk Calculations for the Adolescent Swimmer and Angler

Former Koppers Company, Inc., Newport, DE

Source/Pathway	Potentially Exposed Population	Total Hazard Index	Total Estimated Potential Cancer Risk	Table Referenced	With Dioxin Risk Removed
Central Tendency					
Dermal Exposure to Christina River Sediment	Adolescent Swimmers	0.001	2E-08	79	
	Total	0.001	2E-08		
Reasonable Maximum					
Dermal Exposure to Christina River Sediment	Adolescent Swimmers	0.006	9E-08	80	
	Total.	0.006	9E-08		SAME (No Dioxin already)
Central Tendency					
Dermal Exposure to White Clay Creek Sediment	Adolescent Swimmers	0.00004	2E-09	81	
	Total	0.00004	2E-09		
Reasonable Maximum					
Dermal Exposure to White Clay Creek Sediment	Adolescent Swimmers	0.0002	8E-09	82	
	Total.	0.0002	8E-09		SAME (No Dioxin already)
Central Tendency					
Ingestion of Locally Caught Fish	Anglers	4	3E-05	83	
	Total	4	3E-05		
Reasonable Maximum					
Ingestion of Locally Caught Fish	Anglers	13	3E-04	84	
	Total	13	3E-04		3E-04 (insignificant change)

AR316062

summary xls \ swim, angler

ENVIRONMENTAL STANDARDS

Table 6. RME Risk Calculations for the Exposure Pathways and Risk Scenarios Evaluated
[HHRA Tables 30 – 84, non-inclusive]

AR316063

Table 30

Reasonable Maximum Dermal Exposure to Soil by a Construction Worker

Former Koppers Company, Inc, Newport, DE

Intake (mg/kg-day) = $\frac{Cs*SA*FX*AF*ABS*EF*ED*CF}{BW*AT}$

Cs - Concentration in soil =	mg/kg	chemical specific	
SA - Adult skin surface area available for exposure =	cm^2/day	*1820*	*calculated*
SA_t - Total Adult Surface area =	cm^2	20000	USEPA 1989, EFH
F_s - Fraction of skin surface area available for exposure =		9 1%	reasonable maximum
FX - Fraction of exposed skin covered with soil =		100%	reasonable maximum
AF -Soil Adherence Factor =	mg/cm^2	0 11	USEPA 1995, EFH
ABS_d - Absorption for dioxins =		0.1	US EPA 1995, Region III
ABS_i - Absorption for inorganics =		0 01	USEPA 1995, Region III
EF - Exposure frequency =	days/year	80	Reasonable maximum
ED - Exposure duration =	years	1	Reasonable maximum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	365	Reasonable maximum
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Analyte	Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv.	1.37E-03	8 59E-11	NA	NA	1 23E-12	3.00E+05	3 68E-07
Inorganics							
Arsenic	5.61E+00	3 52E-08	2 85E-04	1 23E-04	5 02E-10	1 58E+00	7 93E-10
Thallium	6.33E+00	3.97E-08	NA	NA	5 67E-10	NA	NA

NA - Not available | Total Hazard Index 0 0001 | Total Cancer Risk 3 69E-07

Table 31
Reasonable Maximum Exposure by Ingestion of Soil by a Construction Worker
Former Koppers Company, Inc, Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs*IngR*EF*ED*CF*FI}{BW*AT}$$

Cs - Concentration in soil =	mg/kg	chemical specific	
IngR - Ingestion rate =	mg/day	50	USEPA 1991, HHEM
EF - Exposure frequency =	days/year	80	Reasonable maximum
ED - Exposure duration =	years	1	Reasonable maximum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1.00E-06	
FI - Fraction of total daily soil ingested at site =		1	reasonable maximum
BW - Body weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	365	Reasonable maximum
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Chemical	Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Oral Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Oral Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	1.37E-03	2 15E-10	NA	NA	3.07E-12	1 50E+05	4 60E-07
Inorganics							
Arsenic	5.61E+00	8 78E-07	3.00E-04	2.93E-03	1 25E-08	1 50E+00	1 88E-08
Thallium	6 33E+00	9 92E-07	NA	NA	1.42E-08	NA	NA
Semivolatiles							
Acenaphthylene	6.34E+00	9 93E-07	NA	NA	1.42E-08	NA	NA
Benzo(a)anthracene	5.64E+01	8 80E-06	NA	NA	3 65E-08	7 30E-01	2 66E-08
Benzo(a)pyrene	4.24E+01	6 64E-06	NA	NA	2 75E-08	7 30E+00	2 01E-07
Benzo(b)fluoranthene	1 02E+02	1 60E-05	NA	NA	6 63E-08	7 30E-01	4 84E-08
Benzo(g,h,i)perylene	2.43E+01	3 80E-06	NA	NA	5.43E-08	NA	NA
Benzo(k)fluoranthene	2 27E+01	3 55E-06	NA	NA	1 47E-08	7.30E-02	1 07E-09
Carbazole	7 59E+00	1.19E-06	NA	NA	4 92E-09	2 00E-02	9 85E-11
Dibenz(a,h)anthracene	7.15E+00	1 12E-06	NA	NA	4.64E-09	7.30E+00	3 39E-08
Indeno(1,2,3-c,d)pyrene	2 89E+01	4 53E-06	NA	NA	1.87E-08	7 30E-01	1 37E-08
Phenanthrene	5 65E+01	8 85E-06	NA	NA	1 26E-07	NA	NA

NA - Not available   Total Hazard Index 0 003   Total Cancer Risk: 8 03E-07

Table 32

Reasonable Maximum Exposure to Construction Worker via Inhalation of Vapors and Dust

Former Koppers Company, Inc, Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Ca \cdot InhR \cdot EF \cdot ED \cdot RA \cdot RF}{BW \cdot AT}$$

Parameter	Units	Value	Source
Ca - Concentration in air =	mg/m³	chem spec.	
InhR - Inhalation Rate =	m³/day	20	USEPA 1991, HHEM
EF - Exposure Frequency =	days/year	80	Reasonable maximum
ED - Exposure Duration =	years	1	Reasonable maximum
RA - Fraction of PM_{15} respirable (≤ 10 um) =		0 84	Cowherd, 1985
RF - Retention Factor for dusts (non-VOAs) =		0 75	Reasonable maximum
BW - Body Weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	365	Reasonable maximum
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Ca = Concentration in Air (mg/m³) = $E_i/(H_b \cdot W_b \cdot V)$

E_i - Emission Rate of Component (mg/sec) = chemical specific

H_b - Downwind Ht (m) = 5 11

W_b - Width (m) = 55

V - Wind speed (m/sec) = 4 99

Length (downwind distance) (m) = 55

r - Roughness Ht (m) = 0 20

z - downwind distance (m) = 55

$z = 6\ 25r[H_b/r \cdot Ln(H_b/r) - 1\ 58 \cdot H_b/r + 1\ 58]$

E_i - Emission Rate (mg/sec) = $C_s \cdot (PER_v + PER_e)$

Parameter	Units	Value
C_s - Concentration in soil =	mg/kg	chem spec
PER_v - Fugitive Dust Emission Rate (Vehicular movement) =	kg/sec	2.93E-05
PER_e - Fugitive Dust Emission Rate (Excavation) =	kg/sec	4 21E-04

Chemicals	Concentration in Soil mg/kg	Emission Rate mg/sec	Concentration in Air mg/m³	Average Daily Intake mg/kg-day	Inhalation Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins									
2,3,7,8-TCDD Equiv.	1 37E-03	6.17E-07	4 40E-10	1 74E-11	NA	NA	2 48E-13	1 50E+05	3 72E-08
Inorganics									
Arsenic	5 61E+00	2 52E-03	1 80E-06	7.10E-08	NA	NA	1 01E-09	1 51E+01	1 53E-08
Thallium	6 33E+00	2 85E-03	2 03E-06	8 02E-08	NA	NA	1.15E-09	NA	NA
Semivolatiles									
Acenaphthylene	6 34E+00	2 85E-03	2 04E-06	8 03E-08	NA	NA	1 15E-09	NA	NA
Benzo(a)anthracene	5 62E+01	2 53E-02	1 80E-05	7.12E-07	NA	NA	1 02E-08	NA	NA
Benzo(a)pyrene	4 24E+01	1 91E-02	1 36E-05	5 37E-07	NA	NA	7 67E-09	3 10E+00	2 38E-08
Benzo(b)fluoranthene	1 02E+02	4 60E-02	3 28E-05	1 29E-06	NA	NA	1 85E-08	NA	NA
Benzo(g,h,i)perylene	2 43E+01	1 09E-02	7 79E-06	3 07E-07	NA	NA	4 39E-09	NA	NA
Benzo(k)fluoranthene	2 27E+01	1.02E-02	7 28E-06	2 87E-07	NA	NA	4 10E-09	NA	NA
Carbazole	7 59E+00	3 42E-03	2 44E-06	9 61E-08	NA	NA	1 37E-09	NA	NA
Dibenz(a,h)anthracene	7 15E+00	3 22E-03	2 30E-06	9 06E-08	NA	NA	1 29E-09	NA	NA
Indeno(1,2,3-c,d)pyrene	2 89E+01	1 30E-02	9.27E-06	3 66E-07	NA	NA	5 23E-09	NA	NA
Phenanthrene	5 65E+01	2 54E-02	1.81E-05	7 16E-07	NA	NA	1 02E-08	NA	NA
					Total Hazard Index	NA		Total Cancer Risk	7 63E-08

NA - Not available

Table 36

Reasonable Maximum Dermal Exposure to Soil and NAPL by a Construction Worker

Former Koppers Company, Inc, Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs*SA*FX*AF*ABS*EF*ED*CF}{BW*AT}$$

Cs - Concentration in soil and NAPL =	mg/kg	chemical specific	
SA - Adult skin surface area available for exposure =	cm^2/day	1820	calculated
SA_t - Total Adult Surface area =	cm^2	20000	USEPA 1989, EFH
F_s - Fraction of skin surface area available for exposure =		9 1%	reasonable maximum
FX - Fraction of exposed skin covered with soil =		100%	reasonable maximum
AF -Soil Adherence Factor =	mg/cm^2	0 11	USEPA 1995, EFH
ABS_d - Absorption for dioxins =		0 1	US EPA 1995, Region III
ABS_i - Absorption for inorganics =		0 01	USEPA 1995, Region III
EF - Exposure frequency =	days/year	80	Reasonable maximum
ED - Exposure duration =	years	1	Reasonable maximum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1 00E-06	
BW - Body weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	365	Reasonable maximum
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Analyte	Concentration in Soil and NAPL mg/kg	Average Daily Intake mg/kg-day	Dermal Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv.	1 37E-03	8.59E-11	NA	NA	1 23E-12	3.00E+05	3 68E-07
Inorganics							
Arsenic	5 71E+00	3 58E-08	2 85E-04	1 26E-04	5 11E-10	1 58E+00	8.07E-10
Iron	1.94E+04	1.21E-04	NA	NA	1 74E-06	NA	NA
Lead	3 34E+01	2.10E-07	NA	NA	2 99E-09	NA	NA
Thallium	5 85E+00	3.67E-08	NA	NA	5 24E-10	NA	NA

NA - Not available

Total Hazard Index 0.0001

Total Cancer Risk: 3 69E-07

Table 37

Reasonable Maximum Exposure by Ingestion of Soil and NAPL by a Construction Worker

Former Koppers Company, Inc, Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs*IngR*EF*ED*CF*FI}{BW*AT}$$

Cs - Concentration in soil and NAPL =	mg/kg	chemical specific	
IngR - Ingestion rate =	mg/day	50	USEPA 1991, HHEM
EF - Exposure frequency =	days/year	80	Reasonable maximum
ED - Exposure duration =	years	1	Reasonable maximum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1.00E-06	
FI - Fraction of total daily soil ingested at site =		1	reasonable maximum
BW - Body weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	365	Reasonable maximum
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Chemical	Concentration in Soil and NAPL mg/kg	Average Daily Intake mg/kg-day	Oral Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Oral Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv.	1 37E-03	2 15E-10	NA	NA	3 07E-12	1 50E+05	4 60E-07
Inorganics							
Arsenic	5.71E+00	8 93E-07	3.00E-04	2 98E-03	1 28E-08	1 50E+00	1 91E-08
Iron	1 94E+04	3.03E-03	NA	NA	4.33E-05	NA	NA
Lead	3 34E+01	5 23E-06	NA	NA	7 48E-08	NA	NA
Thallium	5.85E+00	9.16E-07	NA	NA	1 31E-08	NA	NA
Semivolatiles							
Acenaphthylene	5 41E+00	8 48E-07	NA	NA	1.21E-08	NA	NA
Benzo(a)anthracene	5 92E+01	9 27E-06	NA	NA	1.32E-07	7.30E-01	9 67E-08
Benzo(a)pyrene	4.66E+01	7.30E-06	NA	NA	1 04E-07	7 30E+00	7 61E-07
Benzo(b)fluoranthene	1 12E+02	1 75E-05	NA	NA	2.50E-07	7.30E-01	1.82E-07
Benzo(k)fluoranthene	2.45E+01	3 84E-06	NA	NA	5.49E-08	7 30E-02	NA
Benzo(g,h,i)perylene	2 08E+01	3 26E-06	NA	NA	4.65E-08	NA	NA
Carbazole	6 63E+00	1 04E-06	NA	NA	1 48E-08	2.00E-02	2.96E-10
Chrysene	7 33E+01	1 15E-05	NA	NA	1 64E-07	7 30E-03	1.20E-09
Dibenz(a,h)anthracene	6 58E+00	1 03E-06	NA	NA	1.47E-08	7 30E+00	1 07E-07
Fluoranthene	2 09E+02	3 27E-05	4 00E-01	8 17E-05	4.67E-07	NA	NA
Indeno(1,2,3-c,d)pyrene	2.95E+01	4.62E-06	NA	NA	6 59E-08	7 30E-01	4 81E-08
Phenanthrene	4 98E+01	7 80E-06	NA	NA	1 11E-07	NA	NA

NA - Not available   Total Hazard Index 0 003   Total Cancer Risk 1.68E-06

AR316068

ENVIRONMENTAL STANDARDS

AR000402

Table 38

Reasonable Maximum Exposure to Construction Worker via Inhalation of Vapors and Dust*

Former Koppers Company, Inc, Newport, DE

Intake (mg/kg-day) = $\frac{Ca*InhR*EF*ED*RA*RF}{BW*AT}$

Parameter	Units	Value	Source
Ca - Concentration in air =	mg/m^3	chem spec	
InhR - Inhalation Rate =	m^3/day	20	USEPA 1991, HHEM
EF - Exposure Frequency =	days/year	80	Reasonable maximum
ED - Exposure Duration =	years	1	Reasonable maximum
RA - Fraction of PM_{15} respirable (≤ 10 um) =		0 84	Cowherd, 1985
RF - Retention Factor for dusts (non-VOAs) =		0 75	Reasonable maximum
BW - Body Weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	365	Reasonable maximum
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

E_i - Emission Rate (mg/sec) = $C_s*(PER_v+PER_e)$

Parameter	Units	Value	Source
C_s - Concentration in soil and NAPL =	mg/kg	chem spec	
PER_v - Fugitive Dust Emission Rate (Vehicular movement) =	kg/sec	2.93E-04	Calculated
PER_e - Fugitive Dust Emission Rate (Excavation) =	kg/sec	4.21E-04	Calculated

Ca = Concentration in Air (mg/m^3) = $E_i/(H_b*W_b*V)$

E_i - Emission Rate of Component (mg/sec) = chemical specific

H_b - Downwind Ht (m) = 5 11

W_b - Width (m) = 55

V - Wind speed (m/sec) = 4.99

Length (downwind distance) (m) = 55

r - Roughness Ht (m) = 0 20

z - downwind distance (m) = 55

$z = 6\ 25r[H_b/r * Ln(H_b/r) - 1\ 58*H_b/r + 1\ 58]$

Chemicals	Concentration in Soil and NAPL mg/kg	Emission Rate mg/sec	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins									
2,3,7,8-TCDD Equiv	1 37E-03	9 79E-07	6 98E-10	2 75E-11	NA	NA	3 93E-13	1 50E+05	5 90E-08
Inorganics									
Arsenic	5 71E+00	4 08E-03	2.91E-06	1 15E-07	NA	NA	1.64E-09	1 51E+01	2 47E-08
Iron	1 94E+04	1.38E+01	9 86E-03	3 89E-04	NA	NA	5 56E-06	NA	NA
Lead	3 34E+01	2.39E-02	1 70E-05	6 71E-07	NA	NA	9.59E-09	NA	NA
Thallium	5 85E+00	4 18E-03	2 98E-06	1.18E-07	NA	NA	1.68E-09	NA	NA
Semivolatiles									
Acenaphthylene	5 41E+00	3.87E-03	2 76E-06	1 09E-07	NA	NA	1 55E-09	NA	NA
Benzo(a)anthracene	5 92E+01	4 23E-02	3 02E-05	1 19E-06	NA	NA	1 70E-08	NA	NA
Benzo(a)pyrene	4 66E+01	3 33E-02	2 37E-05	9 36E-07	NA	NA	1 34E-08	3 10E+00	4 15E-08
Benzo(b)fluoranthene	1 12E+02	7 97E-02	5.68E-05	2 24E-06	NA	NA	3 20E-08	NA	NA
Benzo(k)fluoranthene	2 45E+01	1 75E-02	1 25E-05	4 93E-07	NA	NA	7 04E-09	NA	NA
Benzo(g,h,i)perylene	2 08E+01	1 49E-02	1 06E-05	4 18E-07	NA	NA	5 97E-09	NA	NA
Carbazole	6 63E+00	4 73E-03	3 37E-06	1 33E-07	NA	NA	1 90E-09	NA	NA

Table 38

Reasonable Maximum Exposure to Construction Worker via Inhalation of Vapors and Dust*

Former Koppers Company, Inc, Newport, DE

Intake (mg/kg-day) =		Ca*InhR*EF*ED*RA*RF / BW*AT	
Ca - Concentration in air =	mg/m^3	chem spec	
InhR - Inhalation Rate =	m^3/day	20	USEPA 1991, HHEM
EF - Exposure Frequency =	days/year	80	Reasonable maximum
ED - Exposure Duration =	years	1	Reasonable maximum
RA - Fraction of PM_{15} respirable (≤ 10 um) =		0 84	Cowherd, 1985
RF - Retention Factor for dusts (non-VOAs) =		0 75	Reasonable maximum
BW - Body Weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	365	Reasonable maximum
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Ca = Concentration in Air (mg/m^3) = $E_i/(H_b*W_b*V)$

E_i - Emission Rate of Component (mg/sec) = chemical specific

H_b - Downwind Ht (m) = 5 11

W_b - Width (m) = 55

V - Wind speed (m/sec) = 4 99

Length (downwind distance) (m) = 55

r - Roughness Ht. (m) = 0 20

z - downwind distance (m) = 55

$z = 6\ 25r[H_b/r * Ln(H_b/r) - 1\ 58*H_b/r + 1\ 58]$

E_i - Emission Rate (mg/sec) = $C_s*(PER_v+PER_e)$

C_s - Concentration in soil and NAPL =	mg/kg	chem spec	
PER_v - Fugitive Dust Emission Rate (Vehicular movement) =	kg/sec	2 93E-04	Calculated
PER_e - Fugitive Dust Emission Rate (Excavation) =	kg/sec	4.21E-04	Calculated

Chemicals	Concentration in Soil and NAPL mg/kg	Emission Rate mg/sec	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Chrysene	7 33E+01	5.24E-02	3 73E-05	1 47E-06	NA	NA	2.10E-08	NA	NA
Dibenz(a,h)anthracene	6 58E+00	4 70E-03	3 35E-06	1 32E-07	NA	NA	1.89E-09	NA	NA
Fluoranthene	2 09E+02	1 49E-01	1 06E-04	4 19E-06	NA	NA	5 99E-08	NA	NA
Indeno(1,2,3-c,d)pyrene	2 95E+01	2 11E-02	1.50E-05	5.92E-07	NA	NA	8 46E-09	NA	NA
Phenanthrene	4 98E+01	3.56E-02	2.54E-05	1.00E-06	NA	NA	1.43E-08	NA	NA
					Total Hazard Index	NA		Total Cancer Risk	1.25E-07

* Includes NAPL data

NA - Not available

AR316070

AR000404

Table 41
Reasonable Maximum Dermal Exposure to Soil by an Industrial Worker
Former Koppers Company, Inc, Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs * SA * FX * AF * ABS * EF * ED * CF}{BW * AT}$$

Cs - Concentration in soil =	mg/kg	chemical specific	
SA - Adult skin surface area available for exposure =	cm^2/day	1820	calculated
SA_t - Total Adult Surface area =	cm^2	20000	USEPA 1989, EFH
F_s - Fraction of skin surface area available for exposure =		9 1%	reasonable maximum
FX - Fraction of exposed skin covered with soil =		100%	reasonable maximum
AF -Soil Adherence Factor =	mg/cm^2	0 11	USEPA 1995, EFH
ABS_d - Absorption for dioxins =		0 1	US EPA 1995, Region III
ABS_n - Absorption for inorganics =		0.01	USEPA 1995, Region III
EF - Exposure frequency =	days/year	134	reasonable maximum
ED - Exposure duration =	years	25	USEPA 1991, HHEM
CF - Conversion factor (1 kg/1,000,000 mg)=	kg/mg	1 00E-06	
BW - Body weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	9125	USEPA 1991, HHEM
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Analyte	Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal Chronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	5 44E-03	5 71E-10	NA	NA	2 04E-10	3 00E+05	6 12E-05
Inorganics							
Arsenic	8 56E+00	8 99E-08	2 85E-04	3 15E-04	3.21E-08	1 58E+00	5.07E-08
Thallium	8 56E+00	8 99E-08	5.60E-05	1 61E-03	3 21E-08	NA	NA

NA - Not available

Total Hazard Index: 0.0019 — Total Cancer Risk: 6.13E-05

Table 42

Reasonable Maximum Exposure by Ingestion of Soil by an Industrial Worker

Former Koppers Company, Inc, Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs * IngR * EF * ED * CF * FI}{BW * AT}$$

C_s - Concentration in soil =	mg/kg	chemical specific	
$I_{ng}R$ - Ingestion rate =	mg/day	50	USEPA 1991, HHEM
EF - Exposure frequency =	days/year	134	reasonable maximum
ED - Exposure duration =	years	25	USEPA 1991, HHEM
CF - Conversion factor (1 kg/1,000,000 mg)=	kg/mg	1 00E-06	
FI - Fraction of total daily soil ingested at site =		1	reasonable maximum
BW - Body weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	9125	USEPA 1991, HHEM
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Analyte	Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Oral Chronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv.	5 44E-03	1 43E-09	NA	NA	5.10E-10	1 50E+05	7 64E-05
Inorganics							
Arsenic	8 56E+00	2 24E-06	3 00E-04	7 48E-03	8 02E-07	1.50E+00	1 20E-06
Thallium	8 56E+00	2 25E-06	7.00E-05	3 21E-02	8 02E-07	NA	NA
Semivolatiles							
Acenaphthylene	1 30E+01	3.41E-06	NA	NA	1.22E-06	NA	NA
Benzo(a)anthracene	1 70E+02	4.46E-05	NA	NA	1.59E-05	7 30E-01	1 16E-05
Benzo(a)pyrene	1 61E+02	4.21E-05	NA	NA	1 50E-05	7.30E+00	1 10E-04
Benzo(b)fluoranthene	3 70E+02	9 70E-05	NA	NA	3 47E-05	7.30E-01	2.53E-05
Benzo(g,h,i)perylene	8 16E+01	2.14E-05	NA	NA	7.64E-06	NA	NA
Benzo(k)fluoranthene	1 10E+02	2.88E-05	NA	NA	1.03E-05	7 30E-02	7 52E-07
Carbazole	2.96E+01	7.76E-06	NA	NA	2 77E-06	2 00E-02	5.55E-08
Dibenz(a,h)anthracene	1 99E+01	5 21E-06	NA	NA	1.86E-06	7.30E+00	1 36E-05
Indeno(1,2,3-c,d)pyrene	1 10E+02	2 88E-05	NA	NA	1.03E-05	7.30E-01	7 52E-06
Phenanthrene	5 16E+01	1 35E-05	NA	NA	4 83E-06	NA	NA

NA - Not available

Total Hazard Index: 0 040 — Total Cancer Risk: 2 46E-04

Table 45

Reasonable Maximum Dermal Exposure to Soil and NAPL by an Industrial Worker

Former Koppers Company, Inc, Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs * SA * FX * AF * ABS * EF * ED * CF}{BW * AT}$$

Parameter	Units	Value	Source
Cs - Concentration in soil and NAPL =	mg/kg	chemical specific	
SA - Adult skin surface area available for exposure =	cm^2/day	1820	calculated
SA_t - Total Adult Surface area =	cm^2	20000	USEPA 1989, EFH
F_s - Fraction of skin surface area available for exposure =		9 1%	reasonable maximum
FX - Fraction of exposed skin covered with soil =		100%	reasonable maximum
AF - Soil Adherence Factor =	mg/cm^2	0 11	USEPA 1995, EFH
ABS_d - Absorption for dioxins =		0 1	US EPA 1995, Region III
ABS_n - Absorption for inorganics =		0 01	USEPA 1995, Region III
EF - Exposure frequency =	days/year	134	reasonable maximum
ED - Exposure duration =	years	25	USEPA 1991, HHEM
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1 00E-06	
BW - Body weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	9125	USEPA 1991, HHEM
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Analyte	Concentration in Soil and NAPL mg/kg	Average Daily Intake mg/kg-day	Dermal Chronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	5 44E-03	5 71E-10	NA	NA	2 04E-10	3 00E+05	6 12E-05
Inorganics							
Arsenic	7 70E+00	8 08E-08	2 85E-04	2.84E-04	2 89E-08	1 58E+00	4.56E-08
Iron	1 94E+04	2 04E-04	1 50E-01	1.36E-03	7 27E-05	NA	NA
Lead	8 31E+01	8.73E-07	NA	NA	3 12E-07	NA	NA
Thallium	5 40E+00	5 67E-08	5 60E-05	1.01E-03	2.02E-08	NA	NA
NA – Not available			Total Hazard Index	0 003			6 13E-05

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Table 46
Reasonable Maximum Exposure by Ingestion of Soil and NAPL by an Industrial Worker
Former Koppers Company, Inc, Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs * IngR * EF * ED * CF * FI}{BW * AT}$$

Cs - Concentration in soil and NAPL =	mg/kg	chemical specific	
IngR - Ingestion rate =	mg/day	50	USEPA 1991, HHEM
EF - Exposure frequency =	days/year	134	reasonable maximum
ED - Exposure duration =	years	25	USEPA 1991, HHEM
CF - Conversion factor (1 kg/1,000,000 mg)=	kg/mg	1 00E-06	
FI - Fraction of total daily soil ingested at site =		1	reasonable maximum
BW - Body weight =	kg	70	USEPA 1991, HHEM
AT_n - Averaging Time noncarcinogenic =	days	9125	USEPA 1991, HHEM
AT_c - Averaging Time carcinogenic =	days	25550	USEPA 1991, HHEM

Analyte	Concentration in Soil and NAPL mg/kg	Average Daily Intake mg/kg-day	Oral Chronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	5 44E-03	1 43E-09	NA	NA	5 10E-10	1 50E+05	7 64E-05
Inorganics							
Arsenic	7 70E+00	2 02E-06	3 00E-04	6 73E-03	7 21E-07	1 50E+00	1 08E-06
Iron	1 94E+04	5.09E-03	3 00E-01	1 70E-02	1 82E-03	NA	NA
Lead	8.31E+01	2 18E-05	NA	NA	7 79E-06	NA	NA
Thallium	5 40E+00	1 42E-06	7 00E-05	2 02E-02	5 06E-07	NA	NA
Semivolatiles							
Acenaphthylene	1 21E+01	3 18E-06	NA	NA	1 14E-06	NA	NA
Benzo(a)anthracene	2 92E+02	7 65E-05	NA	NA	2.73E-05	7 30E-01	2 00E-05
Benzo(a)pyrene	2 02E+02	5 30E-05	NA	NA	1 89E-05	7.30E+00	1 38E-04
Benzo(b)fluoranthene	4 29E+02	1.13E-04	NA	NA	4 02E-05	7 30E-01	2 93E-05
Benzo(g,h,i)perylene	7 85E+01	2.06E-05	NA	NA	7 35E-06	NA	NA
Benzo(k)fluoranthene	9 95E+01	2.61E-05	NA	NA	9 32E-06	7 30E-02	6.80E-07
Carbazole	2.11E+01	5 52E-06	NA	NA	1.97E-06	2.00E-02	3 94E-08
Chrysene	3 27E+02	8 57E-05	NA	NA	3.06E-05	7.30E-03	2 23E-07
Dibenz(a,h)anthracene	1.55E+01	4 06E-06	NA	NA	1 45E-06	7 30E+00	1 06E-05
Dibenzofuran	1 55E+01	4 06E-06	4 00E-03	1 01E-03	1 45E-06	NA	NA
Fluoranthene	6 59E+02	1 73E-04	4 00E-02	4 32E-03	6 18E-05	NA	NA
Indeno(1,2,3-c,d)pyrene	1.01E+02	2 66E-05	NA	NA	9 50E-06	7 30E-01	6 93E-06
Phenanthrene	6.75E+01	1 77E-05	NA	NA	6.32E-06	NA	NA
NA - Not available			Total Hazard Index	0 05			2 83E-04

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Table 50

Reasonable Maximum Dermal Exposure to Columbia Aquifer Groundwater to an Industrial Worker Showering

Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{DA \cdot EF \cdot ED \cdot FS \cdot SAt}{BW \cdot AT}$

DA - Absorbed dose =	chem. specific	mg/day-cm^2	
EF- Exposure frequency =	250	day/year	US EPA 1991, HHEM Supp Guidance
ED - Exposure duration =	25	year	Carey, 1988
SA - Skin surface area available for contact =	20000	cm^2	calculated
SAt - Total skin surface area =	20000	cm^2	US EPA 1989, RAGS Part A
FS - Fraction of skin surface area available for contact =	100%		reasonable maximum
BW - Body weight =	70	kg	US EPA 1989, RAGS Part A
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

For Inorganics:

DA (mg/day-cm^2) = Kp * Cgw * t * CF

Kp - Dermal permeability constant =	chem specific	cm/hr	
Cgw - Chemical concentration in groundwater =	chem specific	mg/L	
t - Event duration =	0 25	hr	US EPA 1992, Dermal Exp Assess
CF - Conversion factor =	1 00E-03	L/cm^3	

For Organics:

If t < t*, then $DA = 2 \cdot CF \cdot Cgw \cdot Kp \cdot (6 \cdot \tau \cdot t / \pi)^{0.5}$

If t>t*, then $DA = Kp \cdot Cgw \cdot CF \cdot (t/(1+B) + (2 \cdot \tau \cdot ((1+3B) / (1+B)))$

t* - Percutaneous absorption time =	chem specific	hr
B - Partitioning coefficient =	chem. specific	dimensionless
τ - Lag time =	chem. specific	hr

Analyte	Concentration in Groundwater mg/L	Kp cm/hr	t* hr	B	τ hr	Absorbed Dose mg/day-cm^2	Average Daily Intake mg/kg-day	Dermal Chronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Inorganics												
Antimony	5 74E-03	1 00E-03	NA	NA	NA	1 44E-09	2 81E-07	4.00E-06	7.02E-02	1 00E-07	NA	NA
Arsenic	1 68E-03	1 00E-03	NA	NA	NA	4.20E-10	8 23E-08	2 85E-04	2 89E-04	2.94E-08	1 58E+00	4 64E-08
Cadmium	1 14E-03	1 00E-03	NA	NA	NA	2.86E-10	5 59E-08	3 00E-04	1 86E-04	2 00E-08	NA	NA
Iron	3 20E+00	1.00E-03	NA	NA	NA	8 00E-07	1 57E-04	1 50E-01	1 04E-03	5.59E-05	NA	NA
Lead	3 58E-03	4 00E-06	NA	NA	NA	3 58E-12	7 01E-10	NA	NA	2.50E-10	NA	NA
Manganese	1 86E+00	1 00E-03	NA	NA	NA	4 65E-07	9.10E-05	NA	NA	3 25E-05	NA	NA
PCBs/Pesticides												
Dieldrin	3 50E-05	1 60E-02	9 40E+01	3.60E+00	1 80E+01	3 28E-09	6 43E-07	1 50E-05	4.28E-02	2 29E-07	5 33E+01	1 22E-05
Heptachlor	1 80E-05	1 10E-02	9 40E+01	1 90E+00	1 70E+01	1 13E-09	2 21E-07	1 50E-04	1 47E-03	7 89E-08	1 50E+01	1 18E-06
Heptachlor epoxide	6 60E-05	2 76E-02	1 30E+02	9 55E+00	2 07E+01	1 15E-08	2 24E-06	3 90E-06	5 75E-01	8 01E-07	3 03E+01	2 43E-05
Semivolatiles												
bis(2-Ethylhexyl)phthalate	1 31E-02	3 30E-02	1 00E+02	1 30E+01	2.10E+01	2 73E-06	5 34E-04	1 40E-02	3 82E-02	1.91E-04	2 00E-02	3 82E-06
Dibenzofuran	3 00E-03	1 51E-01	9 07E+00	1 32E+00	9 29E-01	6 04E-07	1 18E-04	2.80E-03	4 22E-02	4 22E-05	NA	NA

NA - Not Applicable

Total Hazard Index. 0 73 — 4 16E-05

Gwcol xls \ dermal - RME

Table 51
Reasonable Maximum Oral Exposure to Columbia Aquifer Groundwater While Drinking at the Job Site
Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{Cgw * IR * ED * EF}{BW * AT}$

Cgw - Concentration in groundwater =	chem specific	mg/L	
IR - Ingestion Rate =	1	L/day	US EPA 1991, HHEM Supp. Guidance
ED - Exposure duration =	25	year	US EPA 1991, HHEM Supp. Guidance
EF- Exposure frequency =	250	days/year	US EPA 1991, HHEM Supp Guidance
BW - Body weight =	70	kg	US EPA 1989, RAGS Part A
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

Analyte	Concentration in Groundwater mg/L	Average Daily Intake mg/kg-day	Oral Chronic RfD mg/kg-day	Hazard Index	Lifetime Average Daily Intake mg/kg-day	Oral Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Inorganics							
Antimony	5.74E-03	5 62E-05	4.00E-04	1 40E-01	2.01E-05	NA	NA
Arsenic	1.68E-03	1 65E-05	3.00E-04	5 49E-02	5.88E-06	1.50E+00	8.82E-06
Cadmium	1.14E-03	1.12E-05	5.00E-04	2 24E-02	3.99E-06	NA	NA
Iron	3.20E+00	3 13E-02	3.00E-01	1.04E-01	1.12E-02	NA	NA
Lead	3.58E-03	3 50E-05	NA	NA	1.25E-05	NA	NA
Manganese	1.86E+00	1.82E-02	1.40E-01	1 30E-01	6 50E-03	NA	NA
PCBs/Pesticides							
Dieldrin	3.50E-05	3.42E-07	5.00E-05	6 85E-03	1.22E-07	1.60E+01	1 96E-06
Heptachlor	1.80E-05	1 76E-07	5.00E-04	3 52E-04	6 29E-08	4 50E+00	2.83E-07
Heptachlor epoxide	6.60E-05	6.46E-07	1.30E-05	4.97E-02	2 31E-07	9 10E+00	2.10E-06
Semivolatiles							
Benzo(a)anthracene	2.00E-03	1 96E-05	NA	NA	6.99E-06	7 30E-01	5.10E-06
Benzo(b)fluoranthene	1.00E-03	9 78E-06	NA	NA	3 49E-06	7.30E-01	2.55E-06
Benzo(k)fluoranthene	1.00E-03	9 78E-06	NA	NA	3.49E-06	7 30E-02	2 55E-07
bis(2-Ethylhexyl)phthalate	1.31E-02	1 28E-04	2.00E-02	6 39E-03	4 57E-05	1 40E-02	6 39E-07
Dibenzofuran	3.00E-03	2.94E-05	4.00E-03	7 34E-03	1 05E-05	NA	NA
Phenanthrene	1.04E-02	1 02E-04	NA	NA	3 65E-05	NA	NA
			Total Hazard Index.	0.52			2 17E-05

Gwcol xls \ ingestion - RME
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AR000411

Table 52

Reasonable Maximum Inhalation Exposure to VOC Vapors by an Industrial Worker Showering with Columbia Aquifer Groundwater
Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{Dose * EF * ED}{AT}$

Parameter	Value	Units	Source
Dose - Inhalation dose =	chem specific		
EF - Exposure frequency =	250	showers/year	US EPA 1991, HHEM Supp. Guid
Ed - Exposure duration =	25	years	Carey, 1988
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

Inhalation Dose (mg/kg-shower) =
((VR * S) / (BW * Rex * 10^6)) * (Ds + (exp(-Rex * Dt) / Rex) - (exp(Rex * (Ds - Dt)) / Rex))

Parameter	Value	Units	Source
VR - Ventilation Rate =	15	L/min	Foster, Chrostowski, 1987
S - Indoor VOC generation rate =	chem. specific	ug/m^3-min	
BW - Body Weight =	70	kg	US EPA 1989, RAGS Part A
Rex - Air Exchange Rate =	0.0083	exchange/min	Foster, Chrostowski, 1987
Ds - Duration in Shower =	15	min	US EPA 1995, Exp. Factors Handbook
Dt - Total Duration in Shower Room =	20	min	reasonable maximum

S (ug/m^3-min) = (Cwd * FR) / SV

Parameter	Value	Units	Source
Cwd - Concentration leaving shower droplet after time ts =	chem. specific	ug/L	
FR - Shower Water Flow Rate =	10	L/min	Foster, Chrostowski, 1987
SV - Shower Room Air Volume =	6	m^3	Foster, Chrostowski, 1987

Cwd (ug/L) = Cwo * CF_1 * (1-exp((-Kal * tsd) / (60 * d)))

Parameter	Value	Units	Source
Cwo - Shower water concentration =	chem specific	mg/L	
CF_1 - Conversion factor =	1.00E+03	ug/mg	
Kal - overall mass transfer coefficient =	chem. specific	cm/hr	
tsd - shower droplet drop time =	2	sec	Foster, Chrostowski, 1987
d - shower droplet diameter =	1	mm	Foster, Chrostowski, 1987

Kal (cm/hour) = KL / ((T_1 * u_s) / (T_s * u_1))$^{0.5}$

Parameter	Value	Units
KL - mass transfer coefficient =	chem specific	cm/hr
T_1 - calibration water temperature =	293	K
u_s - water viscosity at Ts =	0.596	cp
T_s - shower water temperature =	318	K
u_1 - water viscosity at Tl =	1.002	cp

KL (cm/hr) = ((1 / kl(voc))+((R * T) / (H * kg(voc))))$^{-1}$

Parameter	Value	Units
kl(voc) - liquid-film mass transfer coefficient =	chem. specific	cm/hr
R - universal gas constant =	8.20E-05	atm-m^3/mol K
T - absolute temperature =	293	K
H - Henry's Law Constant =	chem specific	atm-m^3/mol
kg(voc) - gas-film mass transfer coefficient =	chem. specific	cm/hr

kg(voc) (cm/hr) = kg(H_2O) * (18 / MWvoc)$^{0.5}$

Parameter	Value	Units
kg(H_2O) =	3000	cm/hr
MW - molecular weight =	chem. specific	g/mol

kl(voc) (cm/hr) = kl(CO_2) * (44 / MWvoc)$^{0.5}$

Parameter	Value	Units
kl(CO_2) =	20	cm/hr

Constituent	Cwo mg/L	kl(voc) cm/hr	kg(voc) cm/hr	KL cm/hr	Kal cm/hr	Cwd ug/L	S ug/m^3-min	Inhalation Dose mg/kg-shower	Average Daily Intake mg/kg-day	Inhalation Chronic RfD mg/kg-day	Hazard Index	Lifetime Average Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
PCBs/Pesticides														
Dieldrin	3.50E-05	6.80E+00	6.52E+02	1.28E+00	1.73E+00	1.96E-06	3.26E-06	1.24E-10	8.48E-11	NA	NA	3.03E-11	1.60E+01	4.84E-10
Heptachlor	1.80E-05	6.87E+00	6.59E+02	5.87E+00	7.93E+00	4.18E-06	6.97E-06	2.64E-10	1.81E-10	NA	NA	6.47E-11	4.50E+00	2.91E-10
Heptachlor epoxide	6.60E-05	6.72E+00	6.45E+02	7.62E-01	1.03E+00	2.23E-06	3.71E-06	1.41E-10	9.64E-11	NA	NA	3.44E-11	9.10E+00	3.13E-10
Semivolatiles														
Benzo(a)anthracene	2.00E-03	8.78E+00	8.42E+02	2.72E-01	3.68E-01	2.44E-05	4.06E-05	1.54E-09	1.06E-09	NA	NA	3.77E-10	NA	NA
Benzo(b)fluoranthene	1.00E-03	8.35E+00	8.01E+02	2.56E+00	3.46E+00	1.09E-04	1.82E-04	6.90E-09	4.72E-09	NA	NA	1.69E-09	NA	NA
Benzo(k)fluoranthene	1.00E-03	8.35E+00	8.01E+02	1.33E-02	1.80E-02	6.00E-07	9.99E-07	3.79E-11	2.60E-11	NA	NA	9.27E-12	NA	NA
bis(2-Ethylhexyl)phthalate	1.31E-02	6.71E+00	6.44E+02	3.72E-01	5.03E-01	2.17E-04	3.62E-04	1.37E-08	9.40E-09	NA	NA	3.36E-09	1.40E-02	4.70E-11
Dibenzofuran	3.00E-03	1.02E+01	9.81E+02	4.70E+00	6.35E+00	5.72E-04	9.54E-04	3.62E-08	2.48E-08	NA	NA	8.85E-09	NA	NA
Phenanthrene	1.04E-02	9.94E+00	9.53E+02	1.25E+00	1.69E+00	5.71E-04	9.52E-04	3.61E-08	2.47E-08	NA	NA	8.84E-09	NA	NA
										Total Hazard Index	NA			

Table 36

Reasonable Maximum Dermal Exposure to Columbia Aquifer Groundwater (Including MW-2 and MW-8) for an Industrial Worker Showering
Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{DA * EF * ED * FS * SAt}{BW * AT}$

DA - Absorbed dose =	chem specific	mg/day-cm^2	
EF - Exposure frequency =	250	day/year	US EPA 1991, HHEM Supp Guidance
ED - Exposure duration =	25	year	Carey, 1988
SA - Skin surface area available for contact =	20000	cm^2	calculated
SAt - Total skin surface area =	20000	cm^2	US EPA 1989, RAGS Part A
FS - Fraction of skin surface area available for contact =	100%		reasonable maximum
BW - Body weight =	70	kg	US EPA 1989, RAGS Part A
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

For Inorganics:

DA (mg/day-cm^2) = Kp * Cgw * t * CF

Kp - Dermal permeability constant =	chem. specific	cm/hr	
Cgw - Chemical concentration in groundwater =	chem. specific	mg/L	
t - Event duration =	0.25	hr	US EPA 1992, Dermal Exp. Assess
CF - Conversion factor	1.00E-03	L/cm^3	

For Organics:

If t < t*, then DA = 2 * CF * Cgw * Kp * $(6 * \tau * t / \pi)^{0.5}$
If t>t*, then DA = Kp * Cgw * CF * (t/(1+B) + (2 * τ * ((1+3B) / (1+B)))

t* - Percutaneous absorption time =	chem specific	hr
B - Partitioning coefficient =	chem. specific	dimensionless
τ - Lag time =	chem specific	hr

Analyte	Concentration in Groundwater mg/L	Kp cm/hr	t* hr	B	τ hr	Absorbed Dose mg/day-cm^2	Average Daily Intake mg/kg-day	Dermal Chronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins												
2,3,7,8-TCDD Equiv *	1.17E-03	1.40E+00	3.80E+01	6.30E+02	8.10E+00	6.46E-06	1.26E-03	NA	NA	4.52E-04	3.00E+05	1.00E+00
Inorganics												
Antimony	1.51E-03	1.00E-03	NA	NA	NA	3.78E-10	7.39E-08	4.00E-06	1.85E-02	2.64E-08	NA	NA
Arsenic	1.28E-03	1.00E-03	NA	NA	NA	3.21E-10	6.28E-08	2.85E-04	2.20E-04	2.24E-08	1.58E+00	3.54E-08
Beryllium	3.35E-04	1.00E-03	NA	NA	NA	8.38E-11	1.64E-08	2.00E-04	8.20E-05	5.86E-09	4.30E+01	2.52E-07
Iron	4.13E+00	1.00E-03	NA	NA	NA	1.03E-06	2.02E-04	1.50E-01	1.35E-03	7.22E-05	NA	NA
Lead	9.48E-04	4.00E-06	NA	NA	NA	9.48E-13	1.86E-10	NA	NA	6.63E-11	NA	NA
Manganese	5.61E-01	1.00E-03	NA	NA	NA	1.40E-07	2.75E-05	NA	NA	9.80E-06	NA	NA
Thallium	3.66E-03	1.00E-03	NA	NA	NA	9.14E-10	1.79E-07	5.60E-05	3.20E-03	6.39E-08	NA	NA
PCBs/Pesticides												
alpha-Chlordane	7.82E-05	4.60E-02	1.30E+02	3.00E+01	2.80E+01	2.63E-08	5.15E-06	1.50E-04	3.43E-02	1.84E-06	1.17E+00	2.15E-06
Dieldrin	3.50E-05	1.60E-02	9.40E+01	3.60E+00	1.80E+01	3.28E-09	6.43E-07	1.50E-05	4.28E-02	2.29E-07	5.33E+01	1.22E-05
Heptachlor	1.80E-05	1.10E-02	9.40E+01	1.90E+00	1.70E+01	1.13E-09	2.21E-07	1.50E-04	1.47E-03	7.89E-08	1.50E+01	1.18E-06
Heptachlor epoxide	5.63E-05	2.76E-02	1.30E+02	9.55E+00	2.07E+01	9.77E-09	1.91E-06	3.90E-06	4.90E-01	6.83E-07	3.03E+01	2.07E-[illegible]

Table 36

Reasonable Maximum Dermal Exposure to Columbia Aquifer Groundwater (Including MW-2 and MW-8) for an Industrial Worker Showering

Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{DA \cdot EF \cdot ED \cdot FS \cdot SAt}{BW \cdot AT}$

DA - Absorbed dose =	chem. specific	mg/day-cm²	
EF- Exposure frequency =	250	day/year	US EPA 1991, HHEM Supp Guidance
ED - Exposure duration =	25	year	Carey, 1988
SA - Skin surface area available for contact =	20000	cm²	calculated
SAt - Total skin surface area =	20000	cm²	US EPA 1989, RAGS Part A
FS - Fraction of skin surface area available for contact =	100%		reasonable maximum
BW - Body weight =	70	kg	US EPA 1989, RAGS Part A
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

For Inorganics:

DA (mg/day-cm²) = Kp * Cgw * t * CF

Kp - Dermal permeability constant =	chem. specific	cm/hr	
Cgw - Chemical concentration in groundwater =	chem specific	mg/L	
t - Event duration =	0.25	hr	US EPA 1992, Dermal Exp. Assess
CF - Conversion factor	1.00E-03	L/cm³	

For Organics:

If t < t*, then DA = 2 * CF * Cgw * Kp * $(6 * \tau * t / \pi)^{0.5}$

If t>t*, then DA = Kp * Cgw * CF * (t/(1+B) + (2 * τ * ((1+3B) / (1+B)))

t* - Percutaneous absorption time =	chem. specific	hr
B - Partitioning coefficient =	chem. specific	dimensionless
τ - Lag time =	chem. specific	hr

Analyte	Concentration in Groundwater mg/L	Kp cm/hr	t* hr	B	τ hr	Absorbed Dose mg/day-cm²	Average Daily Intake mg/kg-day	Dermal Chronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Semivolatiles												
2,4-Dimethylphenol	1 50E+01	1 10E-01	1.20E+00	2.00E-02	4.90E-01	1.60E-03	3.12E-01	1.40E-02	2 23E+01	1.12E-01	NA	NA
2-Methylphenol	2.20E+01	1.60E-02	1.57E-02	9.60E-01	8.90E-03	5.73E-05	1 12E-02	3.50E-02	3.20E-01	4 00E-03	NA	NA
4-Methylphenol	5 20E+01	1.80E-02	1.75E-02	9 60E-01	8.70E-03	1 52E-04	2 97E-02	3 50E-03	8 48E+00	1.06E-02	NA	NA
bis(2-Ethylhexyl)phthalate	1 50E-02	3 30E-02	1 00E+02	1 30E+01	2 10E+01	3 13E-06	6.13E-04	1 40E-02	4.38E-02	2 19E-04	2 00E-02	4.38E-06
Dibenzofuran	5 69E+00	1.51E-01	9.07E+00	1.32E+00	9 29E-01	1 14E-03	2 24E-01	2.80E-03	8 00E+01	8.00E-02	NA	NA
Pentachlorophenol	6 00E-02	6.50E-01	1.70E+01	7.20E+01	3.70E+00	1.04E-04	2 03E-02	2 10E-02	9.66E-01	7 25E-03	1 71E-01	1 24E-03
Phenol	5.80E+01	8.10E-03	7.90E-01	2.90E-03	3.30E-01	3.73E-04	7.30E-02	4.20E-01	1 74E-01	2.61E-02	NA	NA
Volatiles												
Benzene	2 64E-01	1 10E-01	6 30E-01	1.30E-02	2 60E-01	2 04E-05	4 00E-03	2.85E-03	1 40E+00	1 43E-03	3.05E-02	4 36E-05
Ethylbenzene	1 79E-01	1.00E+00	1.30E+00	1 40E-01	3 90E-01	1 55E-04	3 03E-02	9 50E-02	3 19E-01	1 08E-02	NA	NA
Styrene	6 49E-02	6.70E-01	9.10E-01	8 90E-02	3.80E-01	3.70E-05	7.25E-03	1 90E-01	3.81E-02	2 59E-03	NA	NA
Toluene	5 48E-01	1 00E+00	7 70E-01	5.40E-02	3.20E-01	4 29E-04	8 39E-02	1.90E-01	4.41E-01	2 99E-02	NA	NA
Xylenes (total)	1 90E+00	8 00E-02	6 53E+00	1 58E-01	3 89E-01	1.31E-04	2.56E-02	1 74E+00	1 47E-02	9 15E-03	NA	NA
							Total Hazard Index		115.08			1 00E+[illegible]

NA - Not applicable/available

Gwcol28 xls \ dermal - RME

Table 57
Reasonable Maximum Oral Exposure to Columbia Aquifer Groundwater (Including MW-2 and MW-8) While Drinking at the Job Site
Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{Cgw * IR * ED * EF}{BW * AT}$

Cgw - Concentration in groundwater =	chem specific	mg/L	
IR - Ingestion Rate =	1	L/day	US EPA 1991, HHEM Supp Guidance
ED - Exposure duration =	25	year	US EPA 1991, HHEM Supp Guidance
EF- Exposure frequency =	250	days/year	US EPA 1991, HHEM Supp Guidance
BW - Body weight =	70	kg	US EPA 1989, RAGS Part A
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

Analyte	Concentration in Groundwater mg/L	Average Daily Intake mg/kg-day	Oral Chronic RfD mg/kg-day	Hazard Index	Lifetime Average Daily Intake mg/kg-day	Oral Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv *	1.17E-03	1 15E-05	NA	NA	4 10E-06	1 50E+05	4 59E-01
Inorganics							
Antimony	1.51E-03	1 48E-05	4.00E-04	3 69E-02	5.28E-06	NA	NA
Arsenic	1.28E-03	1 26E-05	3 00E-04	4.19E-02	4.49E-06	1 50E+00	6 73E-06
Beryllium	3 35E-04	3 28E-06	2 00E-03	1 64E-03	1.17E-06	4 30E+00	5.04E-06
Iron	4.13E+00	4 05E-02	3.00E-01	1 35E-01	1 44E-02	NA	NA
Lead	9.48E-04	9 28E-06	NA	NA	3 31E-06	NA	NA
Manganese	5.61E-01	5 49E-03	1.40E-01	3 92E-02	1.96E-03	NA	NA
Thallium	3 66E-03	3 58E-05	7 00E-05	5 11E-01	1 28E-05	NA	NA
PCBs/Pesticides							
alpha-Chlordane	7.82E-05	7.66E-07	5 00E-04	1 53E-03	2 73E-07	3 50E-01	9 57E-08
Dieldrin	3 50E-05	3 42E-07	5 00E-05	6 85E-03	1.22E-07	1 60E+01	1 96E-06
Heptachlor	1.80E-05	1 76E-07	5 00E-04	3 52E-04	6 29E-08	4.50E+00	2.83E-07
Heptachlor epoxide	5 63E-05	5.50E-07	1 30E-05	4 23E-02	1 97E-07	9 10E+00	1 79E-06
Semivolatiles							
2,4-Dimethylphenol	1 50E+01	1.47E-01	2.00E-02	7 34E+00	5 24E-02	NA	NA
2-Methylnaphthalene	1 30E+01	1 27E-01	2.00E-02	6.36E+00	4.54E-02	NA	NA
2-Methylphenol	2 20E+01	2.15E-01	5 00E-02	4.31E+00	7 69E-02	NA	NA
4-Methylphenol	5 20E+01	5 09E-01	5 00E-03	1 02E+02	1 82E-01	NA	NA
Acenaphthene	1.00E+01	9 78E-02	6.00E-02	1.63E+00	3 49E-02	NA	NA
Acenaphthylene	1 84E-01	1.80E-03	NA	NA	6 42E-04	NA	NA
Anthracene	3.06E-01	3 00E-03	3 00E-01	9.99E-03	1 07E-03	NA	NA
Benzo(a)anthracene	1.70E-01	1.66E-03	NA	NA	5 93E-04	7 30E-01	4 33E-04
Benzo(a)pyrene	1 33E-01	1 30E-03	NA	NA	4 65E-04	7 30E+00	3 40E-03
Benzo(b)fluoranthene	1.30E-01	1.27E-03	NA	NA	4 53E-04	7 30E-01	3 31E-04
Benzo(g,h,i)perylene	6.00E-03	5 87E-05	NA	NA	2.10E-05	NA	NA
Benzo(k)fluoranthene	1 05E-01	1 02E-03	NA	NA	3 65E-04	7 30E-02	2 67E-05
bis(2-Ethylhexyl)phthalate	1.50E-02	1 47E-04	NA	NA	5.24E-05	1 40E-02	7 34E-07
Carbazole	1.80E+00	1 76E-02	NA	NA	6 29E-03	2 00E-02	1 26E-04
Chrysene	1 32E-01	1.29E-03	NA	NA	4.61E-04	7 30E-03	3.37E-06
Dibenzofuran	5 69E+00	5.56E-02	4 00E-03	1 39E+01	1.99E-02	NA	NA
Fluoranthene	8.18E-01	8 01E-03	4 00E-02	2 00E-01	2 86E-03	NA	NA
Fluorene	8 19E+00	8.01E-02	4.00E-02	2.00E+00	2.86E-02	NA	NA
Indeno(1,2,3-c,d)pyrene	5.00E-03	4.89E-05	NA	NA	1.75E-05	7 30E-01	1 28E-05
Naphthalene	6.00E+01	5.87E-01	2 00E-02	2.94E+01	2 10E-01	NA	NA
Pentachlorophenol	6.00E-02	5 87E-04	3 00E-02	1.96E-02	2.10E-04	1 20E-01	2 52E-05
Phenanthrene	1 85E+01	1 81E-01	NA	NA	6.48E-02	NA	NA
Phenol	5 80E+01	5.68E-01	6.00E-01	9 46E-01	2.03E-01	NA	NA
Pyrene	6 37E-01	6 23E-03	3 00E-02	2 08E-01	2.23E-03	NA	NA
Volatiles							
Benzene	2 64E-01	2 58E-03	3 00E-03	8.60E-01	9 22E-04	2 90E-02	2 67E-05
Ethylbenzene	1 79E-01	1 75E-03	1 00E-01	1 75E-02	6 27E-04	NA	NA
Styrene	6 49E-02	6.35E-04	2.00E-01	3.17E-03	2 27E-04	NA	NA
Toluene	5 48E-01	5.36E-03	2.00E-01	2 68E-02	1 92E-03	NA	NA
Xylenes (total)	1 90E+00	1 86E-02	2 00E+00	9 30E-03	6 64E-03	NA	NA
NA - Not available			Total Hazard Index	169 78			4 64E-01

* Cancer risks calculated using one-hit equation, US EPA RAGS Part A, 1989.

Table 58

Reasonable Maximum Exposure - Inhalation of VOC Vapors from Columbia Aquifer Groundwater (Including MW-2 and MW-8) by an Industrial Worker Showering

Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{Dose * EF * ED}{AT}$

Parameter	Value	Units	Source
Dose - Inhalation dose =	chem. specific		
EF - Exposure frequency =	250	showers/year	US EPA 1991, HHEM Supp. Guid.
Ed - Exposure duration =	25	years	Carey, 1988
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

Inhalation Dose (mg/kg-shower) =

$((VR * S) / (BW * Rex * 10^6)) * (Ds + (exp(-Rex * Dt) / Rex) - (exp(Rex * (Ds - Dt)) / Rex))$

Parameter	Value	Units	Source
VR - Ventilation Rate =	15	L/min	Foster, Chrostowski, 1987
S - Indoor VOC generation rate =	chem. specific	ug/m^3-min	
BW - Body Weight =	70	kg	US EPA 1989, RAGS Part A
Rex - Air Exchange Rate =	0.0083	exchange/mi	Foster, Chrostowski, 1987
Ds - Duration in Shower =	15	min	US EPA 1995, Exp. Factors Handbook
Dt - Total Duration in Shower Room =	20	min	reasonable maximum

S (ug/m^3-min) = (Cwd * FR) / SV

Parameter	Value	Units	Source
Cwd - Concentration leaving shower droplet after time ts =	chem specific	ug/L	
FR - Shower Water Flow Rate =	10	L/min	Foster, Chrostowski, 1987
SV - Shower Room Air Volume =	6	m^3	Foster, Chrostowski, 1987

Cwd (ug/L) = Cwo * CFi * (1-exp((-Kal * tsd) / (60 * d)))

Parameter	Value	Units	Source
Cwo - Shower water concentration =	chem specific	mg/L	
CFi - Conversion factor =	1 00E+03	ug/mg	
Kal - overall mass transfer coefficient =	chem. specific	cm/hr	
tsd - shower droplet drop time =	2	sec	Foster, Chrostowski, 1987
d - shower droplet diameter =	1	mm	Foster, Chrostowski, 1987

Kal (cm/hour) = $KL / ((T_l * u_s) / (T_s * u_l))^{0.5}$

Parameter	Value	Units
KL - mass transfer coefficient =	chem specific	cm/hr
T_l - calibration water temperature =	293	K
u_s - water viscosity at Ts =	0 596	cp
T_s - shower water temperature =	318	K
u_l - water viscosity at Tl =	1.002	cp

KL (cm/hr) = $((1 / kl(voc)) + ((R * T) / (H * kg(voc))))^{-1}$

Parameter	Value	Units
kl(voc) - liquid-film mass transfer coefficient =	chem specific	cm/hr
R - universal gas constant =	8 20E-05	atm-m^3/mol K
T - absolute temperature =	293	K
H - Henry's Law Constant =	chem specific	atm-m^3/mol
kg(voc) - gas-film mass transfer coefficient =	chem specific	cm/hr

kg(voc) (cm/hr) = $kg(H_2O) * (18 / MWvoc)^{0.5}$

Parameter	Value	Units
$kg(H_2O)$ =	3000	cm/hr
MW - molecular weight =	chem specific	g/mol

kl(voc) (cm/hr) = $kl(CO_2) * (44 / MW)^{0.5}$

Parameter	Value	Units
$kl(CO_2)$ =	20	cm/hr

Constituent	Cwo mg/L	kl(voc) cm/hr	kg(voc) cm/hr	KL cm/hr	Kal cm/hr	Cwd ug/L	S ug/m^3-min	Inhalation Dose mg/kg-shower	Average Daily Intake mg/kg-day	Inhalation Chronic RfD mg/kg-day	Hazard Index	Lifetime Average Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins														
2,3,7,8-TCDD Equiv	1 17E-03	7 39E+00	7 09E+02	5 86E-02	7.91E-02	3.09E-06	5.15E-06	1 95E-10	1.34E-10	NA	NA	4 78E-11	1 50E+05	7 17E-06
PCBs/Pesticides														
alpha-Chlordane	7.82E-05	6 55E+00	6 29E+02	3 81E+00	5 14E+00	1 23E-05	2.05E-05	7 79E-10	5.34E-10	2 00E-04	2 67E-06	1 91E-10	3.50E-01	6 67E-11
Dieldrin	3 50E-05	6 80E+00	6.52E+02	1.28E+00	1 73E+00	1 96E-06	3.26E-06	1 24E-10	8 48E-11	NA	NA	3.03E-11	1 60E+01	4 84E-10
Heptachlor	1.80E-05	6 87E+00	6.59E+02	5.87E+00	7.93E+00	4.18E-06	6.97E-06	2.64E-10	1.81E-10	NA	NA	6.47E-11	4 50E+00	2.91E-10
Heptachlor epoxide	5 63E-05	6 72E+00	6 45E+02	7 62E-01	1 03E+00	1 90E-06	3.16E-06	1 20E-10	8 22E-11	NA	NA	2 93E-11	9.10E+00	2 67E-10
Semivolatiles														
2,4-Dimethylphenol	1 50E+01	1.20E+01	1 15E+03	9 51E-02	1 28E-01	6.41E-02	1 07E-01	4 05E-06	2 78E-06	NA	NA	9 91E-07	NA	NA
2-Methylnaphthalene	1.30E+01	1 11E+01	1 07E+03	7.50E+00	1 01E+01	3.73E+00	6 21E+00	2 36E-04	1 61E-04	NA	NA	5 76E-05	NA	NA
2-Methylphenol	2 20E+01	1 28E+01	1 22E+03	6 08E-02	8.22E-02	6 02E-02	1.00E-01	3 81E-06	2 61E-06	NA	NA	9 31E-07	NA	NA
4-Methylphenol	5.20E+01	1 28E+01	1 22E+03	5 07E-02	6 85E-02	1.19E-01	1.98E-01	7 50E-06	5.14E-06	NA	NA	1 84E-06	NA	NA
Acenaphthene	1.00E+01	1 07E+01	1 02E+03	4 08E+00	5.52E+00	1.68E+00	2 80E+00	1 06E-04	7 28E-05	NA	NA	2 60E-05	NA	NA
Acenaphthylene	1.84E-01	1 08E+01	1 03E+03	3 36E+00	4 54E+00	2.58E-02	4 30E-02	1 63E-06	1.12E-06	NA	NA	3.99E-07	NA	NA

AR316081

AR000416

Table 58

Reasonable Maximum Exposure - Inhalation of VOC Vapors from Columbia Aquifer Groundwater (Including MW-2 and MW-8) by an Industrial Worker Showering
Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day)= $\frac{Dose * EF * ED}{AT}$

Dose - Inhalation dose =	chem specific		
EF - Exposure frequency =	250	showers/year	US EPA 1991, HHEM Supp Guid.
Ed - Exposure duration =	25	years	Carey, 1988
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

Inhalation Dose (mg/kg-shower) =
((VR * S) / (BW * Rex * 10^6)) * (Ds + (exp(-Rex * Dt) / Rex) - (exp(Rex * (Ds - Dt)) / Rex))

VR - Ventilation Rate =	15	L/min	Foster, Chrostowski, 1987
S - Indoor VOC generation rate =	chem specific	ug/m³-min	
BW - Body Weight =	70	kg	US EPA 1989, RAGS Part A
Rex - Air Exchange Rate =	0 0083	exchange/mi	Foster, Chrostowski, 1987
Ds - Duration in Shower =	15	min	US EPA 1995, Exp Factors Handbook
Dt - Total Duration in Shower Room =	20	min	reasonable maximum

S (ug/m³-min) = (Cwd * FR) / SV

Cwd - Concentration leaving shower droplet after time ts =	chem. specific	ug/L	
FR - Shower Water Flow Rate =	10	L/min	Foster, Chrostowski, 1987
SV - Shower Room Air Volume =	6	m³	Foster, Chrostowski, 1987

Cwd (ug/L) = Cwo * CFi * (1-exp((-Kal * tsd) / (60 * d)))

Cwo - Shower water concentration =	chem. specific	mg/L	
CFi - Conversion factor =	1 00E+03	ug/mg	
Kal - overall mass transfer coefficient =	chem specific	cm/hr	
tsd - shower droplet drop time =	2	sec	Foster, Chrostowski, 1987
d - shower droplet diameter =	1	mm	Foster, Chrostowski, 1987

Kal (cm/hour) = KL / ((T_l * u_s) / (T_s * u_l))$^{0.5}$

KL - mass transfer coefficient =	chem specific	cm/hr
T_l - calibration water temperature =	293	K
u_s - water viscosity at Ts =	0.596	cp
T_s - shower water temperature =	318	K
u_l - water viscosity at Tl =	1 002	cp

KL (cm/hr) = ((1 / kl(voc))+((R * T) / (H * kg(voc))))$^{-1}$

kl(voc) - liquid-film mass transfer coefficient =	chem specific	cm/hr
R - universal gas constant =	8 20E-05	atm-m³/mol K
T - absolute temperature =	293	K
H - Henry's Law Constant =	chem. specific	atm-m³/mol
kg(voc) - gas-film mass transfer coefficient =	chem specific	cm/hr

kg(voc) (cm/hr) = kg(H_2O) * (18 / MWvoc)$^{0.5}$

kg(H_2O) =	3000	cm/hr
MW - molecular weight =	chem specific	g/mol

kl(voc) (cm/hr) = kl(CO_2) * (44 / MW)$^{0.5}$

kl(CO_2) =	20	cm/hr

Constituent	Cwo mg/L	kl(voc) cm/hr	kg(voc) cm/hr	KL cm/hr	Kal cm/hr	Cwd ug/L	S ug/m³-min	Inhalation Dose mg/kg-shower	Average Daily Intake mg/kg-day	Inhalation Chronic RfD mg/kg-day	Hazard Index	Lifetime Average Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Anthracene	3 06E-01	9 94E+00	9.53E+02	7.37E+00	9 96E+00	8 65E-02	1.44E-01	5 47E-06	3 75E-06	NA	NA	1 34E-06	NA	NA
Benzo(a)anthracene	1 70E-01	8 78E+00	8.42E+02	2 72E-01	3 68E-01	2 07E-03	3 45E-03	1 31E-07	8 97E-08	NA	NA	3 20E-08	NA	NA
Benzo(a)pyrene	1.33E-01	8.35E+00	8 01E+02	8 09E-02	1 09E-01	4 84E-04	8 07E-04	3 06E-08	2 10E-08	NA	NA	7 49E-09	3 10E+00	2.32E-08
Benzo(b)fluoranthene	1 30E-01	8.35E+00	8.01E+02	2 56E+00	3 46E+00	1 42E-02	2.36E-02	8 95E-07	6 13E-07	NA	NA	2 19E-07	NA	NA
Benzo(g,h,i)perylene	6 00E-03	7 98E+00	7 66E+02	5 07E-02	6 84E-02	1.37E-05	2.28E-05	8 65E-10	5 92E-10	NA	NA	2 11E-10	NA	NA
Benzo(k)fluoranthene	1 05E-01	8 35E+00	8 01E+02	1 33E-02	1 80E-02	6 27E-05	1 04E-04	3 96E-09	2 72E-09	NA	NA	9 70E-10	NA	NA
bis(2-Ethylhexyl)phthalate	1 50E-02	6 71E+00	6 44E+02	3.72E-01	5 03E-01	2 49E-04	4 15E-04	1 58E-08	1 08E-08	NA	NA	3 86E-09	1 40E-02	5 40E-11
Carbazole	1 80E+00	1 03E+01	9 84E+02	3 54E-03	4 79E-03	2 87E-04	4 78E-04	1 82E-08	1.24E-08	NA	NA	4 44E-09	NA	NA
Chrysene	1 32E-01	8 78E+00	8 42E+02	2 41E+00	3 25E+00	1 36E-02	2 26E-02	8 57E-07	5 87E-07	NA	NA	2 10E-07	NA	NA
Dibenzofuran	5 69E+00	1 02E+01	9 81E+02	4 70E+00	6 35E+00	1 08E+00	1 81E+00	6 86E-05	4.70E-05	NA	NA	1 68E-05	NA	NA
Fluoranthene	8 18E-01	9 33E+00	8 95E+02	3 28E+00	4 43E+00	1 12E-01	1 87E-01	7 11E-06	4 87E-06	NA	NA	1 74E-06	NA	NA
Fluorene	8.19E+00	1.03E+01	9 87E+02	2.94E+00	3.97E+00	1.01E+00	1.69E+00	6.41E-05	4.39E-05	NA	NA	1 57E-05	NA	NA

AR316082

Table 58

Reasonable Maximum Exposure - Inhalation of VOC Vapors from Columbia Aquifer Groundwater (Including MW-2 and MW-8) by an Industrial Worker Showering Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = Dose * EF * ED / AT

Parameter	Value	Units	Source
Dose - Inhalation dose =	chem specific		
EF - Exposure frequency =	250	showers/year	US EPA 1991, HHEM Supp Guid
Ed - Exposure duration =	25	years	Carey, 1988
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

Inhalation Dose (mg/kg-shower) =
((VR * S) / (BW * Rex * 10^6)) * (Ds + (exp(-Rex * Dt) / Rex) - (exp(Rex * (Ds - Dt)) / Rex))

Parameter	Value	Units	Source
VR - Ventilation Rate =	15	L/min	Foster, Chrostowski, 1987
S - Indoor VOC generation rate =	chem. specific	ug/m³-min	
BW - Body Weight =	70	kg	US EPA 1989, RAGS Part A
Rex - Air Exchange Rate =	0 0083	exchange/mi	Foster, Chrostowski, 1987
Ds - Duration in Shower =	15	min	US EPA 1995, Exp. Factors Handbook
Dt - Total Duration in Shower Room =	20	min	reasonable maximum

S (ug/m³-min) = (Cwd * FR) / SV

Parameter	Value	Units	Source
Cwd' - Concentration leaving shower droplet after time ts =	chem. specific	ug/L	
FR - Shower Water Flow Rate =	10	L/min	Foster, Chrostowski, 1987
SV - Shower Room Air Volume =	6	m³	Foster, Chrostowski, 1987

Cwd (ug/L) = Cwo * CFi * (1-exp((-Kal * tsd) / (60 * d)))

Parameter	Value	Units	Source
Cwo - Shower water concentration =	chem. specific	mg/L	
CFi - Conversion factor =	1 00E+03	ug/mg	
Kal - overall mass transfer coefficient =	chem. specific	cm/hr	
tsd - shower droplet drop time =	2	sec	Foster, Chrostowski, 1987
d - shower droplet diameter =	1	mm	Foster, Chrostowski, 1987

Kal (cm/hour) = $KL / ((T_l * u_s) / (T_s * u_l))^{0.5}$

Parameter	Value	Units
KL - mass transfer coefficient =	chem. specific	cm/hr
T_l - calibration water temperature =	293	K
u_s - water viscosity at Ts =	0 596	cp
T_s - shower water temperature =	318	K
u_l - water viscosity at Tl =	1.002	cp

KL (cm/hr) = $((1 / kl(voc))+((R * T) / (H * kg(voc))))^{-1}$

Parameter	Value	Units
kl(voc) - liquid-film mass transfer coefficient =	chem. specific	cm/hr
R - universal gas constant =	8 20E-05	atm-m³/mol K
T - absolute temperature =	293	K
H - Henry's Law Constant =	chem specific	atm-m³/mol
kg(voc) - gas-film mass transfer coefficient =	chem. specific	cm/hr

kg(voc) (cm/hr) = $kg(H_2O) * (18 / MWvoc)^{0.5}$

$kg(H_2O)$ = 3000 cm/hr

MW - molecular weight = chem. specific g/mol

kl(voc) (cm/hr) = $kl(CO_2) * (44 / MW)^{0.5}$

$kl(CO_2)$ = 20 cm/hr

Constituent	Cwo mg/L	kl(voc) cm/hr	kg(voc) cm/hr	KL cm/hr	Kal cm/hr	Cwd ug/L	S ug/m³-min	Inhalation Dose mg/kg-shower	Average Daily Intake mg/kg-day	Inhalation Chronic RfD mg/kg-day	Hazard Index	Lifetime Average Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Indeno(1,2,3-c,d)pyrene	5.00E-03	7 98E+00	7.66E+02	5.07E-02	6 84E-02	1.14E-05	1.90E-05	7.20E-10	4.93E-10	NA	NA	1.76E-10	NA	NA
Naphthalene	6.00E+01	1 17E+01	1 12E+03	7 72E+00	1 04E+01	1 76E+01	2 94E+01	1 11E-03	7 63E-04	9.00E-04	NA	2 72E-04	NA	NA
Pentachlorophenol	6 00E-02	8.13E+00	7.80E+02	7.95E-04	1.07E-03	2.15E-06	3 58E-06	1 36E-10	9.30E-11	NA	NA	3 32E-11	NA	NA
Phenanthrene	1 85E+01	9 94E+00	9 53E+02	1 25E+00	1 69E+00	1.01E+00	1.69E+00	6 41E-05	4.39E-05	NA	NA	1 57E-05	NA	NA
Phenol	5 80E+01	1.37E+01	1 31E+03	1.82E-02	2 45E-02	4.74E-02	7 90E-02	3.00E-06	2 05E-06	NA	NA	7.33E-07	NA	NA
Pyrene	6 37E-01	9.33E+00	8 95E+02	3.93E-01	5.30E-01	1.12E-02	1.86E-02	7 06E-07	4 83E-07	NA	NA	1.73E-07	NA	NA
Volatiles														
Benzene	2.64E-01	1.50E+01	1.44E+03	1.44E+01	1.94E+01	1.26E-01	2 09E-01	7 95E-06	5 44E-06	1.70E-03	3.20E-03	1 94E-06	2 90E-02	5 64E-08
Ethylbenzene	1 79E-01	1.29E+01	1.24E+03	1 25E+01	1.69E+01	7 71E-02	1 28E-01	4.87E-06	3 34E-06	2.90E-01	1.15E-05	1.19E-06	NA	NA
Styrene	6 49E-02	1 30E+01	1.25E+03	1.19E+01	1 61E+01	2 69E-02	4.49E-02	1 70E-06	1.17E-06	2 86E-01	4 08E-06	4 17E-07	NA	NA
Toluene	5.48E-01	1 38E+01	1 33E+03	1 33E+01	1 80E+01	2 47E-01	4.12E-01	1 56E-05	1 07E-05	1 14E-01	9 39E-05	3 82E-06	NA	NA
Xylenes (total)	1 90E+00	1.29E+01	1 24E+03	1.24E+01	1.68E+01	8.13E-01	1.36E+00	5 14E-05	3.52E-05	NA	NA	1.26E-05	NA	NA

NA - Not available

Total Hazard Index: 3 31E-03 | 7 25E-06

Table 62

Reasonable Maximum Dermal Exposure to Potomac Aquifer Groundwater to an Industrial Worker Showering

Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{DA * EF * ED * FS * SAt}{BW * AT}$

DA - Absorbed dose =	*chem specific*	mg/day-cm²	
EF - Exposure frequency =	250	day/year	US EPA 1991, HHEM Supp Guidance
ED - Exposure duration =	25	year	Carey, 1988
SA - Skin surface area available for contact =	20000	cm²	calculated
SAt - Total skin surface area =	20000	cm²	US EPA 1989, RAGS Part A
FS - Fraction of skin surface area available for contact =	100%		reasonable maximum
BW - Body weight =	70	kg	US EPA 1989, RAGS Part A
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

For Inorganics:

DA (mg/day-cm²) = Kp * Cgw * t * CF

Kp - Dermal permeability constant =	chem specific	cm/hr	
Cgw - Chemical concentration in groundwater =	chem. specific	mg/L	
t - Event duration =	0 25	hr	US EPA 1992, Dermal Exp. Assess
CF - Conversion factor	*1.00E-03*	*L/cm³*	

For Organics:

If t < t*, then DA = 2 * CF * Cgw * Kp * (6 * τ * t / π)^0.5

If t>t*, then DA = Kp * Cgw * CF * (t/(1+B) + (2 * τ * ((1+3B) / (1+B)))

t* - Percutaneous absorption time =	chem specific	hr
B - Partitioning coefficient =	chem specific	dimensionless
τ - Lag time =	chem specific	hr

Analyte	Concentration in Groundwater mg/L	Kp cm/hr	t* hr	B	τ hr	Absorbed Dose mg/day-cm²	Average Daily Intake mg/kg-day	Dermal Chronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Inorganics												
Antimony	2 30E-03	1 00E-03	NA	NA	NA	5 75E-10	1.13E-07	4 00E-06	2 81E-02	4 02E-08	NA	NA
Lead	3 50E-03	4 00E-06	NA	NA	NA	3 50E-12	6 85E-10	NA	NA	2 45E-10	NA	NA
PCBs/Pesticides												
Heptachlor epoxide	6 10E-06	2.76E-02	1 30E+02	9 55E+00	2 07E+01	1 06E-09	2.07E-07	3 90E-06	5 32E-02	7 40E-08	3 03E+01	2 24E-06
								Total Hazard Index	0 08		Total Cancer Risk:	2 24E-06

NA - Not applicable

AR316084

Table 63
Reasonable Maximum Oral Exposure to Potomac Aquifer Groundwater While Drinking at the Job Site
Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{Cgw \cdot IR \cdot ED \cdot EF}{BW \cdot AT}$

Cgw - Concentration in groundwater =	chem specific	mg/L	
IR - Ingestion Rate =	1.0	L/day	US EPA 1991, HHEM Supp Guidance
ED - Exposure duration =	25	year	US EPA 1991, HHEM Supp Guidance
EF- Exposure frequency =	250	days/year	US EPA 1991, HHEM Supp Guidance
BW - Body weight =	70	kg	US EPA 1989, RAGS Part A
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

Analyte	Concentration in Groundwater mg/L	Average Daily Intake mg/kg-day	Oral Chronic RfD mg/kg-day	Hazard Index	Lifetime Average Daily Intake mg/kg-day	Oral Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Inorganics							
Antimony	2.30E-03	2 25E-05	4 00E-04	5.63E-02	8.04E-06	NA	NA
Lead	3.50E-03	3 42E-05	NA	NA	1.22E-05	NA	NA
PCBs/Pesticides							
Heptachlor epoxide	6.10E-06	5 97E-08	1 30E-05	4.59E-03	2.13E-08	9 10E+00	1 94E-07
		Total Hazard Index		0 06		Total Cancer Risk.	1.94E-07

AR000420

Table 64

Reasonable Maximum Inhalation Exposure to VOC Vapors by an Industrial Worker Showering with Potomac Aquifer Groundwater

Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{Dose * EF * ED}{AT}$

Parameter	Value	Units	Source
Dose - Inhalation dose =	chem. specific		
EF - Exposure frequency =	250	showers/year	US EPA 1991, HHEM Supp Guid
Ed - Exposure duration =	25	years	Carey, 1988
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

Inhalation Dose (mg/kg-shower) =
((VR * S) / (BW * Rex * 10^6)) * (Ds + (exp(-Rex * Dt) / Rex) - (exp(Rex * (Ds - Dt)) / Rex))

Parameter	Value	Units	Source
VR - Ventilation Rate =	15	L/min	Foster, Chrostowski, 1987
S - Indoor VOC generation rate =	chem. specific	ug/m^3-min	
BW - Body Weight =	70	kg	US EPA 1989, RAGS Part A
Rex - Air Exchange Rate =	0.0083	exchange/mi	Foster, Chrostowski, 1987
Ds - Duration in Shower =	15	min	US EPA 1995, Exp Factors Handbook
Dt - Total Duration in Shower Room =	20	min	reasonable maximum

S (ug/m^3-min) = (Cwd * FR) / SV

Parameter	Value	Units	Source
Cwd - Concentration leaving shower droplet after time ts =	chem specific	ug/L	
FR - Shower Water Flow Rate =	10	L/min	Foster, Chrostowski, 1987
SV - Shower Room Air Volume =	6	m^3	Foster, Chrostowski, 1987

Cwd (ug/L) = Cwo * CFi * (1-exp((-Kal * tsd) / (60 * d)))

Parameter	Value	Units	Source
Cwo - Shower water concentration =	chem. specific	mg/L	
CFi - Conversion factor =	1 00E+03	ug/mg	
Kal - overall mass transfer coefficient =	chem. specific	cm/hr	
tsd - shower droplet drop time =	2	sec	Foster, Chrostowski, 1987
d - shower droplet diameter =	1	mm	Foster, Chrostowski, 1987

Kal (cm/hour) = $KL / ((T_l * u_s) / (T_s * u_l))^{0.5}$

Parameter	Value	Units
KL - mass transfer coefficient =	chem. specific	cm/hr
T_l - calibration water temperature =	293	K
u_s - water viscosity at Ts =	0 596	cp
T_s - shower water temperature =	318	K
u_l - water viscosity at Tl =	1.002	cp

KL (cm/hr) = $((1 / kl(voc)) + ((R * T) / (H * kg(voc))))^{-1}$

Parameter	Value	Units
kl(voc) - liquid-film mass transfer coefficient =	chem specific	cm/hr
R - universal gas constant =	8 20E-05	atm-m^3/mol K
T - absolute temperature =	293	K
H - Henry's Law Constant =	chem. specific	atm-m^3/mol
kg(voc) - gas-film mass transfer coefficient =	chem. specific	cm/hr

kg(voc) (cm/hr) = $kg(H_2O) * (18 / MWvoc)^{0.5}$

Parameter	Value	Units
$kg(H_2O)$ =	3000	cm/hr
MW - molecular weight =	chem specific	g/mol

kl(voc) (cm/hr) = $kl(CO_2) * (44 / MW)^{0.5}$

Parameter	Value	Units
$kl(CO_2)$ =	20	cm/hr

Constituent	Cwo mg/L	kl(voc) cm/hr	kg(voc) cm/hr	KL cm/hr	Kal cm/hr	Cwd ug/L	S ug/m^3-min	Inhalation Dose mg/kg-shower	Average Daily Intake mg/kg-day	Inhalation Chronic RfD mg/kg-day	Hazard Index	Lifetime Average Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
PCBs/Pesticides														
Heptachlor epoxide	6 10E-06	6 72E+00	6 45E+02	7 62E-01	1 03E+00	2 06E-07	3.43E-07	1 30E-11	8.91E-12	NA	NA	3 18E-12	9 10E+00	2 90E-11
									Total Hazard Index		NA		Total Cancer Risk.	2.90E-11

AR316086

ENVIRONMENTAL STANDARDS

Table 67

Reasonable Maximum Dermal Exposure to Soils by a Trespasser (12 - 18 years old)

Former Koppers Company, Inc., Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs * SA * AF * ABS * EF * ED * CF}{BW * AT}$$

Cs - Concentration in soil and sediments =	mg/kg	chemical specific	
SA - Skin surface area available for exposure =	cm^2/day	4381	calculated
Total Surface area =	cm^2	15758	US EPA 1995, EFH
Fraction of skin surface area available for exposure =		27 8%	US EPA 1995, EFH
AF -Soil Adherence Factor =	mg/cm^2	0.025	US EPA 1995, EFH
ABS_d - Absorption for dioxins =		0.1	US EPA 1995, Region III
ABS_s - Absorption for semivolatiles =		0 1	US EPA 1995, Region III
ABS_n - Absorption for inorganics =		0 01	US EPA 1995, Region III
EF - Exposure frequency =	days/year	24	reasonable maximum
ED - Exposure duration =	years	6	reasonable maximum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1.00E-06	
BW - Body weight =	kg	56	US EPA 1995, EFH
AT_n - Averaging time for noncarcinogenic effects =	days	2190	US EPA 1989, RAGS Part A
AT_c - Averaging time for carcinogenic effects =	days	25550	US EPA 1989, RAGS Part A

Chemical	Conc. in Soils mg/kg	Average Daily Intake mg/kg-day	Dermal Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv.	6 56E-03	8 44E-11	NA	NA	7 23E-12	3.00E+05	2 17E-06
Inorganics							
Arsenic	8.40E+00	1 08E-08	2 85E-04	3 79E-05	9 26E-10	1 58E+00	1 46E-09
Thallium	7 12E+00	9.15E-09	NA	NA	7 85E-10	NA	NA
Semivolatiles							
Dibenzofuran	1 24E+02	1 59E-06	NA	NA	1.36E-07	NA	NA
Pentachlorophenol	6 62E+01	8 51E-07	2 10E-02	4.05E-05	7 30E-08	1 71E-01	1 25E-08
Phenanthrene	4 93E+02	6 34E-06	NA	NA	5 43E-07	NA	NA

NA - Not available | Total Hazard Index. 0.00008 | 2 18E-06

Table 68
Reasonable Maximum Exposure by Ingestion of Soils by a Trespasser (12 - 18 years old)
Former Koppers Company, Inc., Newport, DE

Intake (mg/kg-day) = $\frac{Cs * IngR * EF * ED * CF * FI}{BW * AT}$

Cs - Concentration in soil and sediments =	mg/kg	chemical specific	
IngR - Ingestion rate =	mg/day	100	Calabrese et al, 1987
EF - Exposure frequency =	days/year	24	reasonable maximum
ED - Exposure duration =	years	6	reasonable mamimum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1.00E-06	
FI - Fraction of daily soil ingested at site =		1	reasonable maximum
BW - Body weight =	kg	56	US EPA 1995, EFH
AT - Averaging time for noncarcinogenic effects =	days	2190	US EPA 1989, RAGS Part A
and for carcinogenic effects =	days	25550	US EPA 1989, RAGS Part A

Chemical	Conc. in Soils mg/kg	Average Daily Intake mg/kg-day	Oral Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Oral Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	6 56E-03	7.70E-10	NA	NA	6 60E-11	1 50E+05	9 90E-06
Inorganics							
Arsenic	8 40E+00	9 87E-07	3 00E-04	3 29E-03	8 46E-08	1.50E+00	1.27E-07
Thallium	7.12E+00	8.36E-07	NA	NA	7.16E-08	NA	NA
Semivolatiles							
2-Methylnaphthalene	8.69E+01	1 02E-05	NA	NA	8 74E-07	NA	NA
Acenaphthylene	2.52E+01	2.96E-06	NA	NA	2.54E-07	NA	NA
Benzo(a)anthracene	5.64E+02	6 62E-05	NA	NA	5.67E-06	7.30E-01	4.14E-06
Benzo(a)pyrene	3.59E+02	4.21E-05	NA	NA	3 61E-06	7 30E+00	2.64E-05
Benzo(b)fluoranthene	7.50E+02	8.81E-05	NA	NA	7 55E-06	7.30E-01	5.51E-06
Benzo(g,h,i)perylene	1.32E+02	1.55E-05	NA	NA	1 33E-06	NA	NA
Benzo(k)fluoranthene	2.36E+02	2.77E-05	NA	NA	2 38E-06	7.30E-02	1 73E-07
Carbazole	2.99E+02	3.51E-05	NA	NA	3 01E-06	2.00E-02	6.02E-08
Chrysene	5.85E+02	6.87E-05	NA	NA	5.89E-06	7 30E-03	4 30E-08
Dibenz(a,h)anthracene	3.95E+01	4.63E-06	NA	NA	3 97E-07	7 30E+00	2.90E-06
Dibenzofuran	1 24E+02	1 45E-05	NA	NA	1 24E-06	NA	NA
Indeno(1,2,3-c,d)pyrene	1.90E+02	2 24E-05	NA	NA	1.92E-06	7.30E-01	1.40E-06
Pentachlorophenol	6 62E+01	7 77E-06	3.00E-02	2 59E-04	6 66E-07	1.20E-01	8.00E-08
Phenanthrene	4 93E+02	5 79E-05	NA	NA	4.96E-06	NA	NA

NA - Not available | Total Hazard Index. 0 0035 | 5 07E-05

AR316088

ENVIRONMENTAL STANDARDS

Table 71

Reasonable Maximum Dermal Exposure to Soils and NAPL by a Trespasser (12 - 18 years old)

Former Koppers Company, Inc., Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs * SA * AF * ABS * EF * ED * CF}{BW * AT}$$

Cs - Concentration in soil and sediments =	mg/kg	chemical specific	
SA - Skin surface area available for exposure =	cm^2/day	4381	calculated
Total Surface area =	cm^2	15758	US EPA 1995, EFH
Fraction of skin surface area available for exposure =		27 8%	US EPA 1995, EFH
AF -Soil Adherence Factor =	mg/cm^2	0 025	US EPA 1995, EFH
ABS_d - Absorption for dioxins =		0 1	US EPA 1995, Region III
ABS_s - Absorption for semivolatiles =		0 1	US EPA 1995, Region III
ABS_n - Absorption for inorganics =		0 01	US EPA 1995, Region III
EF - Exposure frequency =	days/year	24	reasonable maximum
ED - Exposure duration =	years	6	reasonable mamimum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1.00E-06	
BW - Body weight =	kg	56	US EPA 1995, EFH
AT_n - Averaging time for noncarcinogenic effects =	days	2190	US EPA 1989, RAGS Part A
AT_c - Averaging time for carcinogenic effects =	days	25550	US EPA 1989, RAGS Part A

Chemical	Conc. in Soils and NAPL mg/kg	Average Daily Intake mg/kg-day	Dermal Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	6 56E-03	8 44E-11	NA	NA	7.23E-12	3.00E+05	2 17E-06
Inorganics							
Arsenic	7 48E+00	9 61E-09	2.85E-04	3.37E-05	8.24E-10	1 58E+00	1 30E-09
Iron	1.94E+04	2.50E-05	NA	NA	2.14E-06	NA	NA
Lead	7.05E+01	9 07E-08	NA	NA	7 77E-09	NA	NA
Thallium	4.50E+00	5 79E-09	NA	NA	4 96E-10	NA	NA
Semivolatiles							
Dibenzofuran	5 25E+01	6 75E-07	NA	NA	5 79E-08	NA	NA
Pentachlorophenol	3.44E+01	4 42E-07	2 10E-02	2.11E-05	3 79E-08	1 71E-01	6 48E-09

NA - Not available — Total Hazard Index. 0 0001 — 2 18E-06

Table 72

Reasonable Maximum Exposure by Ingestion of Soils and NAPL by a Trespasser (12 - 18 years old)

Former Koppers Company, Inc., Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs * IngR * EF * ED * CF * FI}{BW * AT}$$

Cs - Concentration in soil and sediments =	mg/kg	chemical specific	
IngR - Ingestion rate =	mg/day	100	Calabrese et al, 1987
EF - Exposure frequency =	days/year	24	reasonable maximum
ED - Exposure duration =	years	6	reasonable mamimum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1.00E-06	
FI - Fraction of daily soil ingested at site =		1	reasonable maximum
BW - Body weight =	kg	56	US EPA 1995, EFH
AT - Averaging time for noncarcinogenic effects =	days	2190	US EPA 1989, RAGS Part A
and for carcinogenic effects =	days	25550	US EPA 1989, RAGS Part A

Chemical	Conc. in Soils and NAPL mg/kg	Average Daily Intake mg/kg-day	Oral Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Oral Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	6 56E-03	7.70E-10	NA	NA	6.60E-11	1 50E+05	9 90E-06
Inorganics							
Arsenic	7 48E+00	8 78E-07	3 00E-04	2.93E-03	7.52E-08	1.50E+00	1.13E-07
Iron	1.94E+04	2.28E-03	NA	NA	1.95E-04	NA	NA
Lead	7.05E+01	8.28E-06	NA	NA	7 10E-07	NA	NA
Thallium	4 50E+00	5 28E-07	NA	NA	4.53E-08	NA	NA
Semivolatiles							
Acenaphthylene	1 52E+01	1.78E-06	NA	NA	1.53E-07	NA	NA
Benzo(a)anthracene	5 00E+02	5.87E-05	NA	NA	5 03E-06	7 30E-01	3 67E-06
Benzo(a)pyrene	2 90E+02	3.40E-05	NA	NA	2 92E-06	7 30E+00	2 13E-05
Benzo(b)fluoranthene	6 26E+02	7.35E-05	NA	NA	6 30E-06	7 30E-01	4 60E-06
Benzo(g,h,i)perylene	1.05E+02	1.23E-05	NA	NA	1 06E-06	NA	NA
Benzo(k)fluoranthene	1 37E+02	1 61E-05	NA	NA	1.38E-06	7 30E-02	1.01E-07
Carbazole	1.09E+02	1 28E-05	NA	NA	1 10E-06	2.00E-02	2.19E-08
Chrysene	5.42E+02	6 37E-05	NA	NA	5 46E-06	7.30E-03	3.98E-08
Dibenz(a,h)anthracene	2.46E+01	2.89E-06	NA	NA	2.47E-07	7 30E+00	1 81E-06
Dibenzofuran	5.25E+01	6 16E-06	NA	NA	5.28E-07	NA	NA
Fluoranthene	1 48E+03	1.74E-04	4 00E-01	4 35E-04	1 49E-05	NA	NA
Indeno(1,2,3-c,d)pyrene	1.51E+02	1 78E-05	NA	NA	1 52E-06	7 30E-01	1 11E-06
Pentachlorophenol	3.44E+01	4 04E-06	3 00E-02	1.35E-04	3 46E-07	1.20E-01	4 15E-08
Phenanthrene	3.45E+02	4 06E-05	NA	NA	3 48E-06	NA	NA
Pyrene	1.26E+03	1 48E-04	3 00E-01	4 93E-04	1 27E-05	NA	NA

NA - Not available — Total Hazard Index: 0.004 — 4 27E-05

AR000425

Table 74 RME (Typo)

~~Central Tendency~~ Dermal Exposure to Non-River Surface Water - Adolescent Trespasser

Former Koppers Company, Inc., Newport, DE

Average Daily Intake (mg/kg-day) = $\frac{DA \cdot EF \cdot ED \cdot SA}{BW \cdot AT}$

DA - Absorbed dose =	chem specific	mg/day-cm^2	
EF - Exposure frequency =	24	day/year	US EPA 1991, HHEM Supp Guidance
ED - Exposure duration =	6	year	Carey, 1988
SA - Skin surface area available for contact =	207	cm^2	calculated
BW - Body weight =	56	kg	US EPA 1989, RAGS Part A
AT_n - Averaging Time noncarcinogenic =	2190	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

For Inorganics:

DA (mg/day-cm^2) = Kp * Cgw * t * CF

Kp - Dermal permeability constant =	chem. specific	cm/hr	US EPA 1992, Dermal Exp Assess.
Cgw - Chemical concentration in groundwater =	chem specific	mg/L	
t - Event duration =	0.2	hr	US EPA 1992, Dermal Exp Assess
CF - Conversion factor	1 00E-03	L/cm^3	

For Organics:

If t < t*, then DA = 2 * CF * Cgw * Kp * (6 * τ * t / p)$^{0.5}$

If t > t*, then DA = Kp * Cgw * CF * (t/(1+B) + (2 * τ * ((1+3B) / (1+B)))

t* - Percutaneous absorption time =	chem specific	hr
B - Partitioning coefficient =	chem specific	dimensionless
τ - Lag time =	chem specific	hr

Analyte	Concentration in Groundwater mg/L	Kp cm/hr	t* hr	B	t hr	Absorbed Dose mg/day-cm^2	Average Daily Intake mg/kg-day	Dermal Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins												
2,3,7,8-TCDD Equiv	1 99E-06	1 40E+00	3.80E+01	6 30E+02	8 10E+00	9 81E-09	2 38E-09	NA	NA	2 04E-10	3 00E+05	6 13E-05
Inorganics												
Arsenic	4 95E-03	1 00E-03	NA	NA	NA	9.90E-10	2 41E-10	2 85E-04	8 44E-07	2 06E-11	1 58E+00	3 26E-11
Iron	6 21E+00	1 00E-03	NA	NA	NA	1 24E-06	3 02E-07	NA	NA	2 59E-08	NA	NA
Lead	4 49E-03	4 00E-06	NA	NA	NA	3 59E-12	8 74E-13	NA	NA	7 49E-14	NA	NA
Manganese	1 36E+00	1 00E-03	NA	NA	NA	2 71E-07	6 59E-08	NA	NA	5 65E-09	NA	NA
Thallium	5.77E-03	1 00E-03	NA	NA	NA	1 15E-09	2 80E-10	NA	NA	2 40E-11	NA	NA

NA - Not Applicable

Total Hazard Index 0 0000008 6 13E-05

AR316609

ENVIRONMENTAL STANDARDS

Table 77

Reasonable Maximum Dermal Exposure to Sediment* by a Trespasser (12 - 18 years old)

Former Koppers Company, Inc., Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs * SA * AF * ABS * EF * ED * CF}{BW * AT}$$

Cs - Concentration in soil and sediments =	mg/kg	chemical specific	
SA - Skin surface area available for exposure =	cm^2/day	1103	calculated
Total Surface area =	cm^2	15758	US EPA 1995, EFH
Fraction of skin surface area available for exposure =		7.0%	US EPA 1995, EFH
AF -Soil Adherence Factor =	mg/cm^2	0 025	US EPA 1995, EFH
ABS_d - Absorption for dioxins =		0 1	US EPA 1995, Region III
ABS_s - Absorption for semivolatiles =		0 1	US EPA 1995, Region III
ABS_n - Absorption for inorganics =		0 01	US EPA 1995, Region III
EF - Exposure frequency =	days/year	10	reasonable maximum
ED - Exposure duration =	years	6	reasonable maximum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1 00E-06	
BW - Body weight =	kg	56	US EPA 1995, EFH
AT_n - Averaging time for noncarcinogenic effects =	days	2190	US EPA 1989, RAGS Part A
AT_c - Averaging time for carcinogenic effects =	days	25550	US EPA 1989, RAGS Part A

Chemical	Conc. in Soils and Sediments mg/kg	Average Daily Intake mg/kg-day	Dermal Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	7 96E-04	1 07E-12	NA	NA	9 21E-14	3 00E+05	2 76E-08
Inorganics							
Arsenic	1 19E+01	1 60E-09	2 85E-04	5 63E-06	1 37E-10	1 58E+00	2 17E-10
Lead	1 27E+02	1 72E-08	NA	NA	1.47E-09	NA	NA
Manganese	8 85E+02	1 19E-07	7 00E-03	1.71E-05	1.02E-08	NA	NA
Thallium	4 32E+00	5 82E-10	NA	NA	4 99E-11	NA	NA
Semivolatiles							
Carbazole	1 02E+02	1 38E-07	NA	NA	1 18E-08	NA	NA
Dibenzofuran	2.55E+02	3 44E-07	NA	NA	2 95E-08	NA	NA

* Includes Hershey Run sediments — Total Hazard Index: 0 00002 — Total Cancer Risk 2 78E-08

NA - Not available

AR316092

tres_sed xls \ dermal - RME
Page 1 of 1

ENVIRONMENTAL STANDARDS

AR000426

Table 78

Reasonable Maximum Exposure by Ingestion of Sediment* by a Trespasser (12 - 18 years old)

Former Koppers Company, Inc., Newport, DE

$$\text{Intake (mg/kg-day)} = \frac{Cs \cdot IngR \cdot EF \cdot ED \cdot CF \cdot FI}{BW \cdot AT}$$

Cs - Concentration in soil and sediments =	mg/kg	chemical specific	
IngR - Ingestion rate =	mg/day	100	Calabrese et al, 1987
EF - Exposure frequency =	days/year	10	reasonable maximum
ED - Exposure duration =	years	6	reasonable mamimum
CF - Conversion factor (1 kg/1,000,000 mg) =	kg/mg	1 00E-06	
FI - Fraction of daily soil ingested at site =		1	reasonable maximum
BW - Body weight =	kg	56	US EPA 1995, EFH
AT - Averaging time for noncarcinogenic effects =	days	2190	US EPA 1989, RAGS Part A
and for carcinogenic effects =	days	25550	US EPA 1989, RAGS Part A

Chemical	Conc. in Soils and Sediments mg/kg	Average Daily Intake mg/kg-day	Oral Subchronic RfD mg/kg-day	Hazard Index	Average Lifetime Daily Intake mg/kg-day	Oral Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	7.96E-04	3 89E-11	NA	NA	3 34E-12	1 50E+05	5 01E-07
Inorganics							
Arsenic	1 19E+01	5 81E-07	3.00E-04	1.94E-03	4 98E-08	1.50E+00	7 47E-08
Lead	1 27E+02	6.23E-06	NA	NA	5.34E-07	NA	NA
Manganese	8.85E+02	4.33E-05	1.40E-01	3.09E-04	3 71E-06	NA	NA
Thallium	4.32E+00	2 11E-07	NA	NA	1.81E-08	NA	NA
Semivolatiles							
Benzo(a)anthracene	3 20E+02	1.57E-05	NA	NA	1 34E-06	7 30E-01	9 80E-07
Benzo(a)pyrene	9 10E+01	4 45E-06	NA	NA	3 82E-07	7 30E+00	2 79E-06
Benzo(b)fluoranthene	1 65E+02	8.07E-06	NA	NA	6 92E-07	7 30E-01	5 05E-07
Benzo(k)fluoranthene	5 51E+01	2 70E-06	NA	NA	2.31E-07	7 30E-02	1 69E-08
Carbazole	1 02E+02	5.00E-06	NA	NA	4.29E-07	2 00E-02	8.58E-09
Chrysene	2 64E+02	1 29E-05	NA	NA	1 11E-06	7 30E-03	8 09E-09
Dibenz(a,h)anthracene	1 25E+01	6.09E-07	NA	NA	5.22E-08	7 30E+00	3.81E-07
Dibenzofuran	2.55E+02	1 25E-05	NA	NA	1 07E-06	NA	NA
Fluoranthene	2 27E+03	1 11E-04	4.00E-01	2 78E-04	9 53E-06	NA	NA
Fluorene	5.67E+02	2.77E-05	4.00E-01	6 93E-05	2.38E-06	NA	NA
Indeno(1,2,3-c,d)pyrene	4.56E+01	2.23E-06	NA	NA	1.91E-07	7 30E-01	1.39E-07
Pyrene	1.17E+03	5 70E-05	3 00E-01	1 90E-04	4.89E-06	NA	NA

* Includes Hershey Run sediments — Total Hazard Index 0.003 — Total Cancer Risk 5 40E-06

NA - Not available

Table 84

Reasonable Maximum Exposure by Ingestion of Locally Caught Fish

Former Koppers Company, Inc., Newport, DE

Daily Intake (mg/kg-day) = $\frac{Cf * IRf * FI * EF * ED}{BW * AT}$

Cf - Concentration in fish =	chem. specific	mg/kg	
IRf - Ingestion rate of fish =	0.025	kg/day	From Ebert, 1992, Connelly et al., 1996, West, 1993
FI - Fraction of fish ingested from affected source =	100%		reasonable maximum
BW - Body weight =	70	kg	US EPA 1989, RAGS Part A
EF - Exposure frequency =	365	days/year	US EPA 1989, RAGS Part A
ED - Exposure duration =	25	year	US EPA 1991, Supp Guid to RAGS
AT_n - Averaging Time noncarcinogenic =	9125	days	US EPA 1989, RAGS Part A
AT_c - Averaging Time carcinogenic =	25550	days	US EPA 1989, RAGS Part A

Analyte	Concentration in Fish mg/kg	Average Daily Intake mg/kg-day	Oral Chronic RfD mg/kg-day	Hazard Index	Lifetime Average Daily Intake mg/kg-day	Oral Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Dioxins							
2,3,7,8-TCDD Equiv	3.01E-07	1.08E-10	NA	NA	3.84E-11	1.50E+05	5.77E-06
Inorganics							
Arsenic	6.59E-01	2.35E-04	3.00E-04	7.85E-01	8.41E-05	1.50E+00	1.26E-04
Lead	1.27E-01	4.54E-05	NA	NA	1.62E-05	NA	NA
Mercury	2.54E-01	9.06E-05	NA	NA	3.24E-05	NA	NA
PCBs/Pesticides							
Aroclor 1254	4.20E-01	1.50E-04	2.00E-05	7.50E+00	5.36E-05	2.00E+00	1.07E-04
Aroclor 1260	2.40E-01	8.57E-05	2.00E-05	4.29E+00	3.06E-05	2.00E+00	6.12E-05
4,4'-DDD	4.40E-02	1.57E-05	NA	NA	5.61E-06	2.40E-01	1.35E-06
4,4'-DDE	1.30E-01	4.64E-05	NA	NA	1.66E-05	3.40E-01	5.64E-06

NA - Not available

Total Hazard Index. 12.57

Total Cancer Risk 3.07E-04

Table 7. Ecological Risk Assessment Endpoints

Table 7. Ecological Risk Assessment Endpoints

Assessment Endpoint	Lines of Evidence	Ecological Receptor	Weight of Evidence
1) Protection of the structure and function of wetland communities and	Vegetation surveys		
	Toxicity test results	Amphipod and Midge	NOAEL 82.87 mg/kg total PAHs, LOAEL 197.6 mg/kg total PAHs
2) Protection of the aquatic benthic invertebrate communities structure and function	Evaluation of the benthic macroinvertebrate population/ community structure		In areas of high total PAH sediment concentration, reduction in population of benthic organisms present
3) Protection of the upland soil community functioning	Toxicity test results	Earthworm	NOAEL 587 mg/kg total PAHs and LOAEL 1264 mg/kg total PAHs
	Plant community surveys		Areas of stressed vegetation associated with elevated levels of contamination
4) Protection of the structure and function of the terrestrial plant community	Plant community surveys		Negative effects of contamination on upland plants particularly in areas where visible contamination found
5) Protection of fish populations and communities from direct toxicity and reproductive impairment	Embryo toxicity tests	Killifish	NOAEL 33.5 mg/kg total PAHs
	Potential indirect effects based on benthic macroinvertebrate toxicity tests		
6) Protection of amphibian population, specifically in terms of recruitment	Toxicity test results	Southern Leopard Frog	Risk exists, effects levels consistent with other sediment contamination related risks

Table 8. Applicable or Relevant and Appropriate Requirements ("ARARs")

AR316097

TABLE 8

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND TO BE CONSIDERED MATERIAL (TBCs) KOPPERS (NEWPORT) SITE

ARAR or TBC	Legal Citation	ARAR Class	Requirement Synopsis	Applicability to Selected Remedy	Area of Concern
I. CHEMICAL SPECIFIC					
A. Water					
1. Safe Drinking Water Act	42 U S.C. §§ 300f et seq				
a. Maximum Contaminant Level Goals (MCLGs)	40 C.F.R § 141.50-51	Relevant and Appropriate	Non-enforceable health goals for public water supplies. The NCP requires that non-zero MCLGs shall be attained by remedial actions for ground water that is a current or potential source of drinking water, where the MCLGs are relevant and appropriate under the circumstances of the release.	The containment of NAPL and NAPL-contaminated soils and sediments will allow for natural attenuation processes to work in the Columbia aquifer. It is expected that attenuation processes will be able to restore impacted ground water outside of the containment area once containment is complete. There is no known contamination in the Potomac Aquifer A State Ground Water Management Zone (GMZ) will be extended to encompass the Site in order to prevent the use of and exposure to Columbia ground water	GW
b. Maximum Contaminant Levels (MCLs)	40 C F.R § 141.11-12	Relevant and Appropriate	Enforceable standards for public drinking water supply systems (with at least fifteen service connections or used by at least 25 people) The NCP requires that MCLs, for those contaminants whose MCLG is zero, shall be attained by remedial actions for ground water that is a current or potential source of drinking water, where the MCLs are relevant and appropriate under the circumstances of the release.	The containment of NAPL and NAPL-contaminated soils and sediments will allow for natural attenuation processes to work in the Columbia aquifer. It is expected that attenuation processes will be able to restore impacted ground water outside of the containment area once containment is complete. There is no known contamination in the Potomac Aquifer. A State Ground Water Management Zone (GMZ) will be extended to encompass the Site in order to prevent the use of and exposure to Columbia ground water.	GW
2. Health Effects Assessment		To be Considered	Non-enforceable toxicity data for specific chemicals for use in public health assessments. Also "to be considered" are Carcinogenic Potency Factors and Reference Doses provided in the Superfund Public Health Evaluation Manual	To be considered where remedial action addresses risk-based criteria or when setting clean-up standards for the protection of human health	Site-wide

ARAR or TBC	Legal Citation	ARAR Class	Requirement Synopsis	Applicability to Selected Remedy	Area of Concern
3. Delaware Comprehensive Water Resources Management Committee Reports, December 13, 1983		To Be Considered	The reports were adopted as policy by the DNREC Secretary. Among these reports is the Groundwater Quality Management Report, July 1983, which provided Delaware with a number of tools for dealing with ground-water contamination.	To be considered for ground water monitoring.	GW
4 Clean Water Act	Clean Water Act, Section 303	Relevant and Appropriate	Water quality criteria set at levels to protect human health for water and fish ingestion and protection of aquatic life in streams, lakes, and rivers	To be considered for ground water management if a surface water discharge will be required To be considered for storm water management if a surface water discharge will be required.	Hershey Run, GW
5 Delaware Surface Water Quality Standards as amended, Feb. 26, 1993	Sections 3, 4, 5, 6, 8, 9, 10, 11.1, 11.2, 11.3, 11.4, 11.6, 12	Applicable	Criteria are provided to maintain surface water for streams, lakes, rivers, and standing water in wetlands of satisfactory quality consistent with public health and recreational purposes, the propagation and protection of fish and aquatic life, and other beneficial uses of water.	Any surface water discharge must meet these levels if more stringent than federal regulations.	Hershey Run
B. Air					
1 Clean Air Act	42 U.S.C. § 7401				
a National Emissions Standards for Hazardous Air Pollutants	40 C.F.R. Part 61	Relevant and Appropriate	Standards promulgated for air emissions from specific source categories. Not applicable but may be relevant and appropriate for emissions from excavations at Superfund sites.	Relevant and appropriate for potential odors and emissions resulting from excavation.	Uplands
2. Delaware Ambient Air Quality Standards	Title 7, Delaware Code, Ch 60, Regulation 3, Section 6003	Applicable	Establishes ambient air quality standards.	Applicable for potential releases from excavation work or other remedial actions.	Uplands
II. LOCATION SPECIFIC					
1. Coastal Zone Management Act of 1972, Coastal Zone Act Reauthorization Amendments of 1990	16 U.S.C. §§ 1451 et seq. 15 C.F.R. Part 930	Applicable	Requires that Federal agencies conducting or supporting activities directly affecting the coastal zone, conduct or support those activities in a manner that is consistent with the approved appropriate State coastal zone management program. (See Delaware's Comprehensive Update and Routine Program Implementation, March 1993)	On-site remedial actions are required to be consistent, to the maximum extent practicable, with Delaware's coastal zone management program EPA must notify Delaware of its determination that the actions are consistent to the maximum extent practicable.	Site-wide
2. The Archaeological and Historical Preservation Act of 1974	16 U.S.C. § 469	Applicable	Requirements relating to potential loss or destruction of significant scientific, historical, or archaeological data	The preferred alternative has the potential for disturbing archeological resources. Further action will be taken to identify the potentially affected resources and action will be taken to mitigate any adverse effects on those resources that would result from Remedial activities	Site-wide

ARAR or TBC	Legal Citation	ARAR Class	Requirement Synopsis	Applicability to Selected Remedy	Area of Concern
3. Protection of Floodplains	40 C F.R. Part 6, Appendix A; 40 C.F.R. § 6.302	Applicable	Sets forth EPA policy for carrying out provisions of Executive Order 11988 (Floodplain Management) which requires actions to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.	Applicable since much of the remedial action will take place within both the 100-year and 500-year floodplains. Due to the encroachment of the containment area into tidal wetlands, wetlands will be constructed on site to mitigate the loss of volume inside the floodplain.	Site-wide
4. Protection of Wetlands	40 C.F.R. Part 6, Appendix A; 40 C.F.R. § 6.302	Applicable	Sets forth EPA policy for carrying out provisions of Executive Order 11990 (Protection of Wetlands) which requires actions to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.	Applicable since the construction of the containment area will affect wetlands.	Wetlands
5. Delaware Coastal Zone Act, 7 Delaware Code Chapter 70, Coastal Zone Act Regulations, 6/9/93	7 Delaware Code, Sections 7003, 7004	To Be Considered	Controls the location, extent, and type of industrial development in Delaware's coastal areas.	Will be considered for consistency since the remedial action involves substantial aquatic habitat and is located in Delaware's coastal area although not in the defined coastal zone of this statute	ALL
6. Delaware Wetlands Regulations Revised June 29, 1984	Sections 1, 2, 7	Applicable	Requires activities that may adversely affect wetlands in Delaware to be permitted. Permits must be approved by the county or municipality having jurisdiction	Any substative requirements shall be met since wetlands will be destroyed and replaced in the Hershey Run marsh, and dredged (or excavated) and restored in the wetlands near the South Ponds. Since all of the wetland or remediation is considered "on-site", no permit will be required.	Wetlands
7. Delaware Regulations Governing the Use of Subaqueous Lands, amended September 2, 1992	Sections 1, 3, 4	Applicable	Requires activities that affect public or private subaqueous lands in the State be permitted.	Any substantive requirements shall be met since the remediation involves dredging and the potential rechannelization of Hershey Run. However, no permit shall be required.	Wetlands
8. Delaware Executive Order 56 on Freshwater Wetlands (1988)		To Be Considered	General policy to minimize the adverse effects to freshwater wetlands.	To be considered for wetland remediation and restoration	Wetlands
9. Governor's Roundtable Report on Freshwater Wetlands (1989)		To Be Considered	General policy to minimize the adverse effects to freshwater wetlands	To be considered for wetland remediation and restoration.	Wetlands
10. Ground Water Protection Strategy of 1984	EPA 440/6-84-002	To be Considered	Identifies ground water quality to be achieved during remedial actions based on aquifer characteristics and use.	The EPA aquifer classification will be taken into consideration during design and implementation of the remedy.	GW
11. Requirements pertaining to White Clay Creek, a Wild and Scenic River	Wild and Scenic River Act 36 C F R. Part 297	Applicable	Requirements to maintain the WSR in a free-flowing condition to protect the water quality and to fulfill other vital national conservation purposes	Applies to White Clay Creek, the stream into which Hershey Run drains	Site-wide

ARAR or TBC	Legal Citation	ARAR Class	Requirement Synopsis	Applicability to Selected Remedy	Area of Concern
III. ACTION SPECIFIC					
A. Miscellaneous					
1. Council on Environmental Quality	40 C.F R. § 1500.2(f)	Relevant and Appropriate	Requires use of all practicable means, consistent with the requirements of NEPA to restore and enhance the quality of the human environment and avoid or minimize any possibe adverse effects upon the quality of the human environment	Institutional controls shall be added to the Site to make sure the restored wetlands remain wildlife habitat.	Wetlands
2. Delaware Regulations Governing Hazardous Substance Cleanup, 1/93	Section 9	Relevant and Appropriate	Establishes clean-up criteria for hazardous waste sites. Only criteria considered relevant and appropriate are for ground water and soil ($1x10^{-5}$; Hazard Index of 1; or natural background if higher).	The cleanup criteria for the Site, though derived from the results of the Ecological Risk Assessment, are protective of Human Health as well.	Uplands, GW
3. Requirements for dredging,excavation and rechannelization	The Rivers and Harbors Act, Section 10	Applicable	Substantive requirements of a Section 10 permit for disposal of dredged and/or excavated materials at an approved facility or in a containment cell	Applies to all materials dredged or excavated during rechannelization of a navigable water of the U.S.	Site-wide
4. Requirements for dewatering from dredging operation	Clean Water Act, Section 404	Applicable	Substantive requirements for the discharge resulting from the dewatering of dredged or fill material into the waters of the U.S.	Applies to all discharges from materials dredged or excavated requiring dewatering during rechannelization of a navigable water	Site-wide
5. Delaware Land Use Restrictive Covenants	Title 7, Delaware Code Chapter 79	Applicable	To provide the required restrictions on land use to protect the integrity of the remedy as well as human health and the environment.	Applies to institutional controls to be implemented at the Site.	Site-wide
B. Water					
1. Clean Water Act (CWA), National Pollutant Discharge Elimination System Requirements	40 C.F.R. Part 122-125	Applicable	Enforceable standards for all discharges to waters of the United States	Discharge limits shall be met for any on-site discharges to surface water including treated ground water (if necessary) and wastewater from dewatering dredge material. Only substantive requirements shall be met and no permit shall be required.	Wetlands GW
2. General Pretreatment Regulations	40 C.F R Part 403	Applicable	Standards for discharge to POTW.	Applicable should the extracted ground water, treated ground water, or wastewater from dredge material be discharged to a POTW.	Wetlands GW
3. Section 10 of the River and Harbors Act	33 U.S.C Section 403 33 C F.R. Part 320-330	Applicable	Permitting requirements for dredging	The stream and wetland dredging will comply to any substantive requirements, but no permit will be required	Wetlands
4. State of Delaware Regulations Governing the Construction of Water Wells, January 20, 1987	Sections 3, 4, 5, 6, 7, 8, 9, 10	Applicable	Contain requirements governing the location, design, installation, use, disinfection, modification, repair, and abandonment of all wells and associated pumping equipment	Installation of any monitoring and recovery wells and the abandonment of wells shall meet all substantive requirements.	Site-wide

ARAR or TBC	Legal Citation	ARAR Class	Requirement Synopsis	Applicability to Selected Remedy	Area of Concern
5. Delaware Water Quality Standards, as amended, February 26, 1993	Sections 3-6, 8-10, 11.1, 11.2, 11.3, 11.4, 11.6, 12	Applicable	Standards are established in order to regulate the discharge into state waters in order to maintain the integrity of the water.	Applicable because the ground water management system will most likely discharge to surface water (the final discharge point will be determined in design).	Hershey Run, GW
6. Delaware River Basin Commission (DRBC) Water Quality	DRBC Ground Water Protected Area Regulation, No. 4, 6(f), 9, 10; Water Code of the Basin, Sections 2.20.4, 2.50.2	To Be Considered	Regulate restoration, enhancement, and preservation of waters in the Delaware River basin.	To be considered if remedial action involves discharge of >50,000 gallons/day average over any month or a withdrawal of ground water of 100,000 gallons/day or more average over any month.	Hershey Run, GW
7 Delaware Regulations Governing the Allocation of Water March 1, 1987	Sections 1, 3, 5.05	Applicable	Contain information pertaining to water allocation permits and criteria for their approval.	May be applicable for the ground water management system. No permit required.	Hershey Run, GW
8. State of Delaware Groundwater Management Plan November 1, 1987		To Be Considered	Policy for ground-water management.	To be considered in setting the ground water management zone.	GW
9 Delaware Regulations Governing Control of Water Pollution, amended 6/23/83	Section 7, 8, 9, 10, 11, 12, 13	Applicable	Contain water quality regulations for the discharging into surface and ground water.	Applicable for potential discharge of treated ground water into surface water Also applicable for potential storm water runoff into Hershey Run, White Clay Creek or the Christina River	Surface Waters, GW
C. Sediments/Solids					
1. Delaware Sediment and Stormwater Regulations January 23, 1991	Section 3, 6, 9; 10, 11, 15	Applicable	Establishes a statewide sediment and stormwater management program	A stormwater and sediment management plan consistent with Delaware requirements must be approved by EPA before construction disturbing over 5,000 square feet of land can begin	Site-wide
D. Waste Handling and Disposal					
1. RCRA Subtitle D Landfill Regulations	40 C.F.R. § 258.60(a)	Relevant and Appropriate	Closure requirements for RCRA subtitle D landfills	Provides some technical requirements for the cap for the containment area	Uplands
2 Delaware Regulations Governing Hazardous Waste	SEE BELOW F 5, F.7, F.9, F.11, F.13, F.15, F.17	SEE BELOW	Delaware Regulations Governing Hazardous Waste Part 261 define "hazardous waste" The regulations listed below apply to the handling of such hazardous waste.	SEE BELOW	SEE BELOW

ARAR or TBC	Legal Citation	ARAR Class	Requirement Synopsis	Applicability to Selected Remedy	Area of Concern
3. Resource Conservation and Recovery Act of 1976, Hazardous and Solid Waste Amendments of 1984	SEE BELOW F.6, F.8, F.10, F.12, F.14, F.16, F.18 Federal regulations would not apply for those regulations which Delaware has the authority from EPA to administer.	SEE BELOW	Regulates the management of hazardous waste, to ensure the safe disposal of wastes, and to provide for resource recovery from the environment by controlling hazardous wastes "from cradle to grave"	SEE BELOW	SEE BELOW
4 Standards Applicable to Generators of Hazardous Waste	Delaware Regulations Governing Hazardous Waste, §§ 262.10-58	Applicable	Establishes standards for generators of hazardous wastes including waste determination manifests and pre-transport requirements. (Applies to recovered creosote NAPL drummed for off-site treatment or recycling.)	Applicable to operator(s) of the NAPL recovery and ground water management systems because the wastes to be recovered are a RCRA-hazardous waste.	Site-wide
5. Standards Applicable to Generators of Hazardous Waste	EPA Regulations, 40 C.F.R Part 262.10-58	Applicable	Establishes standards for generators of hazardous wastes including waste determination manifests and pre-transport requirements	Applicable to operator(s) of the NAPL recovery and ground water management systems because the wastes to be recovered are a RCRA-hazardous waste.	Site-wide
6. Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	Delaware Regulations Governing Hazardous Waste, Part 264 (40 C.F.R. §§ 264)	Applicable	Regulations for owners and operators of TSDFs which define acceptable management of hazardous wastes	Applies to onsite recovery and treatment systems which handle hazardous waste	Site-wide
7. Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	EPA Regulations, 40 C F.R. Part 264	Applicable	Regulations for owners and operators of TSDFs which define acceptable management of hazardous wastes	Applies to onsite recovery and treatment systems which handle hazardous waste	Site-wide
8 RCRA Requirements for Use and Management of Containers	Delaware Regulations Governing Hazardous Waste, §§ 264.170-178	Applicable	Requirements for storage of hazardous waste in storage containers.	Applicable for temporary storage containers and on-site treatment systems.	Site-wide
9 RCRA Requirements for Use and Management of Containers	EPA Regulations, 40 C F.R §§ 264.170-178	Applicable	Requirements for storage of hazardous waste in storage containers	Applicable for temporary storage containers and on-site treatment systems	Site-wide
10. RCRA Requirements for Tanks Systems	Delaware Regulations Governing Hazardous Waste, §§ 264.190-199	Applicable	Requirements for storage or treatment of hazardous waste in tank systems.	Only applicable for onsite treatment systems and temporary storage tanks containing hazardous wastes.	Site-wide

ARAR or TBC	Legal Citation	ARAR Class	Requirement Synopsis	Applicability to Selected Remedy	Area of Concern
11. RCRA Requirements for Tanks Systems	EPA Regulations, 40 C.F.R. §§ 264.190-199	Applicable	Requirements for storage or treatment of hazardous waste in tank systems.	Only applicable for onsite treatment systems and temporary storage tanks containing hazardous wastes.	Site-wide
12. The Hazardous Waste Permit Program	Delaware Regulations Governing Hazardous Waste, Part 122	Applicable	Requires a permit for the treatment, storage, or disposal of any hazardous waste as identified or listed in Part 261.	Any substative requirements will be met. But no permit will be required	Site-wide
13 The Hazardous Waste Permit Program	EPA Regulations, 40 C.F.R. Part 122	Applicable	Requires a permit for the treatment, storage, or disposal of any hazardous waste as identified or listed in Part 261.	Any substative requirements will be met. But no permit will be required	Site-wide
14 Identification and Listing of Hazardous Wastes	Delaware Regulations Governing Hazardous Wastes, Part 261	Applicable	Identifies solid wastes which are regulated as hazardous wastes.	Use to determine which materials to be disposed of are hazardous wastes.	Site-wide
15. Identification and Listing of Hazardous Wastes	EPA Regulations, 40 C F R. Part 261	Applicable	Identifies solid wastes which are regulated as hazardous wastes	Use to determine which materials to be disposed of are hazardous wastes	Site-wide
16. RCRA Land Disposal Restrictions	Delaware Regulation Governing Hazardous Waste, Part 268	Applicable	Restrictions on land disposal of hazardous wastes.	Applies to consolidation of waste which is hazardous from across the Site. (EPA has herein designated the containment areas as Areas of Contamination)	Site-wide
17. RCRA Land Disposal Restrictions	EPA Regulations, 40 C.F.R. Part 268	Applicable	Restrictions on land disposal of hazardous wastes.	Applies to consolidation of waste which is hazardous from across the Site. (EPA has herein designated the containment areas as Areas of Contamination.)	Site-wide

Table 9. Cost Summaries - Alternatives 1, 2, 3, 4, and 5

AR316105

Table 9. Cost Summaries for Alternatives 1, 2, 3, 4, and 5

Remedial Alternative	Description	Capital Cost	Present Worth Operations & Maintenance Cost (7%, 30 Yrs)	Total Present Worth Cost
1	No Action	$0	$0	$0
2	Cover upland soils; Sediment cap in Fire Pond, South Pond and K Pond; Sheetpile & NAPL collection at Fire Pond and South Pond; MNR in Hershey Run and tidal wetlands; MNA of ground water contamination	$15,934,988	$1,490,864	$17,425,852
3	Excavate, consolidate and cap shallow soils and shallow tidal sediments; Cap Fire, K and South Ponds; Sheetpile and NAPL collection at Fire Pond and South Ponds areas; Rechannelization of Hershey Run; Wetlands mitigation; MNA of ground water contamination	$40,094,305	$40,094,305	$43,344,688
4	Excavate, consolidate and cap all contaminated soils and sediments; Subsurface ground water barrier wall around consolidation areas with passive NAPL recovery; Restoration of ground water through excavation of NAPL-contaminated aquifer material outside of consolidation areas; Rechannelization of Hershey Run; Wetlands mitigation; Monitoring of ground water contamination	$49,837,587	$1,918,652	$51,756,239
5	In-situ steam-enhanced extraction of subsurface NAPL; excavation and off-site treatment of sediments and certain soils; Wetland restoration; MNA of ground water contamination	$189,365,815	$1,419,957	$190,785,772

Table 10. Cost Estimate Details for Selected Remedy

AR316107

AR000441

Table 10. Cost Estimate Details for Selected Remedy

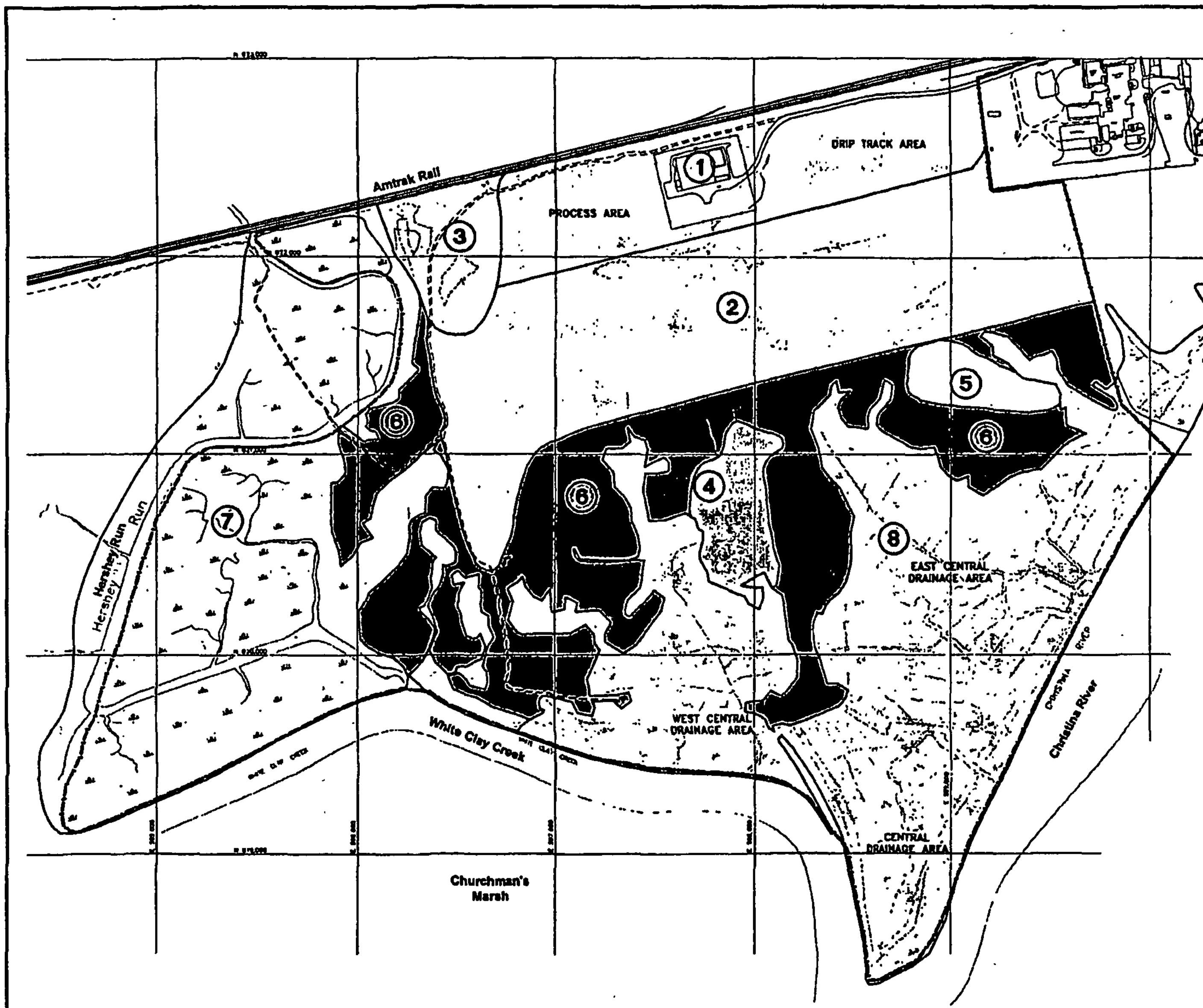
Item	Item Description	Estimated Quantity	Unit	Unit Price	Cost	Costs to be Bourne by Wetlands Developer*
	Capital Costs					
1	Pre-Design Investigation	1	LS	$500,000	$500,000	
2	Mobilization/Demobilization	1	LS	$100,000	$100,000	
3	Site Preparation					
3a	Clearing	102 7	Acres	$5,670	$582,309	
3b	Erosion/Sedimentation Control	1	LS	$35,000	$35,000	
4	Remove/Replace Surface Soils					
4a	Excavate/Trans/Stockpile Sediment From Upper Hershey	12,000	CY	$100	$1,200,000	
4b	Excavate/Trans/Stockpile NAPL Impacted Soil Below GW	48,400	CY	$100	$4,840,000	
4c	Soil Removal Excavate/Transport/Consolidation or Stockpile	715,619	CY	$6	$2,146,857	$2,146,857
4d	Compaction of Clean Soil Used To Fill in NAPL Excavations	48,400	CY	$6	$290,400	
4e	Water Treatment	1	LS	$500,000	$500,000	
5	NAPL Area Capping					
5a	Place 60 mil HDPE Liner In Former NAPL Areas	7 5	Acres	$25,700	$192,750	
6	Barrier Wall					
6a	Platform Construction/Backfill	1	LS	$20,000	$20,000	
6b1	Slurry Wall Installation	125,100	SF	$8	$1,000,800	
6b2	Sheetpile Wall Installation	41,700	SF	$22	$917,400	
6c	Cap on Slurry Wall	2,471	CY	$18	$44,480	
6d	NALP Interceptor Trench w / 2 - 75 Yard Finger Trenches					
6d1	Excavation of Trench - In line with sheet piles & slurry wall	18,533	CY	$145	$2,687,285	
6d2	Excavation of Trench Fingers 210' X 21' X 3'	1,050	CY	$145	$152,250	
6d4	Filter Fabric for all trenches	60,707	SY	$0	$3,642	
6d5	Stone Backfill for Trenches	19,583	CY	$74	$1,449,142	
6d6	Perforated 36" Stand pipe - (1-31' & 22' = 53')	53	LF	$75	$3,975	
6d7	Two locking manhole covers	2	EA	$250	$500	
7	Excavation and Upper Hershey Run Rechannelization					
7a	Excavation of Channel [(PRP= 3300 CY was 6500 cy in text, $478,500), 45,600 conservatively includes all of HR]	45,600	CY	$145	$6,612,000	
7b	Backfill in Entire Channel (6"=5,542cy) (3'=32,000cy)	32,000	CY	$65	$2,080,000	
7c	Geotextile	6 9	Acres	$2,550	$17,646	
7d	6-Inch Stone Backfill in New Channel	444	CY	$74	$32,874	
7e	Backfill Existing Channel (not expected to be required)	0	CY	$170	$0	
8	Wetlands Construction					
8a	Install Sediment Control Systems	1	LS	$50,000		$50,000
8b	Forested Riparian Wetlands -Organic Soil Placement	18,553	CY	$30		$556,600
8c	Forested Riparian Wetlands -Vegetation	23	Acres	$20,000		$460,000
8d	Tidal Marsh Wetlands -Organic Soil Placement	13713	CY	$30		$411,390
8e	Tidal Marsh Wetlands -Vegetation	17	Acres	$18,000		$306,000
8f	Wet Meadow/Emergent Wetlands -Organic Soil Placement	24,200	CY	$30		$726,000
8g	Meadow/Shrub Wetland and Emergent Wetlands -Vegetation	30 5	Acres	$19,000		$579,120
8h	Existing Meadow/Shrub Wetland Restoration -Remove	10	Acres	$43,000		$430,000
8i	Existing Meadow/Shrub Wetland Restoration -Seeding	10	Acres	$19,000		$190,000
9	On-site Consolidation (38 acre consolidation area)	38	Acres			
9a	Grading/Compaction of Surface	39,398	CY	$6	$236,388	
9b	Grading and Compaction of Impacted Soils	327,305	CY	$7	$2,291,135	
10	Low-Permeability Vegetative Cover					
10a1	Grade Traffic Areas (PRP= 351,408 SF, $42,178)	416,040	SF	$0	$49,925	
10a2	Geotextile on Traffic Areas (PRP= 8 1 Acres, $17,913)	11	Acres	$2,220	$24,489	
10a3	Install Gravel Pad and Haul Road (PRP= 4,353 CY, $97,083)	6,744	CY	$22	$150,402	
10b	HDPE Geomembrane Liner (acreage * 1 05 for overlap)	39 9	Acres	$25,700	$1,025,430	
10c	Geocomposite Drainage Layer-	38 0	Acres	$41,385	$1,572,630	
10d	18-inch Backfill from Stockpiled Soil	91,960	CY	$3	$262,086	
10e	6-inch Topsoil/Seeding	30,653	CY	$61	$1,869,853	
10f	Drainage System V-Ditch Reinforced Concrete	80	LF	$10	$800	
11	Miscelaneous					
11a	Reseed All Areas other than Cap	7 8	Acres	$5,670	$44,226	
11b	Miscellaneous Site Restoration	1	LS	$20,000	$20,000	
11c	Miscellaneous Waste Disposal	1	LS	$600,000	$600,000	
12	NAPL Monitoring Wells	0	Well	$3,000	$0	
13	Groundwater MNA (Initial Evaluation & Well Installation)					
13a	Natural Attenuation Modeling	1	Model	$150,000	$150,000	
13b	Groundwater Monitoring Wells	20	Well	$3,000	$60,000	
13c	Groundwater Sampling	8	Events	$25,000	$200,000	
13d	Report	1	Report	$50,000	$50,000	

Table 10. Cost Estimate Details for Selected Remedy

14	Passive NAPL Recovery					
14a	Pilot Studies	12	Area	$5,000	$60,000	
14d	Oil Separator Units	6	Unit	$20,000	$120,000	
14e	Protective Housings (sheds)	6	Shed	$10,000	$60,000	
14f	NAPL Storage Tanks	7	Tank	$5,000	$35,000	
14g	Water Treatment (carbon filtration)	1	LS	$178,500	$178,500	
15	Indirects	63	Weeks	$20,540	$1,294,020	
16	Archaeological Evaluations	1	LS	$350,000	$350,000	
				Subtotal:	**$36,114,193**	**$5,855,967**
		Administration and Enigneering (15%)			$5,417,129	$878,395
			Contingency (20%)		$8,306,264	$1,346,872
				Total Capital Costs:	**$49,837,587**	**$8,081,234**
	Operations and Maintenance (O&M) Costs					
	30 year costs					
17	Site inspections (30 yrs)	1	Annual	$20,000	$20,000	
18	Landfill maintenance (i e , mowing) (1/3 area from Item 9 per year)	12 67	Acres/YR	$100	$1,267	
19	Misc Erosion Control and Repairs (i e , clearing access roads of vegetation, etc)	1	Annual	$1,500	$1,500	
20	NAPL Monitoring (30 yrs)	1	Annual	$15,000	$15,000	
21	NAPL Transport and Disposal (30 yrs)	25	GAL/YR	$100	$2,500	
22	Passive NAPL Recovery and Disposal (30 yrs)					
22a	Oil Separator Unit Maintenance (30 yrs)	1	Annual	$30,000	$30,000	
22b	Manual Bailing (30 yrs)	0	Annual	$60,000	$0	
22c	NAPL Disposal (30 yrs) (off-site disposal or recycling)	35	GAL / YR	$100	$3,500	
22d	Water Treatment (carbon filtration)	1	Annual	$30,000	$30,000	
23	Groundwater Monitoring (30 years)	2	Annual	$7,500	$15,000	
				Subtotal:	**$118,767**	**$0**
	P-Present Worth = A{[((1+i)^n)-1)]/[i(1+i)^n]}		A - Annual Payment		$118,767	$0
				I - interest Rate	7%	7%
				n - # years	30	30
				P-Present Worth (30) =	**$1,473,780**	**$0**
	5 year costs					
	Wetland Monitoring (5 yrs)	21 7	Acres/YR	$5,000	$108,500	$108,500
				Subtotal:	**$108,500**	**$108,500**
	P-Present Worth = A{[((1+i)^n)-1)]/[i(1+i)^n]}		A - Annual Payment		$108,500	$108,500
				I - interest Rate	7%	7%
				n - # years	5	5
				P-Present Worth (5) =	**$444,871**	**$444,871**
	* Note Wetlands development costs are not part of the remedy, but rather are presented for purposes of comparison with the FS Addendum "Alternative 10" cost estimates	**Total Present Worth O&M Cost:**			**$1,918,652**	**$444,871**
		Total Estimated Cost for Alternative 4:			**$51,756,239**	**$8,526,108**
		Total Rounded Cost for Alternative 4:			**$51,760,000**	**$8,530,000**

AR316109

AR316141



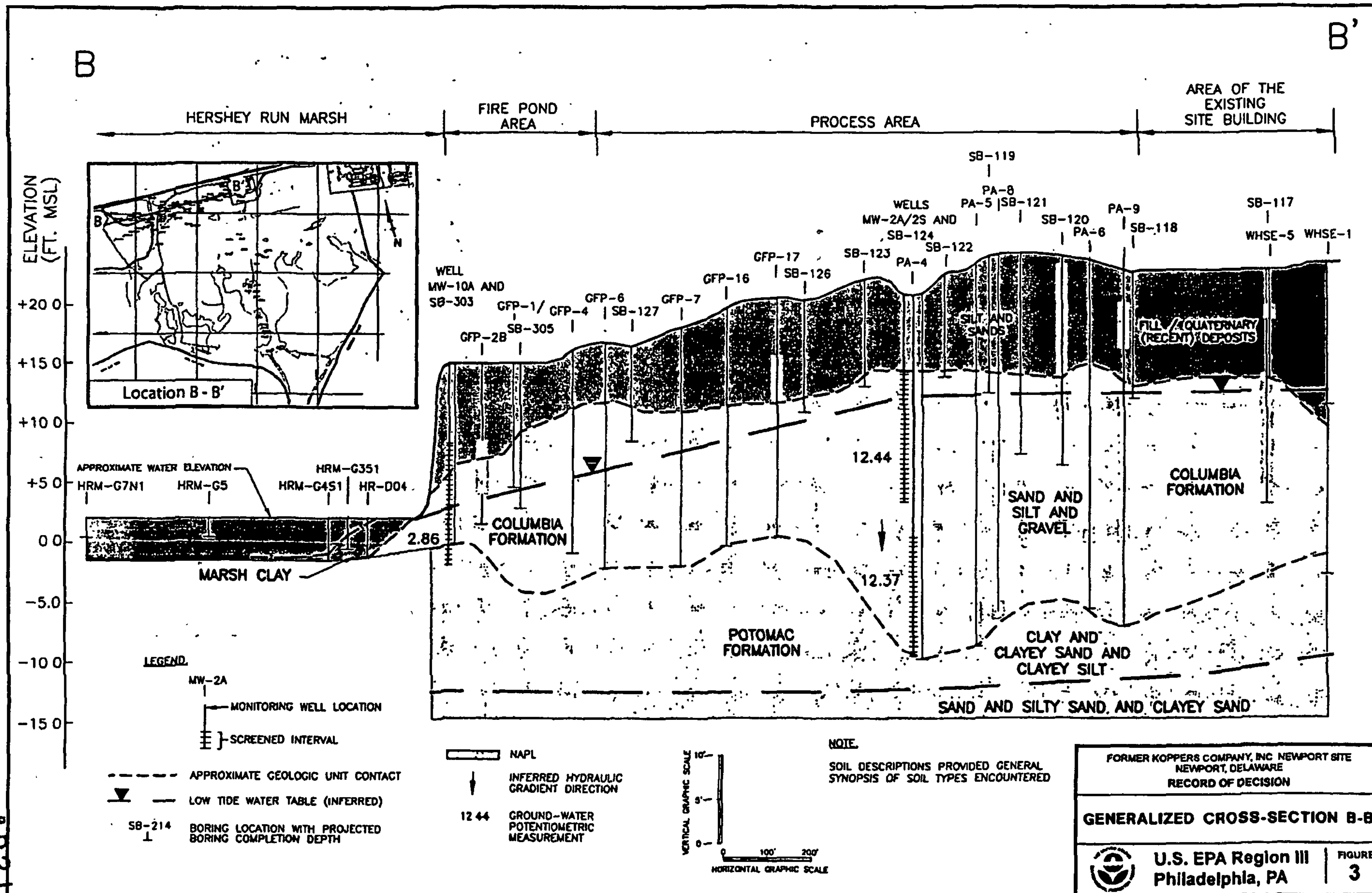
FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION

SITE PLAN

U.S. EPA Region III
Philadelphia, PA

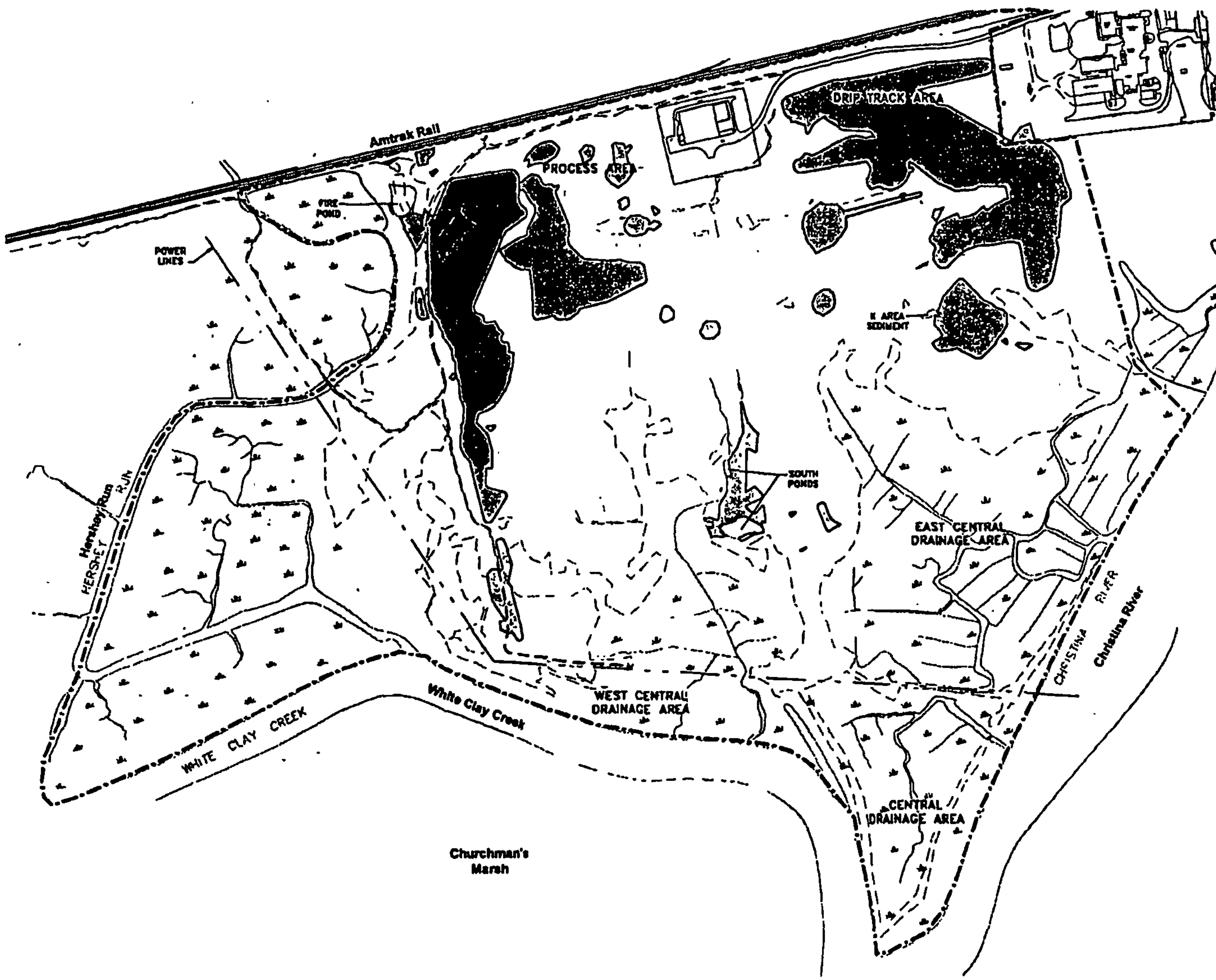
FIGURE 2

AR316112



AR316113

AR000446



LEGEND:

SITE BOUNDARY

WETLANDS BOUNDARY

APPROXIMATE EXTENT OF SURFICIAL SOIL CONTAINING GREATER THAN 600 mg/kg TOTAL PAHs

NOTES:

1 MAPPING BASED ON DATA PROVIDED BY WOODWARD-CLYDE, APRIL, 1997

2 APPROXIMATE EXTENT OF SOIL CONTAINING GREATER THAN 600 MG/KG TOTAL PAHs DEFINED BY ANALYTICAL RESULTS AND VISUAL OBSERVATIONS OF NAPL IN THE TOP 1-FOOT DEPTH INTERVAL

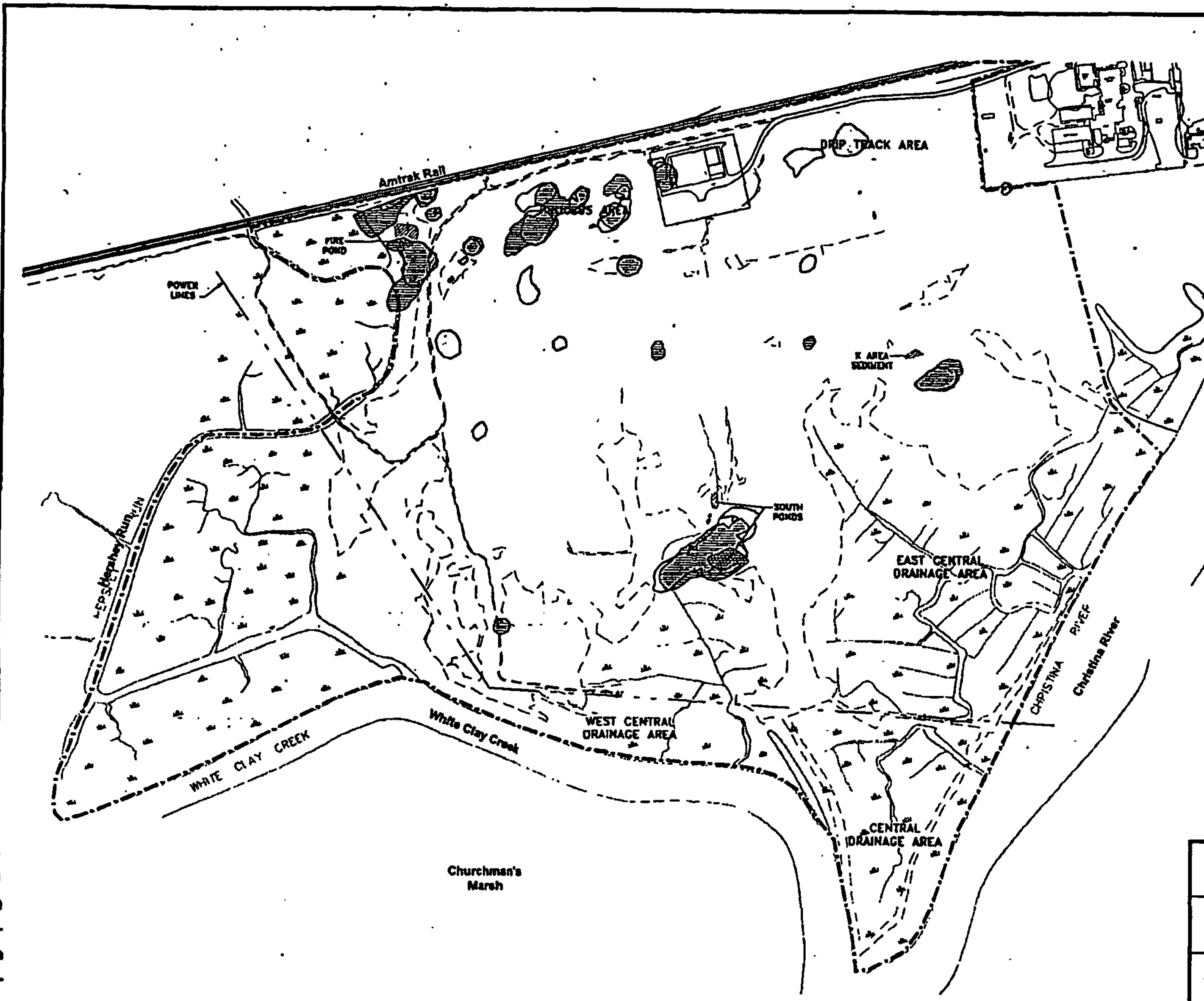
0 500' 1000'
GRAPHIC SCALE

FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION

SURFICIAL SOIL CONTAINING GREATER THAN 600 MG/KG TOTAL PAHs

U.S. EPA Region III
Philadelphia, PA

FIGURE 4



LEGEND:

SITE BOUNDARY

WETLANDS BOUNDARY

EXTENT OF SUBSURFACE NAPL IN VADOSE ZONE (1- TO 10-FEET BGS)

EXTENT OF SUBSURFACE NAPL IN SATURATED ZONE (10 FEET BGS TO TOP OF FINE-GRAINED LAYER)

NOTES:

1. MAPPING BASED ON DATA PROVIDED BY WOODWARD-CLYDE, APRIL 1997

2. EXTENT OF SUBSURFACE NAPL DETERMINED USING SITE DATA AND MVS SOFTWARE

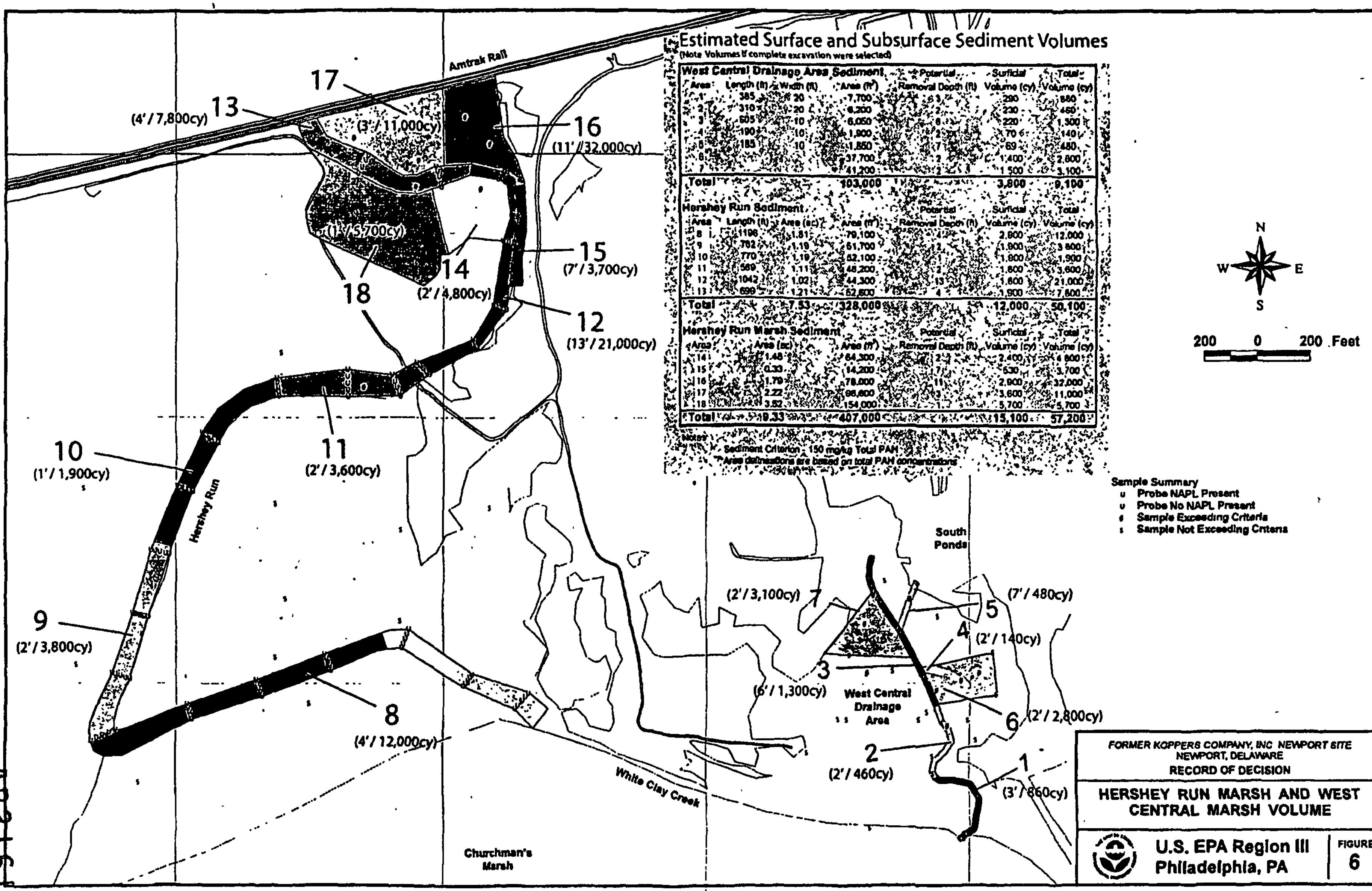
0 500' 1000'
GRAPHIC SCALE

FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION

EXTENT OF SUBSURFACE NAPL

U.S. EPA Region III
Philadelphia, PA

FIGURE 5



Estimated Surface and Subsurface Sediment Volumes

(Note Volumes if complete excavation were selected)

West Central Drainage Area Sediment				Potential	Surficial	Total
Area	Length (ft)	Width (ft)	Area (ft²)	Removal Depth (ft)	Volume (cy)	Volume (cy)
1	385	20	7,700	3	290	860
2	310	20	6,200	2	230	460
3	605	10	6,050	6	220	1,300
4	190	10	1,900	2	70	140
5	185	10	1,850	7	69	480
6			37,700	2	1,400	2,800
7			41,200	2	1,500	3,100
Total			103,000		3,800	9,100

Hershey Run Sediment				Potential	Surficial	Total
Area	Length (ft)	Area (ac)	Area (ft²)	Removal Depth (ft)	Volume (cy)	Volume (cy)
8	1198	1.81	79,100	4	2,800	12,000
9	702	1.19	51,700	2	1,900	3,800
10	770	1.19	52,100	1	1,900	1,900
11	569	1.11	48,200	2	1,800	3,600
12	1042	1.02	44,300	13	1,600	21,000
13	698	1.21	52,600	4	1,900	7,800
Total		7.53	328,000		12,000	50,100

Hershey Run Marsh Sediment			Potential	Surficial	Total
Area	Area (ac)	Area (ft²)	Removal Depth (ft)	Volume (cy)	Volume (cy)
14	1.48	64,300	2	2,400	4,800
15	0.33	14,200	7	530	3,700
16	1.79	78,000	11	2,900	32,000
17	2.22	96,600	3	3,600	11,000
18	3.52	154,000	1	5,700	5,700
Total	19.33	407,000		15,100	57,200

Notes:
Sediment Criterion - 150 mg/kg Total PAH
* Area delineations are based on total PAH concentrations

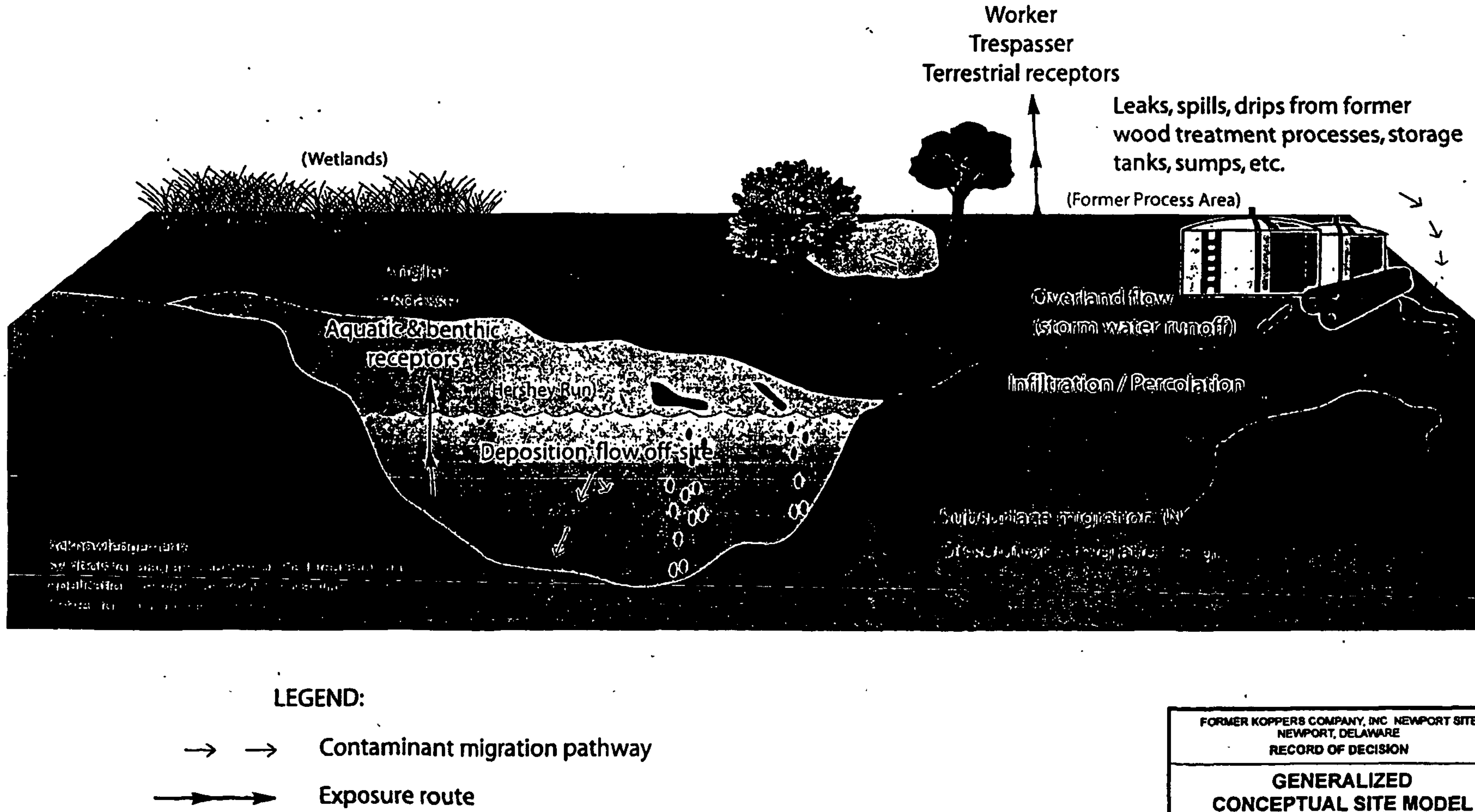
FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION

HERSHEY RUN MARSH AND WEST CENTRAL MARSH VOLUME

U.S. EPA Region III
Philadelphia, PA

FIGURE 6

AR316116



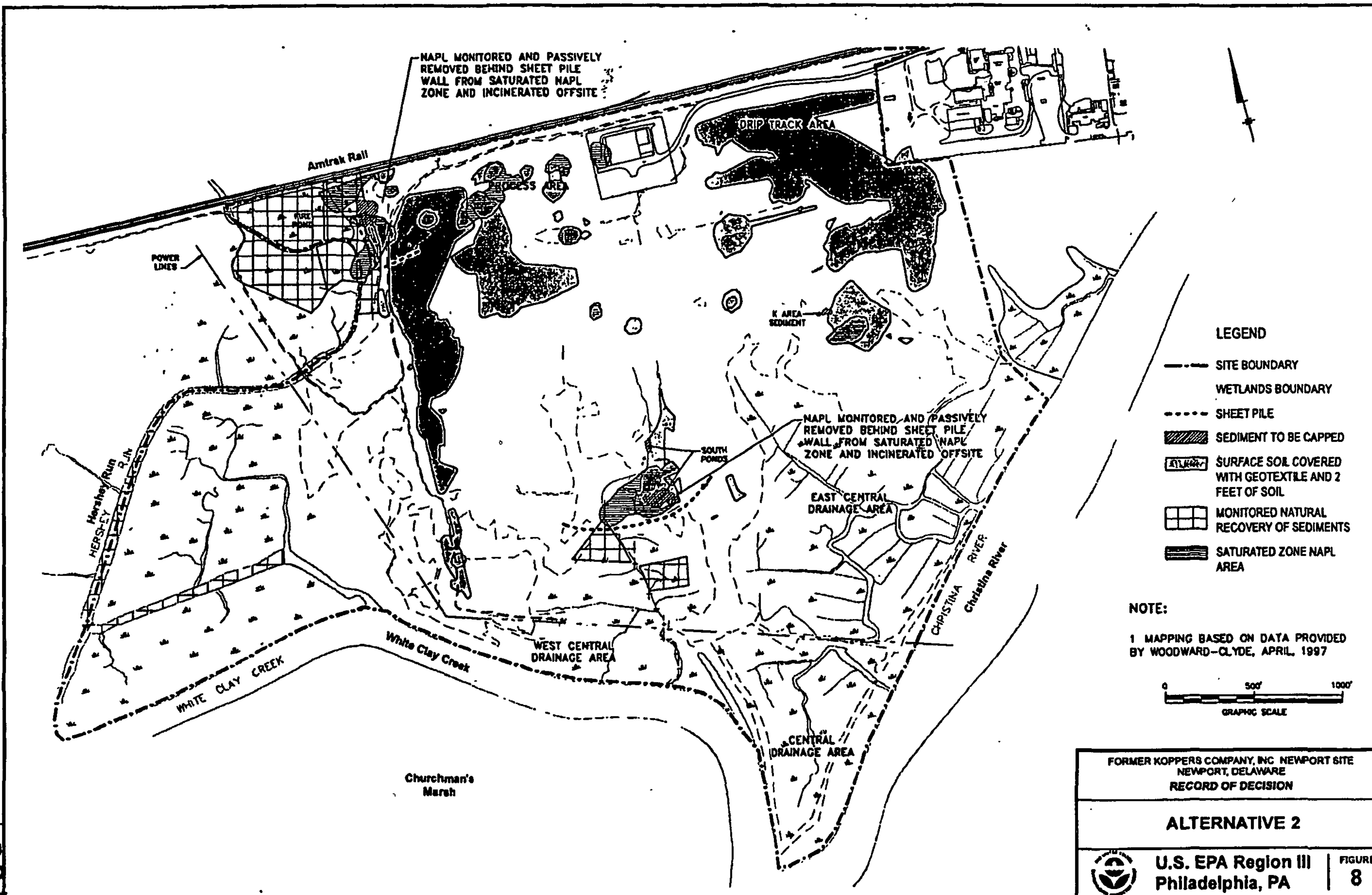
FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION

GENERALIZED CONCEPTUAL SITE MODEL

U.S. EPA Region III
Philadelphia, PA

FIGURE 7

AR316117



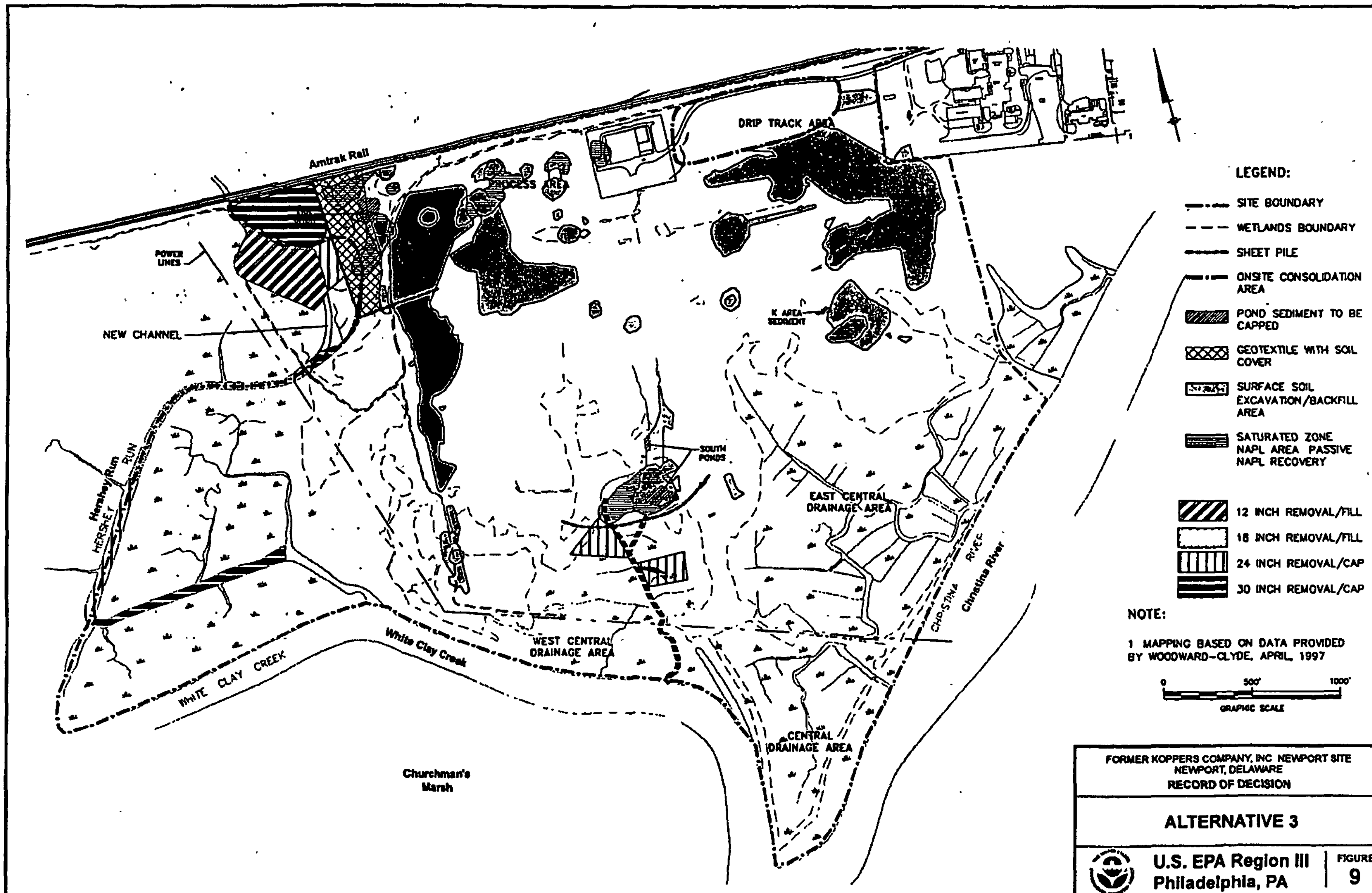
FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION

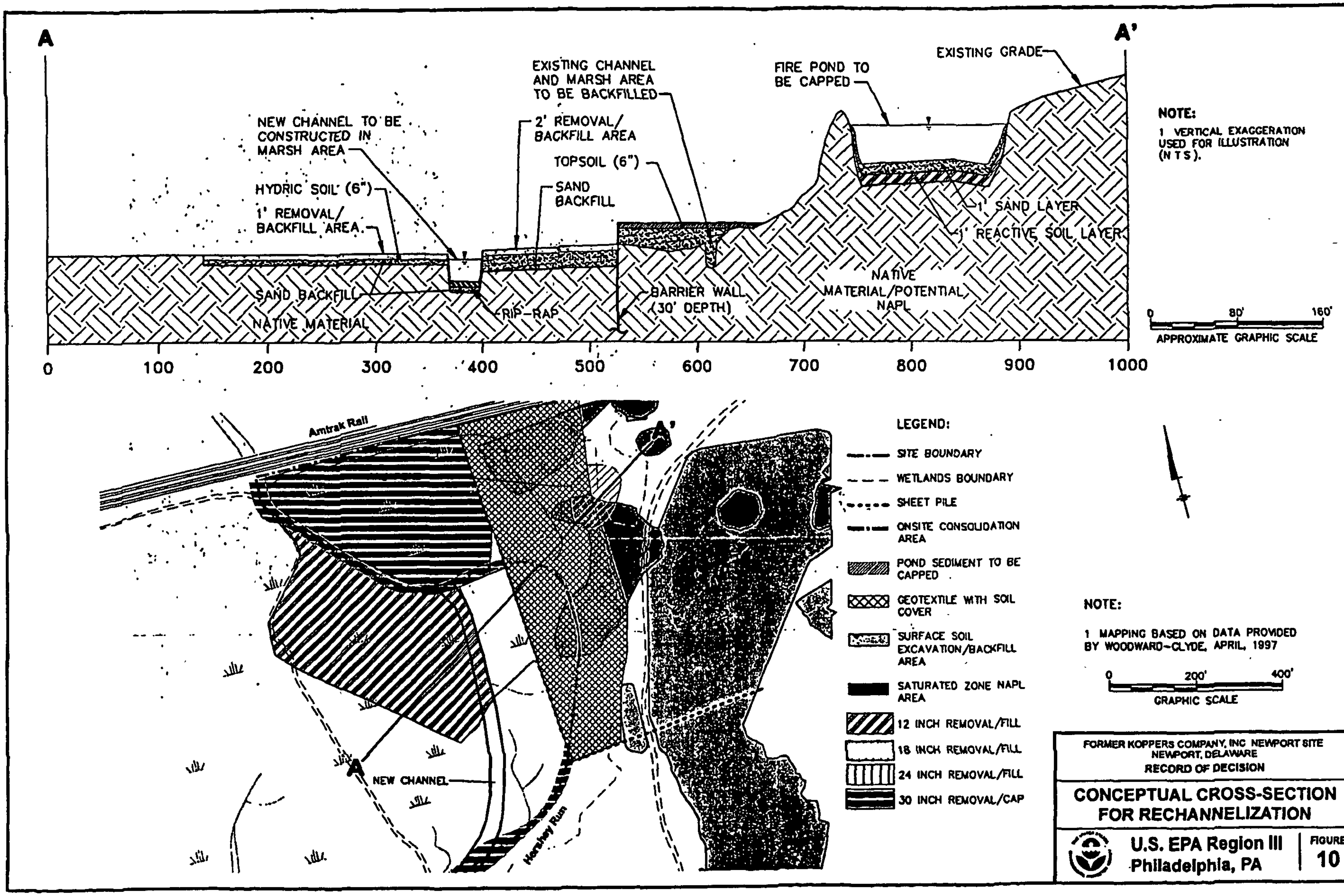
ALTERNATIVE 2

U.S. EPA Region III
Philadelphia, PA

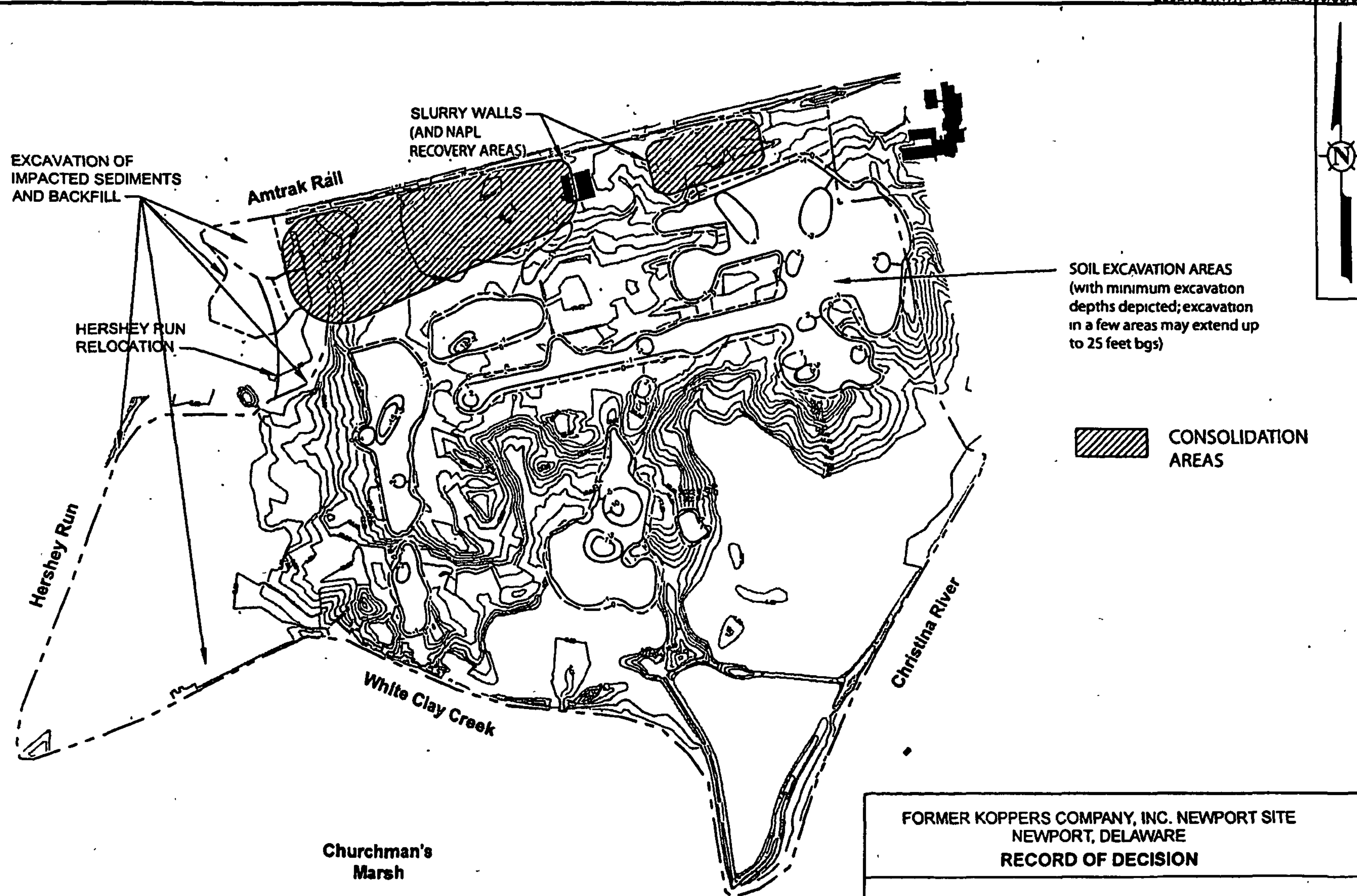
FIGURE 8

AR316118


Amtrak Rail
DRIP TRACK AREA
PROCESS AREA
POWER LINES
NEW CHANNEL
K AREA SEDIMENT
SOUTH PONDS
EAST CENTRAL DRAINAGE AREA
WEST CENTRAL DRAINAGE AREA
CENTRAL DRAINAGE AREA
Hershey Run
HERSHEY RUN
White Clay Creek
WHITE CLAY CREEK
CHRISTINA RIVER
Christina River
Churchman's Marsh
LEGEND:
SITE BOUNDARY
WETLANDS BOUNDARY
SHEET PILE
ONSITE CONSOLIDATION AREA
POND SEDIMENT TO BE CAPPED
GEOTEXTILE WITH SOIL COVER
SURFACE SOIL EXCAVATION/BACKFILL AREA
SATURATED ZONE NAPL AREA PASSIVE NAPL RECOVERY
12 INCH REMOVAL/FILL
18 INCH REMOVAL/FILL
24 INCH REMOVAL/CAP
30 INCH REMOVAL/CAP
NOTE:
1 MAPPING BASED ON DATA PROVIDED BY WOODWARD-CLYDE, APRIL, 1997
0
500'
1000'
GRAPHIC SCALE
FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION
ALTERNATIVE 3
U.S. EPA Region III
Philadelphia, PA
FIGURE
9


A
A'
EXISTING GRADE
FIRE POND TO BE CAPPED
EXISTING CHANNEL AND MARSH AREA TO BE BACKFILLED
NEW CHANNEL TO BE CONSTRUCTED IN MARSH AREA
2' REMOVAL/ BACKFILL AREA
TOPSOIL (6")
SAND BACKFILL
HYDRIC SOIL (6")
1' REMOVAL/ BACKFILL AREA
1' SAND LAYER
1' REACTIVE SOIL LAYER
NATIVE MATERIAL/POTENTIAL NAPL
BARRIER WALL (30' DEPTH)
RIP-RAP
SAND BACKFILL
NATIVE MATERIAL
0
100
200
300
400
500
600
700
800
900
1000
NOTE:
1 VERTICAL EXAGGERATION USED FOR ILLUSTRATION (N T S).
0
80'
160'
APPROXIMATE GRAPHIC SCALE
Amtrak Rail
NEW CHANNEL
Hershey Run
LEGEND:
SITE BOUNDARY
WETLANDS BOUNDARY
SHEET PILE
ONSITE CONSOLIDATION AREA
POND SEDIMENT TO BE CAPPED
GEOTEXTILE WITH SOIL COVER
SURFACE SOIL EXCAVATION/BACKFILL AREA
SATURATED ZONE NAPL AREA
12 INCH REMOVAL/FILL
18 INCH REMOVAL/FILL
24 INCH REMOVAL/FILL
30 INCH REMOVAL/CAP
NOTE:
1 MAPPING BASED ON DATA PROVIDED BY WOODWARD-CLYDE, APRIL, 1997
0
200'
400'
GRAPHIC SCALE
FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION
CONCEPTUAL CROSS-SECTION FOR RECHANNELIZATION
U.S. EPA Region III
Philadelphia, PA
FIGURE
10

29024801NWPT-02 REV.03/30/04



FORMER KOPPERS COMPANY, INC. NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION

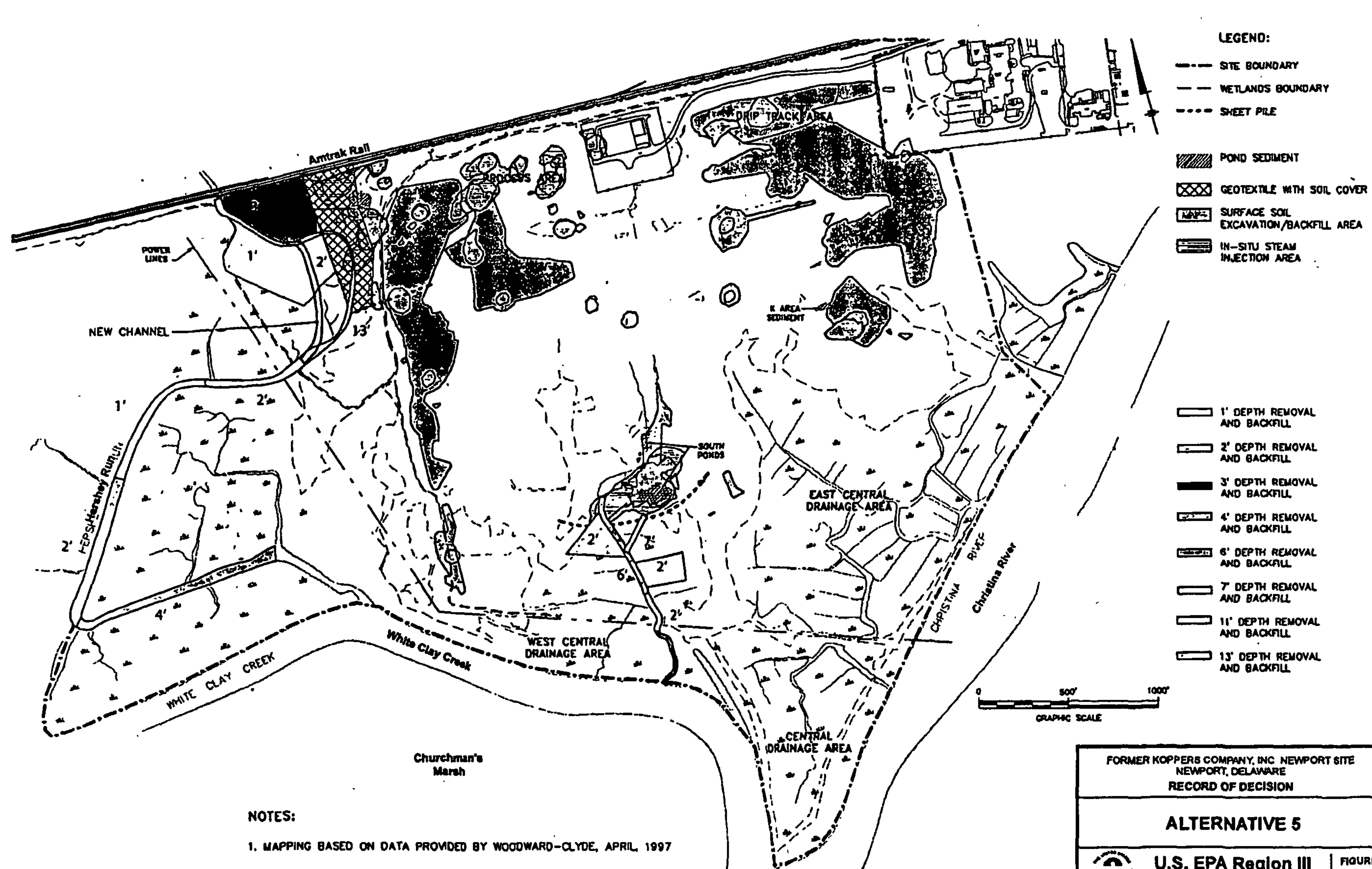
ALTERNATIVE 4

U.S. EPA Region III
Philadelphia, PA

FIGURE
11

AR316121

AR000454



NOTES:

1. MAPPING BASED ON DATA PROVIDED BY WOODWARD-CLYDE, APRIL, 1997

FORMER KOPPERS COMPANY, INC NEWPORT SITE
NEWPORT, DELAWARE
RECORD OF DECISION

ALTERNATIVE 5

U.S. EPA Region III
Philadelphia, PA

FIGURE 12

EPA Docket No. CERC-03-2006-0266DC

ATTACHMENT 4

KOPPERS CO.
UNILATERAL ADMINISTRATIVE ORDER
FOR REMEDIAL DESIGN/REMEDIAL ACTION
ADMINISTRATIVE RECORD FILE * **
INDEX OF DOCUMENTS

1. Letter to Mr. William Giarla, Beazer East, Inc., from Mr. Peter Schaul, U.S. EPA, re: Special Notice Demand Letter, 11/4/05. P. The following are attached:

   a) an undated Consent Decree;

   b) an undated Administrative Order on Consent for Remedial Design;

   c) a June 25, 2005 Narrative Cost Summary Report.

2. Letter to Ms. Patricia Miller, U.S. EPA, from Ms. Lindsay Howard, Babst, Calland, Clements, and Zomnir, re: Request for extension for response to Special Notice Letter, 12/14/05. P.

3. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Robert Markwell, Beazer East, Inc., re: Response to Special Notice Letter and Good Faith Offer, 1/30/06. P. A January 31, 2006 cover letter to Ms. Donna Duer, US Department of Justice, from Ms. Lindsay Howard, Babst, Calland, Clements, and Zomnir, and a January 30, 2006 Proposed Administrative Settlement Agreement and Order on Consent, are attached.

4. Letter to Mr. William Giarla, Beazer East, Inc., from Mr. Peter Schaul, U.S. EPA, re: Response to Special Notice Letter, (undated). P.

5. Letter to Ms. Patricia Miller, U.S. EPA, from Ms. Lindsay Howard, Babst, Calland, Clements, and Zomnir, re: Response to Good Faith Offer, 3/17/06. P.

* Administrative Record File available //.

** This Index of Documents for the Koppers Co., Unilateral Administrative Order Administrative Record File hereby incorporates by reference all documents contained in the Koppers Co., Remedial Administrative Record File Index of Documents.

KOPPERS COMPANY
ADMINISTRATIVE RECORD FILE *
INDEX OF DOCUMENTS

SDMS DocID 156381

I. SITE IDENTIFICATION

1. Potential Hazardous Waste Site Log for the Koppers Company Site, 11/1/79. P. 100001-100001.

2. Potential Hazardous Waste Site Identification and Preliminary Assessment, 5/20/80. P. 100002-100005.

3. Letter to Mr. Anthony S. Bartholomeo, U.S. EPA, from Mr. William L. Osburn, Delaware Department of Natural Resources & Environmental Control (DNREC), re: Transmittal of information from "Public Water Systems in Delaware," 5/20/80. P. 100006-100011. The information is attached

4. U.S. EPA sampling report, 5/28/80. P. 100012-100014. Photographs of the site are attached.

5. Letter to Mr. William M. Thomas, U.S. EPA, from Ms. Lisa A Hamilton, DNREC, re. Transmittal of U S. Geological Survey quadrangles showing the Koppers Company Site, 5/29/80. P. 100015-100016. The quadrangles are attached.

6. Memorandum to the file from Mr. Garth Glenn and C.K. Lee, re: Summary of a May 28, 1980, inspection and sampling conducted at the site, 5/30/80. P. 100017-100019. A hand-drawn site map is attached.

7. U.S. EPA Potential Hazardous Waste Site Inspection Report, 6/9/80 P. 100020-100031.

8. Memorandum to Mr. Jeffrey Haas, U.S EPA, from Mr. Gerard Crutchley, U.S. EPA, re: Summary of a May 28, 1980, inspection and sampling conducted at the site, 6/11/80. P. 100032-100046. A list of samples, a map of the area, and a copy of the Potential Hazardous Waste Site Inspection Report are attached.

9. Telephone conversation record of Mr. Peter Brown with B. Hofman re: Receipt of sampling results from the May 28, 1980, inspection and sampling, 8/18/80. P. 100047-100047. An August 20, 1980, Potential Hazardous Waste Site Tentative Disposition, Mr. Gerard Crutchley's June 11, 1980, memorandum to Mr. Jeffrey Haas, and a June 9, 1980, Potential Hazardous Waste Site Inspection Report are attached.

* Administrative Record File available 9/26/96, updated 9/2/04, 10/7/04 and 9/30/05 .

10. Memorandum to the file from C.K. Lee, re: Recommendation that all area wells be investigated, then selected wells be sampled, 9/22/80 P. 100048-100049. A map showing the proposed area for the investigation is attached.

11. Geohydrology of the Wilmington Area, Hydrologic Map Series, No. 3, prepared by Delaware Geological Survey, 1981. P. 100050-100053.

12. Memorandum to Ms. Rita Lavelle, U.S. EPA, from Mr. Robert Perry, U.S. EPA, re. The applicability of Section 102(2)(C) of the National Environmental Policy Act (NEPA) to response actions under Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 9/1/82. P. 100054-100064.

13. DNREC Wetlands Regulations, adopted 12/23/76, revised 6/29/84. P. 100065-100089.

14. Memorandum to U.S. EPA Regional Administrators from Ms. Josephine Cooper and Mr. Lee Thomas, U.S. EPA, re: CERCLA remedial actions and NEPA/Environmental Impact Statement (EIS) functional equivalency, 8/22/84. P. 100090-10093.

13. Report: <u>Preliminary Assessment of Koppers Company Emergency and Remedial Response Information System</u>, prepared by DNREC, 1984. 100094-1000124.

15. Report: <u>Preliminary Field Trip Report for the Koppers Company Site</u>, prepared by NUS Corporation, 1/14/85. P. 100125-100155. A January 14, 1985, transmittal to Mr. Harold Byer, U.S. EPA, from Mr. Garth Glenn, NUS Corporation, letter is attached.

16. Data Management Summary Reports, prepared by Environmental Testing and Certification on behalf of DuPont, 4/19/85. P. 100156-100160. An August 19, 1985, transmittal letter to Ms. Laura Boornazian, U S. EPA, from A.B. Palmer, E.I. DuPont de Nemours, Inc. (DuPont), stating that A.B. Palmer believes there has been no recent testing for contaminants at the Newport Landfill is attached.

17. Sample Data Summary for the Koppers Company Site, prepared by NUS Corporation, 7/8/85. P. 100161-100170. A July 8, 1985, transmittal letter to Mr. Harold Byer, U.S. EPA, from Mr. Garth Glenn, NUS Corporation, and a hand-drawn sample location map are attached.

18. Letter to Ms. Laura Boornazian, U.S. EPA, from Ms. Eileen M. Hack, DNREC, re: Comments regarding the site inspections of Koppers Company and Sussex County Landfills and recommendation that Hazardous Ranking System packages be completed on both sites, 1/13/86 P. 100171-100173 An excerpt from a report is attached.

19. Report: Site Inspection of the Koppers Company Site, prepared by NUS Corporation, 2/27/86. P. 100174-100390. A March 3, 1986, transmittal letter to Mr. Harold Byer, U.S. EPA, from Mr. Garth Glenn, NUS Corporation, is attached.

20. Letter to Ms. Eileen Hack, DNREC, from Ms. Laura Boornazian, U.S. EPA, re: Transmittal of the final site inspection report for the Koppers Company Site, 3/10/86. P. 100391-100391.

21. Letter to Koppers Company from Mr. Bruce Smith, U.S. EPA, re: Request for release of all documents concerning hazardous substances to U.S. EPA, 2/3/88. P. 100392-100395. A certified mail receipt is attached.

22. 104(e) letter to DuPont from Mr. Bruce Smith, U.S. EPA, re: Request for release of all documents concerning hazardous substances to U.S. EPA, 2/3/88. P. 100396-100398.

23. 104(e) letter to Mr. Gerardo Amador, U.S. EPA, from Ms. Suzanne Burtt, Koppers Company, re: Confirmation of a February 11, 1988, telephone conversation in which Mr. Amador granted Koppers Company an extension in releasing documents to U.S. EPA, 2/12/88. P. 100399-100399.

24. Letter to Mr. Gerardo Amador, U.S. EPA, from Ms Julie Whited, DuPont, re: Response to U.S. EPA's February 3, 1988, request for information, 2/22/88. P. 100400-100645. The following are attached:

    a) a deposition of Koppers Company, Inc., by its designee Mary Holland, In The Matter Of United States of America vs. New Castle County, William Ward, Stauffer Chemical, and ICI Americas, Inc., vs. Avon Products, Inc., et al., Civil Action No. 80-489;

    b) a copy of the deed for the Koppers Company Site;

c) a copy of the Agreement Option with a March 30, 1970 transmittal letter to Mr. Thomas Bourne, Koppers Company, from C.M Thayer, DuPont;

d) a copy of the Lawyers Title Insurance Policy for the site,

e) a February 27, 1988, report entitled Site Inspection of Koppers Company.

25. Letter to Mr. Gerardo Amador, U.S. EPA, from Mr. William Giarla, Koppers Company, re: Response to U.S. EPA's February 3, 1988, request for information, 2/25/88. P. 100646-100666. The following are attached:

a) a list of the primary constituents of creosote;

b) a description of the Boulton wood treating process;

c) a document entitled Liquid Effluent Discharges and Proposed Treatment, Forest Products Plant, Newport, Delaware;

d) an April 29, 1971, letter to Mr. Carl Shields, Delaware Water and Air Resources Commission, from Mr. R.P. Williams, Koppers Company, with a response to Mr. Williams from Mr. John Bryson, DNREC, attached

26. Letter to Mr Gary A. Molchan, DNREC, from Mr. Ben Mykijewycz, U.S. EPA, re. Notice that the Koppers Company Site is a candidate for proposal to the NPL on Update #10, 10/16/89. P. 100667-100667.

27. U.S. EPA Pollution Report #1, Koppers Company, 12/14/89. P. 100668-100673. A November 20, 1989, memorandum to Mr. Gregg Crystall, U.S. EPA, from Mr. John C. Kilcher, Roy F. Weston, Inc., is attached.

28. Memorandum to the Regional Administrators for U.S. EPA Regions I through X, from Mr. Donald R. Clay, U.S. EPA, re: Guidelines for the development of risk assessments for sites remediated under CERCLA, 8/28/90. P. 100674-100677.

29. Summary of the joint site inspection of the Koppers Company Site conducted by DNREC and NUS Corporation on December 20, 1984, (undated). P. 100678-100679. A site map is attached.

30. Letter to Ms Eileen Hack, DNREC, from Ms. Laura Boornazian, U.S. EPA, re: Transmittal of the draft site inspection report and request for comments, (undated). P. 100680-100680.

31. U S. EPA Organics Analysis Data Sheet, Lab Sample ID # 80-083, (undated). P. 100681-100683.

32. U.S. EPA Organics Analysis Data Sheet, Lab Sample ID # 80-084, (undated). P. 100684-100688.

34. U.S. EPA Organics Analysis Data Sheet, Lab Sample ID # 80-085, (undated). P. 100689-100692

35. U.S. EPA Organics Analysis Data Sheet, Lab Sample ID # 80-086, (undated). P. 100693-100695.

36. U S. EPA Organics Analysis Data Sheet, Lab Sample ID # 25-036, (undated). P. 100696-100709. An October 13, 1980, U.S EPA Inorganics Traffic Report shipping slip for sample number C8055, Case Number 268 is attached.

37. U.S EPA Organics Analysis Data Sheet, Lab Sample ID # 25-037, (undated). P. 100710-100720. An October 13, 1980, U.S EPA Inorganics Traffic Report shipping slip for sample number C8056, Case Number 268 is attached.

38. Report: Field Investigations of Uncontrolled Hazardous Waste Sites, prepared by Ecology & Environment, Inc., (undated). P. 100721-100740.

39. Report: Evaluation of Tumor Prevalence in Mummichogs from the Delaware Estuary Watershed, prepared by U S. Fish & Wildlife Service, 12/04. P. 100722-100766.

III. REMEDIAL RESPONSE PLANNING

1. Report: Remedial Investigation/Feasibility Study (RI/FS) Work Plan for the Koppers Company Site, prepared by Dames & Moore, 5/9/91. P. 300001-300106 A May 9, 1991, transmittal letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. Eric Tartler, Dames & Moore, is attached.

2. Letter to Mr. S Andrew Sochanski, U.S. EPA, from Mr. Robert Allen, DNREC, re: Comments regarding the RI/FS work plan, 8/30/91. P. 300107-300109.

3. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. M. Margie Zhang, DNREC, re: Notification of Ms. Zhang's appointment as project officer for the Koppers Company Site, 9/20/91. P. 300110-300110.

4. Memorandum to Mr. Robert Allen, DNREC, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Comments regarding the RI/FS work plan, 9/23/91. P. 300111-300111.

5. Administrative Order on Consent In The Matter Of: Koppers Company Site, Docket No. III-91-16-DC, 9/26/91. P. 300112-300160. A September 25, 1991, transmittal memorandum to Mr. Edwin Erickson, U.S. EPA, from Mr. Thomas Voltaggio and Ms. Marcia Mulkey, U.S. EPA, is attached.

6. Letter to Ms. M. Margie Zhang, DNREC, from Mr. S. Andrew Sochanski, U.S EPA, re: Transmittal of the Administrative Order on Consent for the site, 10/11/91. P. 300161-300161.

7. Report: Site Analysis, Koppers Chemical, Newport, Delaware, Volume I, 10/91. P. 300162-300180.

8. Report: Koppers Company NPL Site, Preliminary Health Assessment, prepared by Oak Ridge National Laboratory, 12/31/91. P. 300181-300218. A December 31, 1991, transmittal letter to Mr. Lee Tate, ATSDR, from Robin Brothers, Oak Ridge National Laboratory, is attached.

9. Report: Draft Remedial Investigation/Feasibility Study Work Plan for the Koppers Company Site, 1/20/92. P. 300219-300334. January 20, 1992, transmittal letters to Mr. S. Andrew Sochanski, U.S. EPA, and Ms Jane Patarcity, Beazer East, Inc. (Beazer), and Mr. Brandt Butler, DuPont, from Mr. James Buczala, Ms Ceil Mancini, and Mr. Robert Gresh, Woodward-Clyde Consultants, are attached.

10. Letter to Ms. Felicia Dailey, ATSDR, from Ms. M. Margie Zhang, DNREC, re: Transmittal of Dr. Gerald Llewellyn's comments regarding the Preliminary Health Assessment for the site, 2/11/92. P. 300335-300336. Dr. Llewellyn's comments

11. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re. Comments regarding the RI/FS work plan, 2/19/92. P 300337-300339.

12. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. M. Marie Zhang, DNREC, re: Transmittal of comments regarding the RI/FS work plan, 2/19/92 P. 300340-300345. A February 19, 1992, facsimile transmittal page is attached.

13. Comments of Mr. Robert Allen, DNREC, regarding the RI/FS work plan, 2/21/92. P. 300346-300347. A February 24, 1992, facsimile transmittal page to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. M. Margie Zhang, DNREC, is attached.

14. Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmazyn, DuPont, from Mr. S. Andrew Sochanski, U.S EPA, re: Notification that U.S. EPA has found the February 2, 1992, RI/FS work plan to be deficient and transmittal of comments regarding the document's deficiencies, 4/15/92 P. 300348-300380.

15. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Description of the historical significance of the Koppers Company Site area and recommendation that a Stage IA and IB level survey of the site area be conducted, 4/24/92. P. 300381-300382.

16. Report: <u>Revised Remedial Investigation/Feasibility Study Work Plan (RWP) for the Koppers Company Site</u>, 6/18/92. P. 300383-300553. A June 18, 1992, transmittal letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. James Buczala, Ms. Ceil Mancini, and Mr. Robert Gresh, Woodward-Clyde Consultants, is attached

17. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. M. Margie Zhang, DNREC, re: Comments regarding the June 18, 1992, RWP, 7/28/92. P. 300554-300555.

18. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Comments regarding the June 18, 1992, RWP, 8/4/92. P. 300556-300558.

19. DNREC Regulations Governing the Use of Subaqueous Lands, adopted 5/8/91, amended 9/2/92. P. 300559-300585.

20. Memorandum to Ms. M. Margie Zhang, DNREC, from Mr. Robert Allen, DNREC, re: Comments regarding the June 18, 1992, RWP, 9/7/92. P. 300586-300586.

21. Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmazyn, DuPont, from Mr. S. Andrew Sochanski, U.S. EPA, re: Notification that U.S. EPA has found the June 18, 1992, RWP to be deficient and transmittal of comments regarding the document's deficiencies, 11/6/92. P. 300587-300605.

22. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms Jane Patarcity, Beazer, re: Notification that Beazer and DuPont object to U S. EPA's disapproval of the June 18, 1992, RWP and are invoking dispute resolution, 11/20/92. P. 300606-300646. Woodward-Clyde Consultants' response to U.S. EPA's comments regarding the RWP are attached.

23. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr Robert Ehlenberger, Woodward-Clyde Consultants, re: Transmittal of Woodward-Clyde Consultants' proposed resolutions for finalizing the June 18, 1992, RWP, 12/7/92. P. 300647-300686. The resolutions are attached.

24. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. James Buczala and Mr. Robert Ehlenberger, Woodward-Clyde Consultants, re: Transmittal of a map showing proposed background soil sampling location submitted for U.S. EPA's review, 12/11/92. P. 300687-300678. The map is attached.

25. Report: Revised Remedial Investigation/ Feasibility Study Work Plan for the Koppers Company Site, prepared by Woodward-Clyde Consultants, 12/21/92. P. 300689-300887. A December 21, 1992, transmittal letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. James Buczala, Ms. Ceil Mancini, and Mr. Robert Ehlenberger, Woodward-Clyde Consultants, is attached.

26. Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmazyn, DuPont, from Mr. S. Andrew Sochanski, U.S. EPA, re: Transmittal of a meeting summary for a December 15, 1993, Dispute Resolution Meeting, transmittal of specifications for hazardous warning signs to be posted around the site, and approval of an deadline extension, 1/3/93. P. 300888-300900. The meeting summary and the sign specifications are attached.

27. Memorandum to Ms. Lydia Ogden Askew, U.S. EPA, from Mr. S. Andrew Sochanski, U.S. EPA, re: Recommendation of changes to be made in the December 31, 1991, Preliminary Public Health Assessment for the Koppers Company Site, 1/19/93. P. 300901-300939. The following are attached:

    a) a December 7, 1992, transmittal letter to Ms. Laura Janson, U.S. EPA, from Mr. Max M. Howie, Agency for Toxic Substances and Disease Registry (ATSDR);

    b) an ATSDR Public Notice,

    c) an ATSDR Fact Sheet;

    d) the Preliminary Public Health Assessment.

28. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. M. Margie Zhang, DNREC, re Comments regarding the December 21, 1992, RWP, 1/20/93. P. 300940-300941.

29. Memorandum to Ms. M. Margie Zhang, DNREC, from Mr. Gerald Llewellyn, DNREC, re: Comments regarding the Revised Preliminary Public Health Assessment, 1/21/93. P. 300942-300942.

30. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. Robert Ehlenberger, Woodward-Clyde Consultants, re: Notification on behalf of Beazer and DuPont of the selection of Maar Associates, Inc., to assist in the performance of the Cultural and Historical Survey (CHS) for the site, 1/29/93. P. 300943-300978. Personnel qualifications and three certificates of insurance are attached.

31. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr Robert Ehlenberger, Woodward-Clyde Consultants, re. Notification on behalf of Beazer and DuPont of the selection of Geoarchaeology Research Associates and Dr. Joseph Sculdenrein to assist in the performance of the CHS for the site, 3/3/93. P. 300979-301008. The following are attached:

a) a chart entitled Cultural Resources Personnel Organization;

b) a table entitled Hours by Personnel and Task;

c) personnel qualifications for Maar Associates, Inc., and Geoarchaeology Research Associates;

d) certificates of insurance for Maar Associates, Inc , and Geoarchaeology Research Associates.

32. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. Derron LaBrake and Mr. Robert Ehlenberger, Woodward-Clyde Consultants, re: Notification of a revision to the December 21, 1992, RWP, 3/17/93. P. 301009-301010.

33. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. Robert Ehlenberger, Woodward-Clyde Consultants, re: Transmittal of selected attachments to the Cultural and Historical Resources Work Plan (CHRSWP), 4/2/93 P. 301011-301018. A revision to Table 5-1, Hours by Personnel and Task, Figure 4-1, Section 106 Compliance Process, and three technical drawings are attached.

34 Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmazyn, DuPont, from Mr. S. Andrew Sochanski, U.S. EPA, re: Notification of conditional approval of the December 21, 1992, RWP, 4/7/93. P. 301009-301027. U.S. EPA's comments regarding the RWP are attached.

35 Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. James Buczala and Mr. Robert Ehlenberger, Woodward-Clyde Consultants, re: Outline of major issues to be addressed at the April 19, 1993, meeting to discuss the December 21, 1992, RWP, 4/16/93. P. 301028-301034. A facsimile transmittal page is attached

36. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Transmittal of comments regarding the CHRSWP, 4/19/93. P. 301035-301038. Ms. Stocum's comments are attached.

37. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Notification that Beazer and DuPont object to U.S. EPA's comments regarding the December 21, 1992, RWP and are invoking dispute resolution, 4/22/93. P. 301039-301062. Woodward-Clyde Consultants' response to comments regarding the RWP are attached.

38. Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmazyn, DuPont, from Mr S. Andrew Sochanski, U.S. EPA, re: Transmittal of comments to be incorporated into the final RWP, 6/8/93. P. 301063-301067.

39. Report: Quality Assurance Project Plan for the Koppers Company Site, prepared by Woodward-Clyde Consultants, 6/23/93. P. 301068-301787.

40. Report: Revised Remedial Investigation/ Feasibility Study Work Plan for the Koppers Company Site, prepared by Woodward-Clyde Consultants, 6/23/93. P. 301788-302006. A June 23, 1993, transmittal letter to Mr. S. Andrew Sochanski, U S. EPA, from Mr. Robert Ehlenberger, Woodward-Clyde Consultants, is attached.

41. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. Robert Ehlenberger, Woodward-Clyde Consultants, re: Notification on behalf of Beazer and DuPont of the selection of Bowser-Morner to conduct selected geotechnical analyses, 7/1/93. P. 302007-302008.

42. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re. Approval of the revised CHRSWP, 7/27/93. P. 302009-302009.

43. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. M. Margie Zhang, DNREC, re: Approval of and comments regarding the June 23, 1993, RWP, 8/4/93. P. 302010-302011.

44. Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmazyn, DuPont, from Mr. S. Andrew Sochanski, U.S. EPA, re: Transmittal of comments to be incorporated into the final RWP, the Field Sampling Plan (FSP), the Quality Assurance Project Plan (QAPjP), and the Health and Safety Plan (HASP), 8/24/93. P. 302012-302051.

45. Memorandum to the U.S. EPA Regional Administrators for Regions I through X from Mr. Richard Guimond, U.S. EPA, re: Description of U.S. EPA's new policy on conducting risk assessments at Superfund sites where potentially responsible parties (PRPs) are conducting the RI/FS, 9/1/93. P. 302052-302057.

46. Memorandum to Ms. M. Margie Zhang, DNREC, from Mr. Robert Allen, DNREC, re: Comments on U.S. EPA's comments regarding the June 23, 1993, RWP, 9/20/93. P. 302058-302059. A September 21, 1993, facsimile transmittal page addressed to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. Zhang is attached.

47. Report: Preliminary Public Health Assessment for the Koppers Company Site, prepared by ATSDR, 10/21/93 P. 302059-302093. An October 21, 1993, transmittal letter to Ms. Laura Janson, U.S. EPA, from Mr Max Howie, ATSDR, is attached.

48. Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmacyzn, DuPont, from Mr. Walter Graham, U.S. EPA, re: Clarification of U.S. EPA's comments regarding the June 23, 1993, RWP and approval of an extension to the submittal date for the work plan, the FSP, the QAPjP, and the HASP, 11/29/93. P. 302094-3020115. A copy of Mr. Sochanski's August 24, 1993, letter with comments is attached.

49. Letter to Mr Walter Graham, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Proposal of an agenda for the planned December 15, 1993, meeting, request for an extension to the submittal date for the RWP, the FSP, the QAPjP, and the HASP, and transmittal of responses to comments regarding these documents, 12/14/93. P. 302116-302172. A chart entitled Chronology of Events, RI/FS Work Plan, Koppers Company Site, and the responses to U.S. EPA's comments are attached.

50. Letter to Mr. Terry Stilman, U.S. EPA, from Ms. M. Margie Zhang, DNREC, re: Transmittal of Applicable or Relevant and Appropriate Requirements (ARARs) for Removal Action at the Koppers Company Site, 12/20/93. P. 302173-302179 The list of ARARs and an envelope addressed to Mr. S. Andrew Sochanski, U.S. EPA, are attached.

51. Letter to Mr. S Andrew Sochanski, U.S. EPA, from Mr. Christopher Burns, Tetra Tech, Inc., re: Transmittal of a summary of the December 15, 1993, Dispute Resolution Meeting, prepared by Tetra Tech, Inc., 12/20/93. P. 302180-302190. The summary is attached

52. Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmazyn, DuPont, from Mr. S. Andrew Sochanski, U.S EPA, re: Clarification and transmittal of a summary of the December 15, 1993, Dispute Resolution Meeting summary prepared by Tetra Tech, Inc., 12/23/93. P. 302191-302192.

53. Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmazyn, DuPont, from Mr. S. Andrew Sochanski, U.S EPA, re: Clarification and transmittal of a summary of the December 15, 1993, Dispute Resolution Meeting, prepared by Tetra Tech, Inc., transmittal of specifications for hazardous warning signs to be posted around the Koppers Company Site, and notification of

approval of an extension of the submittal date for the RWP, the FSP, the QAPjP, and the HASP, 1/3/94 P. 302193-302205. The meeting summary and the sign specifications are attached.

54. Report: Revised Work Plan, RI/FS for the Koppers Company Site, prepared by Woodward-Clyde Consultants, 1/31/94 P. 302206-302420. A January 31, 1994, transmittal letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. James Buczala and Mr. Robert Ehlenberger, Woodward-Clyde Consultants, and a January 31, 1994, transmittal letter to Ms. Jane Patarcity, Beazer, and Mr. Brandt Butler, DuPont, from Mr. H. Scott Laird, Woodward-Clyde Consultants, are attached.

55. Report: Field Sampling Plan, RI/FS for the Koppers Company Site, prepared by Woodward-Clyde Consultants, 1/31/94. P. 302421-302631. A January 31, 1994, transmittal letter to Mr. S. Andrew Sochanski, U S. EPA, from Mr. James Buczala and Mr. Robert Ehlenberger, Woodward-Clyde Consultants, is attached

56. Report: Quality Assurance Project Plan, RI/FS for the Koppers Company Site, prepared by Woodward-Clyde Consultants, 1/31/94. P. 302632-303427. A January 31, 1994, transmittal letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. James Buczala and Mr. Robert Ehlenberger, Woodward-Clyde Consultants, is attached.

57. Report: Health and Safety Plan RI/FS for the Koppers Company Site, prepared by Woodward-Clyde Consultants, 1/31/94. P. 303428-303568. A January 31, 1994, transmittal letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. James Buczala and Mr. Robert Ehlenberger, Woodward-Clyde Consultants, is attached.

58. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. M. Margie Zhang, DNREC, re: Comments regarding the January 31, 1994, RWP and the January 31, 1994, FSP, 3/4/94. P. 303569-303570.

59. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Transmittal of the approval sheet for the January 31, 1994, QAPjP, Table 1a, and Table 2, which were originally omitted from the QAPjP, 3/14/94 P. 303571-303578. The approval sheet and tables are attached.

60. Letter to Ms. Jane Patarcity, Beazer, and Mr. Joel Karmazyn, DuPont, from Mr. S. Andrew Sochanski, U S. EPA, re: Approval of the January 31, 1994, RWP, the January 31, 1994, the January 31, 1994, FSP, and the January 31, 1994, QAPjP, and the January 31, 1994, HASP with the insertion of U.S. EPA's review, 5/4/94. P. 303579-303618. The review is attached.

61. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. M. Margie Zhang, DNREC, re: Comments on the January 31, 1994, RWP, the January 31, 1994, FSP, the January 31, 1994, QAPjP, and the January 31, 1994, HASP, 5/9/94. P. 303619-303620.

62. Letter to Mr. S. Andrew Sochanski, U.S. EPA, from Mr. H. Scott Laird, Woodward-Clyde Consultants, re Notification on behalf of Beazer and DuPont that James C. Anderson Associates, Inc., has been selected to perform drilling services and Enesco Wadsworth-Alert has been selected to perform pesticide and PCB analyses, 5/19/94. P. 303621-303670. James C. Anderson Associates, Inc.'s qualifications and a performance evaluation for Enesco Wadsworth-Alert are attached.

63 Letter to Ms. Jane Patarcity, Beazer, from Mr. Peter Ludzia, U.S. EPA, re: Approval of the January 31, 1994, RWP, the January 31, 1994, FSP, the January 31, 1994, QAPjP, and the January 31, 1994, HASP, subject to previously agreed-upon modifications and notification that Ms. Lisa Marino has replaced Mr. S Andrew Sochanski as the Remedial Project Manager for the site, 5/26/94. P. 303671-303674. A summary of the understandings reached by Beazer and U.S. EPA and a map of off-site aquatic sampling locations are attached.

64. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Notification of Beazer and DuPont's withdrawal of their May 26, 1994, request for Dispute Resolution and correction of dates in U.S EPA's letter of May 26, 1994, 6/16/94. P. 303675-303675.

65. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Results of a survey of public supply and residential wells surrounding the site, 6/16/94. P. 303676-303685. The following are attached:

    a) Table 1, Residential/Commercial Well Inventory;

b) Table 2, Residential Wells Proposed for Sampling;

c) a map of public and private water supply wells;

d) a map of residential/commercial well locations.

66 Letter to Ms. Lisa Marino, U.S. EPA, from Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Notification on behalf of Beazer and DuPont of the selection of Victor Colbert Construction to provide earthwork services at the site, 6/17/94. P 303686-303687.

67. Letter to Ms. Lisa Marino, U S. EPA, from Ms. M. Margie Zhang, DNREC, re: Comments regarding the Residential Well Survey, 6/22/94. P. 303688-303689.

68. Letter to Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Notification of approval of the proposed background sampling locations, 6/22/94. P. 303690-303690.

69. Letter to Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Comments regarding the results of the residential well survey, 7/7/94. P. 303691-303693.

70. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Response to U.S. EPA's July 7, 1994, comments regarding the results of the residential well survey and confirmation of an extension to the submittal date for the revised report, 7/21/94. P. 303694-303696.

71. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Transmittal of a description of the proposed ultraviolet soil sediment field screening method, 7/21/94. P. 303697-303699. The description of the method is attached.

72. Memorandum to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Transmittal of an article entitled Using Ultraviolet Light to Investigate Petroleum-Contaminated Soil, 7/26/94. P. 303700-303709. The article is attached.

73 Letter to Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Recommendations for the clearing of potential wetland areas and request for information regarding compliance with DNREC and U.S. Army Corp of Engineers (USACE) regulations, 7/27/94 P 303710-303711.

74. Letter to Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Approval of the ultraviolet soil sediment field screening method with suggestions, 8/3/94. P. 303712-303712.

75 Letter to Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re. Response to Woodward-Clyde Consultants' July 27, 1994, letter responding to U S EPA's comments regarding the results of the residential well survey, 8/9/94. P. 303713-303714.

76. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Transmittal of information regarding compliance with DNREC and USACE regulations requested in U.S. EPA's letter of July 27, 1994, 8/10/94 P. 303715-303718. A technical drawing of preliminary wetlands boundaries is attached.

77. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Deborah Conte Toth, BCM Engineers, re: Transmittal of BCM Laboratory's Quality Assurance Program plan and copies of the methods BCM Engineers will use for analysis of sediment samples, 8/10/94. P. 303719-303813. The program plan and methods are attached.

78. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Notification on behalf of Beazer and DuPont of the selection of RMC Environmental Services, Inc., and BCM Engineers to perform benthic taxonomy consulting services and selected analytical services for soil and sediment samples, 8/10/94. P. 303814-303856. Statements of qualifications for RMC Environmental Services, Inc., and BMC Engineers are attached.

79. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Results of a survey of public supply and residential wells surrounding the site, 8/16/94. P. 303857-303905. The following are attached:

a) Table 1, Residential/Commercial Well Inventory;

b) Table 2, Residential Wells Proposed for Sampling;

c) a map of public and private water supply wells,

d) a map of residential/commercial well locations;

e) Appendix A.

80. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Description of modifications to the January 31, 1994, FSP and the January 31, 1994, QAPjP, 8/16/94. P. 303906-303908.

81. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Comments regarding the Phase IA Cultural Resources Survey for the site, 8/23/94. P 303909-303913. Ms. Stocum's comments and an August 25, 1994, letter to Ms. Lisa Marino from Ms. Stocum transmitting a revised second page to her comments is attached.

82. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. Derron LaBrake and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Transmittal of the Preliminary Covertype Map showing proposed vegetation sampling locations, 8/29/94. P. 303914-303917. The map and a facsimile transmittal page addressed to Ms. Elizabeth Rogers from Ms. Lisa Marino, U.S. EPA, are attached.

83. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. M. Margie Zhang, DNREC, re: Comments regarding the proposed locations for background soil sampling for the site, 9/2/94. P. 303918-303920. A map showing the area proposed for collection is attached.

84. Letter to Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of Ms. Marino's September 7, 1994, letter to Woodward-Clyde Consultants regarding the Phase IA Cultural Resources Survey Report and schedule and a copy of the RI/FS project schedule, 9/7/94. P. 303921-303925. Ms. Marino's letter and the schedules are attached.

85. Letter to Mr. William Moyer, DNREC, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of Woodward-Clyde Consultants's August 10, 1994, letter regarding compliance with DNREC and USACE regulations, 9/8/94. P. 303926-303926.

86. Letter to Mr. Chuck Barscz, National Park Service, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of Woodward-Clyde Consultants's August 10, 1994, letter regarding compliance with DNREC and USACE regulations, 9/8/94. P. 303927-303927.

87. Memorandum to U.S. Fish and Wildlife Service, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of Woodward-Clyde Consultants' August 10, 1994, letter regarding compliance with DNREC and USACE regulations, 9/8/94. P. 303928-303928.

88. Memorandum to Mr. Peter Stokely, U.S. EPA, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of Woodward-Clyde Consultants's August 10, 1994, letter regarding compliance with DNREC and USACE regulations, 9/8/94. P. 303929-303929.

89. Report: Laboratory Audit Report, prepared by Quanterra Environmental Services, 9/8/94. P. 303930-304092. A September 8, 1994, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Ms. Ann Racine and Mr. H. Scott Laird, Woodward-Clyde Consultants, is attached.

90. Report: Laboratory Audit Report, prepared by Quanterra Environmental Services, 9/8/94. P. 304093-304187. A September 8, 1994, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. Willian Lyon and Mr. H. Scott Laird, Woodward-Clyde Consultants, is attached.

91. Letter to Ms. Lisa Marino, U S. EPA, from Ms. Susan Colman, Geomatrix Consultants, Inc. (Geomatrix), re: Notification that Geomatrix has selected AWD Technologies, Inc (AWD), to perform chemical data validation for the site, 9/8/94. P. 304188-304205. Resumes for AWD personnel are attached.

92. Letter to Mr. Robert Davis, U.S. EPA, from Mr. Robert Pennington, U.S. Fish and Wildlife Service, re: Notification that the U.S. Fish and Wildlife Service has no concerns regarding the terrestrial covertype sampling map and the Substantive Requirements for Wetlands Permit Program, 9/12/94. P. 304206-304207.

93. Letter to Mr. Ronald Thomas, Maar Research Associates, Inc., from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Approval of Mr. Thomas's decision to name Dr. Douglas Kellogg as the geoarchaeologist responsible for monitoring the RI Phase I wetlands investigation at the Koppers Company Site, 9/12/94. P. 304208-304208.

94. Memorandum to Ms. M. Margie Zhang, DNREC, from Mr. Robert Allen, DNREC, re: Suggestion that terrestrial covertype sampling plots be located by a grid system or by a random procedure in order to eliminate unintentional bias, 9/14/94. P. 304209-304209.

95 Letter to Mr. H. Scott Laird and Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Outline of sample integrity issues associated with the September 1, 1994, sampling activities conducted at the Koppers Company Site and request for response to the issues, 9/15/94. P. 304210-304212. A facsimile transmittal page is attached.

96. Letter to Ms. Lisa Marino, U.S. EPA, from Mr H. Scott Laird, Woodward-Clyde Consultants, re: Transmittal of the Revised Phase IA Cultural Resources Survey for the Koppers Company Site on behalf of Beazer and DuPont, 9/16/94. P. 304213-304213.

97. Letter to Ms Lisa Marino, U.S. EPA, from Mr. Timothy Glazer and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Results of a September 2, 1994, field audit for the site, 9/16/94. P. 304214-304227. A field audit checklist is attached.

98. Memorandum to Mr. John Bartholomeo, USACE, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of information regarding soil boring at the site and request for feedback, 9/21/94. P. 304228-304229. A facsimile transmittal page is attached.

99. Letter to Mr H. Scott Laird and Mr. Derron LaBrake, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Comments regarding the Preliminary Terrestrial Covertype Map for the site, 9/21/94. P. 304230-304231.

100. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Description of soil sampling conditions and recommendations for modifications to the first flush sampling, 9/22/94. P. 304232-304235. A sample location plan is attached.

101. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Responses to U.S. EPA's September 15, 1994, comments regarding Woodward-Clyde's surface water and sediment sampling program for the site, 9/22/94. P. 304236-304239.

102. Memorandum to Ms. Lisa Marino, U.S. EPA, from Mr John Bartholomeo, USACE, re: Notification that the soil boring plan meets the requirements of the U.S. ACE permit program, 9/23/94. P. 304240-304241. A facsimile transmittal page is attached.

103. Report: Phase IA Cultural Resources Survey for the Koppers Company Site, prepared by Maar Associates, Inc., 9/23/94. P. 304242-304340. A September 16, 1994, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. H. Scott Laird, Woodward-Clyde Consultants, is attached.

104 Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Jessica Billy, Maar Associates, Inc., re: Transmittal of errata sheet 3-12 of the cultural resources survey, 9/23/94. P. 304341-304342 The errata sheet is attached.

105. Letter to Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, from Ms. Lisa Marino, U.S. EPA, re: Request that Ms. Stocum notify Ms. Marino if she feels that her comments regarding the draft Phase IA Cultural Resources Survey for the Koppers Company Site were not adequately addressed in the final version, 9/28/94. P. 304343-304343.

106 Letter to Ms. Lisa Marino, U.S. EPA, from Mr. Derron LaBrake and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Responses to U.S. EPA's September 21, 1994, comments regarding the proposed terrestrial covertype sampling locations, 9/28/94. P. 304344-303447. A copy of the Preliminary Terrestrial Covertype Map for the site is attached.

107. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Request that the requirement for sediment collection during the first flush sampling program be removed, 9/28/94. P. 304348-304349.

108. Area B, E, and F maps relating to the terrain conductivity survey at the site, 9/29/94. P. 304350-304362. An October 3, 1994, transmittal page addressed to Ms. Lisa Marino, U.S. EPA, and Ms. Elizabeth Rogers, Tetra Tech, Inc., from Mr. Douglas Kier, Woodward-Clyde Consultants, is attached.

109. Inorganic Data Validation Report for the Koppers Company Site, prepared by Lockheed Environmental Systems & Technologies (Lockheed), 9/29/94. P 304363-304417. An October 6, 1994, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Susanne Stevens, U.S. EPA, is attached.

110. Letter to Mr. Derron LaBrake and Mr. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Notification that U.S. EPA accepts Woodward-Clyde Consultants' modifications to the sampling plan and approval to begin the terrestrial covertypes survey, 9/30/94. P. 304418-304418.

111. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Proposal of a revised schedule for the RI/FS at the site, 9/30/94. P. 304419-304428. Two proposed schedules are attached.

112. Memorandum to Ms. Lisa Marino, U.S. EPA, and Ms. Elizabeth Rogers, Tetra Tech, Inc., from Mr. Keith Kowalski, Woodward-Clyde Consultants, re: Transmittal of Figure 2-5 showing boring locations within Area J of the site, 9/30/94. P. 304429-304430. Figure 2-5 is attached.

113. Report: <u>Terrain Conductivity Survey for the Koppers Company Site</u>, prepared by Woodward-Clyde Consultants, 9/94. P. 304431-304491. A September 14, 1994, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr H. Scott Laird, Woodward-Clyde Consultants, is attached.

114. Letter to Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U S. EPA, re: Comments regarding the terrain conductivity survey, 10/5/94. P. 304492-304495.

115. Letter to Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Notification that U.S. EPA approves the revised residential well survey with comment, 10/6/94. P. 304496-304496.

116. Letter to Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Approval of modifications to the first flush sampling program proposed in Woodward-Clyde Consultants' letters of September 22, 1994, and September 28, 1994, 10/6/94. P. 304497-304499. A U.S. EPA list of recommended field and analytical parameters for surface water is attached.

117. Area D, J, K, N, UST, and GAS UST maps relating to the terrain conductivity survey at the site, 10/6/94. P. 304500-304524 An October 7, 1994, transmittal page addressed to Ms. Lisa Marino, U.S. EPA, and Ms. Elizabeth Rogers, Tetra Tech, Inc., from Mr. Douglas Kier, Woodward-Clyde Consultants, is attached.

118. Inorganic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 10/11/94. P. 304525-304602. An October 13, 1994, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Susanne Stevens, U S. EPA, is attached.

119. Organic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 10/18/94. P. 304603-304916. An October 13, 1994, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Susanne Stevens, U.S. EPA, is attached.

120. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Description of plans for the first flush sampling event at the site and response to issues raised in U.S. EPA's letter of October 6, 1994, regarding sampling, 10/24/94. P. 304917-304920.

121. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Proposal of five additional off-site soil sampling locations for the RI, 10/28/94. P. 304921-304924. Table 1, Background Soil Sampling Locations and a map showing the proposed sampling locations are attached.

122. Inorganic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 10/31/94. P. 304925-304976. A November 10, 1994, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Susanne Stevens, U.S. EPA, is attached.

123. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Documentation of telephone conversations regarding the installation of additional shallow monitoring wells at the site, 11/1/94. P. 304977-304978.

124. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Notification on behalf of Beazer and DuPont of the selection of Entrix, Inc., to provide ecological consulting services, 11/3/94 P. 304979-304979.

125. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Description of shallow well development at the site, 11/7/94. P. 304980-304981.

126. Organic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 11/9/94. P. 304982-305104.

127. Dioxin Data Validation Report for the Koppers Company Site, prepared by Lockheed, 11/9/94. P. 305105-305145. A November 15, 1994, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Susanne Stevens, U.S. EPA, is attached.

128. Letter to Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms Lisa Marino, U.S. EPA, re: Comments regarding the background soil sampling locations proposed in Woodward-Clyde Consultants' letter of October 28, 1994, 11/17/94. P. 305146-304147.

129. Inorganic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 11/25/94. P. 305148-305169. A November 28, 1994, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms Susanne Stevens, U.S. EPA, is attached.

130. Report: <u>Analytical Report for the Koppers Company Site</u>, prepared by U.S. EPA, 11/29/94. P. 305170-305262. A November 29, 1994, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. Frederick Dreisch and Ms. Peggy Zawodny, U.S. EPA, is attached

131. Report: <u>Analytical Report for the Koppers Company Site</u>, prepared by U.S. EPA, 12/5/94. P. 305263-305300. A December 5, 1994, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. Frederick Dreisch and Ms. Peggy Zawodny, U.S. EPA, is attached.

132. Organic Data Validation Report for the Koppers Company Site, prepared by Dow Environmental, Inc., 12/7/94. P. 305301-305384. A December 7, 1994, transmittal letter to Ms. Jane Patarcity, Beazer, from Mr. Andy Mehalko, Dow Environmental, Inc., is attached.

133. Inorganic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 12/8/94. P. 305385-305432. A December 12, 1994, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms Susanne Stevens, U.S. EPA, is attached.

134. Report: Summary of Analytical Results Received Through November 30, 1994, for the Koppers Company Site, 12/15/94. P. 305433-305897. A December 15, 1994, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, is attached.

135. Organic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 12/21/94. P. 305898-306045. A December 22, 1994, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Susanne Stevens, U.S. EPA, is attached.

136. Dioxin/Furan Data Validation Report for the Koppers Company Site, prepared by Lockheed, 1/12/95. P. 306046-306144. A January 17, 1995, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Susanne Stevens, U.S. EPA, is attached.

137. Dioxin Data Validation Report for the Koppers Company Site, prepared by Lockheed, 1/23/95. P. 306145-306189. A January 25, 1995, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Cynthia Caporale, U.S. EPA, is attached.

138. Organic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 1/30/95. P. 306190-306237. A January 31, 1995, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Cynthia Caporale, U.S. EPA, is attached.

139. Letter to Mr. Randy Sturgeon, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Comments regarding the Management Summary for the Phase I Archaeological Survey of Old Airport Road, 2/6/95. P. 306238-306238.

140. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Notification on behalf of Beazer and DuPont of the selection of Mr. Charles LeeDecker as the Cultural Resources Task Leader for the site, 2/21/95. P. 306239-306247. Mr. Leedecker's qualifications are attached.

141. Letter to Ms. Jane Patarcity, Beazer, from Ms. Lisa Marino, U.S. EPA, re: Request for the credentials of Dr. Ralph Markarian, Entrix, Inc., 2/21/95. P. 306248-306248.

142. Inorganic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 2/23/95. P. 306249-306252. A March 2, 1995, transmittal memorandum to Ms Lisa Marino, U.S. EPA, from Ms. Cynthia Caporale, U.S. EPA, is attached.

143. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Transmittal of resumes for Entrix, Inc., personnel, 2/24/95. P. 306253-306313. The resumes are attached.

144. Report: Geoarchaeological Evaluation, Phase I Cultural Resources Survey for the Koppers Company Site, prepared by Maar Associates, Inc., 2/95. P. 306314-306359. A February 28, 1995, transmittal letter to Ms Lisa Marino, U.S. EPA, from Mr. H. Scott Laird and Mr. Charles LeeDecker, Woodward-Clyde Consultants, is attached.

145. Report: Phase IA Cultural Resources Survey for the Koppers Company Site, prepared by Maar Associates, Inc., 2/95 P. 306360-306456. An April 24, 1995, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Ms. Jessica Billy, Maar Associates, Inc., is attached.

146. Memorandum to Ms. Susan Colman, Geomatrix, T. Faye, Beazer, Mr. Peter Ludzia, U.S. EPA, and Ms. M. Margie Zhang, DNREC, from Mr. Charles LeeDecker, Woodward-Clyde Consultants, re: Transmittal of the February 1995 Geoarchaeological Evaluation, Phase I Cultural Resources Survey for the Koppers Company Site, 3/2/95. P. 306457-306457.

147. Letter to James Buczala and H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Permission to backfill the excavations produced during the Phase IB Cultural Resources Survey work, 3/8/95. P. 306458-306459.

148. Memorandum to Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, from Ms. Lisa Marino, U.S. EPA, re: Request for a confirmation of a date by which Ms. Stocum will comment on the Geoarchaeological Evaluation for the site, 3/15/95. P. 306460-306460.

149. Memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Notification that Ms. Stocum plans to comment on the February 1995 Geoarchaeological Evaluation for the site around mid-April, 3/20/95. P. 306461-306462. A facsimile transmittal page is attached.

150. Report: Analytical Report for the Koppers Company Site, prepared by U.S EPA, 3/21/95. P. 306463-306503 A March 21, 1995, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. Frederick Dreisch and Ms. Peggy Zawodny, U.S. EPA, is attached.

151. Report: Work Plan for Phase IB Cultural Resources Studies at the Koppers Company Site, prepared by Maar Associates, Inc., 3/27/95. P. 306504-306518. A March 27, 1995, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, is attached.

152 Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Jessica Billy, Maar Associates, Inc., re: Transmittal of Figures 2, 3, and 4 for the March 27, 1995, Phase IB Cultural Resources Studies work plan, 3/28/95. P. 306519-306522. The figures are attached.

153. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. H. Scott Laird, Woodward-Clyde Consultants, re: Description of Round 1 ground water sampling events and plans for Round 2 sampling, 4/4/95. P. 306523-306633. A tabulated summary of Phase I ground water results is attached.

154. Report: Phase II Remedial Investigation Scope of Work for the Koppers Company Site, prepared by Woodward-Clyde Consultants, 4/27/95. P. 306634-307090. An April 27, 1995, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, is attached.

155. Letter to Ms. Lisa Marino, U.S EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Notification that the Phase IA Cultural Resources Survey is acceptable and request for additional copies, 5/1/95. P. 307091-307091.

156. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Notification that the February, 1995 Phase I Cultural Resources Survey and the March 27, 1995, Phase IB Cultural Resources Studies work plan need revision, 5/1/95. P. 307092-307097. Ms. Stocum's comments regarding the documents are attached.

157. Report: Phase I Remedial Investigation Data Package for the Koppers Company Site, Attachment 1, Volume 1 of 4, prepared by Woodward-Clyde Consultants, 5/8/95. P. 307098-307425. A May 8, 1995, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, is attached.

158. Report: Phase I Remedial Investigation Data Package for the Koppers Company Site, Attachment 1, Volume 2 of 4, prepared by Woodward-Clyde Consultants, 5/8/95. P. 307426-307685.

159. Report: Phase I Remedial Investigation Data Package for the Koppers Company Site, Attachment 1, Volume 3 of 4, prepared by Woodward-Clyde Consultants, 5/8/95 P. 307686-307736.

160. Report. Phase I Remedial Investigation Data Package for the Koppers Company Site, Attachment 1, Volume 4 of 4, prepared by Woodward-Clyde Consultants, 5/8/95. P. 307737-307826.

161. Report: Phase I Remedial Investigation Data Package for the Koppers Company Site, Attachments 2 Through 7, prepared by Woodward-Clyde Consultants, 5/8/95. P. 307827-308075

162. Letter to Mr. James Buczala and Mr. H. Scott Laird, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of the May 1, 1995, letters written by Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, commenting on the Phase IA Cultural Resources Survey, the February 1995 Phase I Cultural Resources Survey and the March 27, 1995, Phase IB Cultural Resources Studies work plan, 5/9/95. P. 308076-308084. The letters are attached.

163. Memorandum to the file from Ms. Lisa Marino, U S. EPA, re. Notification that Woodward-Clyde Consultants missed the holding time for a portion of the ground water sample and will use the split sample data for this location collected by Tetra Tech, Inc., 5/9/95. P. 308085-308085.

164. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Susan Colman, Geomatrix, re: Notification on behalf of Beazer and DuPont of the selection of Dames & Moore to perform the FS for the site and Environmental Standards, Inc., to perform the Public Health Assessment, 5/18/95. P. 308086-308100. The resumes of Dames & Moore and Environmental Standards, Inc., personnel are attached.

165. Letter to Ms. Susan Colman, Geomatrix, from Ms. Lisa Marino, U.S. EPA, re: Notification that U.S. EPA approves of the selection of Dames & Moore to perform the FS for the site but will not comment on the proposed selection of Environmental Standards, Inc., until Beazer and DuPont submit a formal request to perform risk assessments, 5/30/95. P. 308101-308101.

166. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. M. Margie Zhang, DNREC, re: Comments regarding the Phase II Remedial Investigation Scope of Work (RI SOW), 6/6/95. P. 308102-308104. A facsimile transmittal page is attached.

167. Report: Analytical Report, prepared by U S. EPA, 6/7/95. P. 308105-308132. A June 7, 1995, transmittal letter to Ms. Lisa Marino, U.S. EPA, is attached.

168 Inorganic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 6/15/95. P. 308133-308134. A June 22, 1995, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Cynthia Caporale, U.S. EPA, is attached.

169. Organic Data Validation Report for the Koppers Company Site, prepared by Lockheed, 6/16/95. P. 308135-308257 A June 22, 1995, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Cynthia Caporale, U.S. EPA, is attached.

170 Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of comments regarding the April 27, 1995, Phase II RI SOW, 6/27/95. P. 308258-308305. The comments are attached.

171. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Request for an extension of the submittal date for the response to U.S. EPA's June 27, 1995, comments regarding the April 27, 1995, Phase II RI SOW and notification that Beazer and DuPont are invoking dispute resolution, 7/12/95. P. 308306-308308.

172. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Transmittal of a summary of resolutions of the Delaware Division of Historical and Cultural Affairs' comments regarding the February 1995 Geoarchaeological Evaluation and the March 27, 1995, Phase IB Cultural Resources Studies work plan for the site achieved at a June 13, 1995, meeting, as well as the map depicting the potential location of prehistoric sites and excerpts from the Geoarchaeological Evaluation, both revised in accordance with the Delaware Division of Historical and Cultural Affairs' comments, 7/20/95. P. 308309-308328. The summary, the map, and the excerpt are attached.

173. Letter to Jane Patarcity, Beazer, from Ms. Lisa Marino, U.S. EPA, re: Offer of an extension to the submittal date for the response to U.S. EPA's comments regarding the April 27, 1995, Phase II RI SOW, 7/25/95. P. 308329-308330.

174. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Transmittal of Woodward-Clyde Consultants' response to U.S. EPA's June 27, 1995, comments regarding the April 27, 1995, Phase II RI SOW, 8/2/95. P 308331-308406. The response is attached.

175. Report: Revised Phase II Remedial Investigation Scope of Work for the Koppers Company Site, prepared by Woodward-Clyde Consultants, 8/18/95. P. 308407-308991. An August 18, 1995, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Ms. Ceil Mancini and Mr. James Buczala, Woodward-Clyde Consultants, is attached.

176. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Transmittal of comments regarding Woodward-Clyde Consultants' July 20, 1995, summary of resolutions and revised excerpts from the Geoarchaeological Evaluation, 8/21/95. P. 308992-308996. The comments and an August 29, 1995, transmittal letter from Ms. Marino to Mr. James Buczala, Woodward-Clyde Consultants, are attached.

177. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Request for permission for Environmental Standards, Inc., to perform the Public Health Assessment portion of the Risk Assessment and for Woodward-Clyde Consultants to perform the Ecological Assessment portion of the Risk Assessment for the site on behalf of Beazer and DuPont, 8/30/95. P. 308997-309055. Statements of qualifications for Environmental Standards, Inc., and Woodward-Clyde Consultants, are attached.

178. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of comments in response to Woodward-Clyde Consultants' August 2, 1995, response to U.S. EPA's June 27, 1995, comments regarding the April 27, 1995, Phase II RI SOW and the August 18, 1995, Phase II RI SOW, 9/13/95. P. 309056-309068. The comments are attached.

179. Report: Field Oversight Summary Report for the RI/FS Oversight at the Koppers Company Site, prepared by Tetra Tech, Inc., 9/14/95. P. 309069-309353. A September 14, 1995, transmittal letter to Ms. Lisa Marino, U.S. EPA, from Ms. Elizabeth Rogers, Tetra Tech, Inc. summarizing Tetra Tech, Inc.'s conclusions and recommendations and a September 28, 1995, transmittal letter from Ms. Marino to Mr. James Buczala, Woodward-Clyde Consultants, are attached.

180. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Comments regarding the August 18, 1995, Phase II RI SOW, 9/19/95. P. 309354-309355

181. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Confirmation of the one-week extension granted by U.S. EPA for Beazer and DuPont's response to U.S. EPA's September 13, 1995, comments, 9/22/95. P. 309356-309356.

182. Letter to Ms. Lisa Marino, U.S. EPA, from Ms Jane Patarcity, Beazer, re: Notification that Beazer and DuPont invoke dispute resolution with respect to U.S. EPA's September 13, 1995, comments, 9/28/95. P. 309357-309358. An envelope is attached.

183. Report: Geoarchaeological Evaluation, Phase I Cultural Resources Survey for the Koppers Company Site, prepared by Maar Associates, Inc., 10/2/95. P. 309360-309408. An October 3, 1995, transmittal letter to Ms Lisa Marino, U.S. EPA, from Ms. Jessica Billy, Maar Associates, is attached.

184. Report: Phase IB Cultural Resources Studies Work Plan for the Koppers Company Site, prepared by Maar Associates, 10/2/95. P. 309409-309422.

185. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Transmittal of response to U.S. EPA's September 13, 1995, comments, 10/4/95. P. 309423-309450.

186. Report: Phase II Remedial Investigation Scope of Work-Response to U.S. EPA Comments Dated September 13, 1995, Volume 2 of 3, prepared by Woodward-Clyde Consultants, 10/4/95. P. 309451-309786.

187. Report: Phase II Remedial Investigation Scope of Work-Response to U.S. EPA Comments Dated September 13, 1995, Volume 3 of 3, prepared by Woodward-Clyde Consultants, 10/4/95. P. 309787-310087.

188. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Recommendations for the use of split sample data collected by Tetra Tech, Inc., 11/1/95. P. 310088-310089.

189. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Transmittal of a set of data inadvertently excluded from the data screening package attached to Woodward-Clyde Consultants' October 4, 1995, letter to U.S. EPA, 11/1/95. P. 310090-310114. The set of data is attached

190. Memorandum to Ms. Lisa Marino, U.S. EPA, from Mr. Keith Kowalski, Woodward-Clyde Consultants, re: Transmittal of ground water elevation data, 11/22/95. P. 310115-310116. The data are attached.

191. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Transmittal of comments regarding Woodward-Clyde Consultants' letter of October 4, 1995, 11/28/95. P. 310117-310124. The comments and a map indicating additional Phase II sampling locations are attached.

192. Letter to Ms. Jane Patarcity, Beazer, from Ms. Lisa Marino, U.S. EPA, re: Approval of Beazer and DuPont's August 30, 1995, request to have Environmental Standards, Inc., perform the Public Health Assessment for the site and rejection of the request to have Woodward-Clyde Consultants perform the Ecological Assessment, 11/29/95. P. 310125-310126.

193 Organic and Inorganic Data Validation Reports for the Koppers Company Site, prepared by Lockheed, 11/29/95. P. 310127-310301. A November 30, 1995, transmittal memorandum to Mr. S. Andrew Sochanski, U.S. EPA, from Ms. Cynthia Caporale, U.S. EPA, is attached.

194. Organic, Inorganic, and Dioxin/Furon Data Validation Reports for the Koppers Company Site, prepared by Lockheed, 12/1/95. P. 310302-310404. A December 5, 1995, transmittal memorandum to Ms. Lisa Marino, U.S. EPA, from Ms. Cynthia Caporale, U.S. EPA, is attached.

195. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Request for extension of the submittal date for the changes to the August 18, 1995, Phase II RI SOW, 12/4/95. P. 310405-310406.

196. Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Notification that Beazer and DuPont invoke dispute resolution with respect to U.S. EPA's November 28, 1995, inclusion of surface water samples and pesticide/PCB and PCDD/PCDF analyses as part of the Phase II RI SOW, 12/11/95. P. 310407-310408.

197. Letter to Ms. Jane Patarcity, Beazer, and Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Approval of an extension of the submittal date for the changes to the Phase II RI SOW, agreement to drop PCDD/PCDF, PAH, and pesticide analysis from the surface water and PCDD/PCDF analysis from sediment samples, and explanation of U.S EPA's reasons for requiring analysis of metals in surface water samples and pesticides/PCBs, metals, and PAHs in sediment samples, 12/14/95. P. 310409-310411.

198 Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Transmittal of responses to issues raised in U.S. EPA's letter of November 28, 1995, and revised text, tables, and figures for the December 21, 1995, Revised Phase II Remedial Investigation Scope of Work, 12/20/95 P. 310412-310423. The responses are attached.

199. Report: Revised Phase II Remedial Investigation Scope of Work, prepared by Woodward-Clyde Consultants, 12/21/95. P. 310424-311009. An August 18, 1995, transmittal letter is attached.

200. Memorandum to Ms. Lisa Marino, U.S. EPA, from Mr. Keith Kowalski, Woodward-Clyde Consultants, re: Transmittal of Figure 4-1A, an addition to the December 21, 1995, Revised Phase II RI SOW, showing off-site Phase II sediment/surface water sampling locations at the site, 12/21/95. P. 311010-311011. Figure 4-1A is attached.

201. Memorandum to U.S. EPA Personnel, from Mr. Stephen Luftig, U.S. EPA, re: Description of U.S. EPA's revised policy on allowing PRPs to conduct risk assessments, 1/26/96. P. 311012-311014.

202. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Notification on behalf of Beazer and DuPont of the selection of John Milner Associates to perform the Phase IB Cultural Resources Survey and of Dr. John Sprinkle to replace Mr. Charles LeeDecker as the Cultural Resources Task Manager for Woodward-Clyde Consultants, 2/16/96. P. 311015-311037. Dr. Sprinkle's resume and the resumes of John Milner Associates personnel are attached.

203 Letter to Ms. Lisa Marino, U.S. EPA, from Ms. Faye Stocum, Delaware Division of Historical and Cultural Affairs, re: Transmittal of comments regarding the July 20, 1995, Revised Geoarchaeological Evaluation Phase I Cultural Resources Survey and the October 2, 1995, Revised Phase IB Cultural Resources Studies work plan, 2/29/96. P. 311038-311043. The comments are attached.

204. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Description of damage to wells at the site, 2/29/96. P. 311044-311045.

205. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Notification that Woodward-Clyde Consultants will be forwarding validation letters for data they collected during the Phase I RI and transmittal of a summary list of the data to be included in that package, 3/4/96. P. 311046-311047. The summary list is attached.

206. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Proposal to revise the immunoassay screening methodology presented in the December 21, 1996, Revised Phase II RI SOW to include both Ensys RISc and Ohmicron PAH RaPID Assay, 3/4/96. P. 311048-311090. Information regarding the proposed methods is attached.

207. Letter to Ms. Lisa Marino, U S. EPA, from Mr James Buczala, Woodward-Clyde Consultants, re: Proposal and description of an alternative approach to handling soil cutting drilling operations at the site, 3/5/96. P. 311091-311092.

208. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Approval of Woodward-Clyde Consultants' March 4, 1996, proposal to revise the immunoassay screening methodology, 3/7/96 P. 311093-311093.

209. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Transmittal of the addendum to the January 31, 1996, HASP, 3/8/96. P. 311094-311105. The addendum is attached.

210. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Approval, with provisions, of Woodward-Clyde Consultants' March 5, 1996, proposal to use an alternative approach to handling soil cutting drilling operations at the site, 3/12/96. P. 311106-311106.

211. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Directions for confirmation of well integrity and request for a summary of collected field data to evaluate the integrity of the damaged monitoring wells, as well as recommendations for corrective measures, 3/19/96. P. 311107-311108.

212. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: U.S. EPA's conditional approval of the October 2, 1995, Revised Phase IB Cultural Resources Studies work plan and the July 20, 1995, Geoarchaeological Evaluation Phase I Cultural Resources Survey provided that John Milner Associates revises them in accordance with the February 29, 1996, comments of Ms. Faye Stocum, Delaware Division of Cultural and Historical Affairs, 3/21/96. P. 311109-311110.

213. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Proposal of modifications to item No. 2 in Section VIII (I) of the September 30, 1991, Administrative Order on Consent dealing with monthly progress reporting, 3/21/96. P. 311111-311113.

214. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Evaluation of the extent of damage to wells at the site, as requested in U.S. EPA's letter of March 19, 1996, 4/1/96. P. 311114-311115.

215. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Results of the March 15, 1996, PAH immunoassay screening evaluation conducted at the site, as requested in U.S. EPA's letter of March 7, 1996, and notification of the selected methodology, 4/8/96. P. 311116-311118.

216. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Agreement with Woodward-Clyde Consultants' April 1, 1996, proposal to evaluate the Phase I and Phase II RI ground water sample results prior to making a determination regarding the need for corrective action, 4/9/96. P. 311119-311119.

217. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Comments regarding the March 8, 1996, addendum to the January 31, 1996, HASP, 4/9/96. P. 311120-311121.

218. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. John Sprinkle and Mr. James Buczala, Woodward-Clyde Consultants, re: Transmittal of the April 11, 1996, Revised Phase IB Cultural Resources Studies work plan, prepared by MAAR Associates, Inc., and revised by Woodward-Clyde Consultants and the April 11, 1996, Revised Geoarchaeological Evaluation, Phase I Cultural Resources Survey, prepared by MAAR Associates, Inc., and revised by Woodward-Clyde Consultants, 4/11/96. P. 311122-311192. The reports are attached.

219. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Request that Woodward-Clyde Consultants continue to submit data summary tables, but not raw data sheets, with its monthly progress reports, in response to Woodward-Clyde Consultants' March 21, 1996, proposal of modifications to the September 30, 1991, Administrative Order on Consent dealing with monthly progress reporting, 4/24/96. P. 311193-311194.

220. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Concerns posed by USACE and Tetra Tech, Inc., regarding health and safety practices at the site, 4/24/96. P. 311195-311196.

221. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Description of modifications made to field tasks based on field observations made during Phase II RI data collection at the site, 4/24/96. P. 311197-311198.

222. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Transmittal of a map showing the preliminary findings of the dense nonaqueous phase liquid (DNAPL) delineation program and the proposed Phase II RI monitoring well locations, 4/24/96. P. 311200-311201. The map is attached.

223. Memorandum to Ms. Lisa Marino, U.S. EPA, from Mr. Ron Gantreau, Woodward-Clyde Consultants, re: Transmittal of two maps showing the approximate locations of hand borings in Hershey Run Marsh, West Central Marsh, and East Central Marsh at the site, as well as preliminary boring logs, 4/30/96. P. 311202-311205. The maps and boring logs are attached.

224. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Concerns regarding Woodward-Clyde Consultants' April 24, 1996, proposed modifications to the Phase II RI work plan, 5/6/96. P. 311206-311208.

225. Letter to Ms. Lisa Marino, U.S. EPA, from Mr. James Buczala, Woodward-Clyde Consultants, re: Response to U.S. EPA's May 6, 1996, concerns regarding proposed modifications to the Phase II RI work plan, 5/30/96 P. 311209-311215.

226. Letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, re: Response to Woodward-Clyde Consultants' May 30, 1996, letter in response to U.S. EPA's May 6, 1996, concerns regarding proposed modifications to the Phase II RI work plan, 6/20/96. P. 311216-311217.

227. Report: Phase IA Cultural Resources Survey for the Koppers Company Site, prepared by Maar Associates, Inc., (undated). P. 311218-311306.

228. Report: Quality Assurance Project Plan, Remedial Investigation/Feasibility Study, Former Koppers Company, Inc, Newport Site, prepared by Woodward-Clyde Consultants, 1/31/94. P. 311307-311480. A December 5,2002 transmittal letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Stuart Messur, Blasland, Bouck & Lee, Inc., is attached.

229. Presentation entitled, "Agenda - Overview of the Remedial Investigation," prepared by Woodward-Clyde Consultants, 3/24/97. P. 311481-311545.

230. Report: Remedial Investigation Report, Former Koppers Company, Inc , Newport Site, Newport, Delaware, Volume 1 of 3, prepared by Blasland, Bouck & Lee, Inc., 5/97. P. 311546-311703. A May 10, 1997, transmittal letter to Ms. Stephanie Dehnhard, U.S. EPA, from Mr. David Hale, Blasland, Bouck & Lee, Inc., is attached.

231. Report: Remedial Investigation Report, Former Koppers Company, Inc., Newport Site, Newport, Delaware, Volume 2 of 3, Tables/Appendices, prepared by Blasland, Bouck & Lee, Inc., 5/97. P. 311704-312359.

232. Report: Remedial Investigation Report, Former Koppers Company, Inc., Newport Site, Newport, Delaware, Volume 3 of 3, Appendices, prepared by Blasland, Bouck & Lee, Inc., 5/97. P. 312360-312838.

233. Report: Phase IB Archeological Survey of Selected Areas of the Former Koppers Company, Inc. Property, prepared by John Milner Associates, Inc., 1997. P. 312839-312968. A June 26, 1997, transmittal letter to Mr. John Sprinkle, Woodward-Clyde Consultants, from Mr. Douglas Kellogg, John Milner Associates, Inc., and a June 26, 1997, transmittal memorandum to Ms. Stephanie Dehnhard, U.S. EPA, from Mr. Douglas Kellogg, John Milner Associates, Inc., are attached.

234 Report: Final Ecological Risk Assessment, Former Koppers Company, Inc. Site, Newport, Delaware, prepared by U.S. EPA, U.S. Fish & Wildlife Service, and Roy F. Weston, 8/97. P. 312969-313308. The following are attached.

a) an August 26, 1997, transmittal letter to Ms Maryann Nicholson, Dupont, from Ms. Stephanie Dehnhard, U.S. EPA;

b) a June, 1997, review of EPA's Draft Final Ecological Risk Assessment, prepared by PTI Environmental Services;

c) a June 11, 1997, transmittal memorandum to Ms Stephanie Dehnhard, U.S. EPA, from Ms. Lucinda Jacobs, PTI Environmental Services;

d) undated EPA responses to comments submitted by PTI Environmental Services.

235. Letter to Ms. Maryann Nicholson, DuPont, from Ms. Stephanie Dehnhard, U.S. EPA, re: How Ecological Risk Assessment results translate into remedial goals, 9/5/97. P. 313309-313312.

236. Report: Analysis of Sediment and Soil Toxicity Data for the Former Koppers Company, Inc., Newport Site, prepared by PTI Environmental Services, 10/97. P. 313313-313358. The following are attached:

a) an October, 1997, report entitled "Discussion of Statistical Methods Used to Establish Ecotoxicity Thresholds from Toxicity Test Data for the Koppers Company, Inc., Newport Site," prepared by PTI Environmental Services;

b) an October 10, 1997, transmittal letter to Ms. Stephanie Dehnhard, U.S. EPA, from Ms. Lucinda Jacobs, PTI Environmental Services;

c) a September 16, 1997, facsimile transmittal memorandum to Ms. Stephanie Dehnhard, U.S. EPA, from Ms. Lucinda Jacobs, PTI Environmental Services;

d) a September 16, 1997, letter to Ms. Stephanie Dehnhard, U.S. EPA, from Ms. Lucinda Jacobs, PTI Environmental Services, regarding action items from a meeting on September 10, 1997;

e) an October 8, 1997, packet of maps depicting TPAH concentrations.

237. Letter to Ms. Jane Patarcity, Beazer, from Ms. Stephanie Dehnhard, U.S. EPA, re: Transmittal of comments on the Draft Human Health Risk Assessment, 12/21/98. P. 313359-313375. The comments are attached.

238. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Comments on the Draft Remedial Investigation Report of May 1997, 1/11/99. P. 313376-313424.

239. Letter to Mr. Matthew Mellon, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Comments on the Draft Remedial Investigation Report of May 1997, 1/27/99. P. 313425-313426.

240 Report: <u>Remedial Investigation Report, Former Koppers Company, Inc., Newport Site, Newport, Delaware, Volume 1 of 3</u>, prepared by Blasland, Bouck & Lee, Inc., 4/99. P. 313427-313775.

241. Report: <u>Human Health Risk Assessment for the Former Koppers Company, Inc Site</u>, prepared by Environmental Standards, Inc., 4/30/99. P. 313776-314106.

242. Report: <u>Feasibility Study Report, Former Koppers Company, Inc., Newport Site, Newport, Delaware</u>, prepared by Blasland, Bouck & Lee, Inc., 9/99. P. 314107-314279 A June 18, 1999, proposed Feasibility Study outline, a September 30, 1999, transmittal letter to Mr. Matthew Mellon, U.S. EPA, from Mr. David Hale, Blasland, Bouck & Lee, Inc., and a November 5, 1999, transmittal memorandum to Mr. Matthew Mellon, U.S. EPA, from Mr. David Hale, Blasland, Bouck & Lee, Inc., are attached.

243. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Notice that EPA will provide comments on and an addendum to the Revised Draft Remedial Investigation Report, 9/27/00. P. 314280-314285. An October 4, 2000, letter to Mr. Matthew Mellon, U.S. EPA, from Ms Jane Patarcity, Beazer, and Ms. Maryann Nicholson, DuPont, regarding the response to comments on the Revised Draft Remedial Investigation Report is attached.

244. Letter to Mr. Matthew Mellon, U.S. EPA, from Ms. Jane Patarcity, Beazer, and Ms. Maryann Nicholson, DuPont, re: Response to comments on the Revised Draft Remedial Investigation Report, 10/4/00. P. 314286-314289.

245. Packet of maps entitled, "Benzo(a)pyrene equivalence - B(a)P," prepared by Mr. Matthew Mellon, U.S. EPA, 2001. P. 314290-314294.

246 Map entitled, "All TPAH RAO (ERA) Exceedences," prepared by Mr. Matthew Mellon, U.S. EPA, 2001. P. 314295-314295.

247. Letter to Mr. Peter Schaul, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Confirmation of August 29, 2001, meeting, 8/20/01. P. 314296-314297. An August 29, 2001, meeting agenda is attached.

248. Meeting agenda, 8/29/01. P 314298-314301. A PowerPoint presentation is attached.

249. Meeting sign-in sheet, 8/29/01. P. 314302-314302.

250. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re. Schedule by which EPA proposes to complete the Remedial Investigation and Feasibility Study, 9/7/01. P. 314303-314303.

251. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Preliminary remedial action objectives in the Ecological Risk Assessment, 9/17/01. P. 314304-314309.

252. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Acceptance of Human Health Risk Assessment, 9/20/01. P. 314310-314310.

253. Letter to Mr. Matthew Mellon, U.S. EPA, from Ms. Jane Patarcity, Beazer, and Ms. Maryann Nicholson, DuPont, re: Comments on Ecological Risk Assessment, Human Health Risk Assessment, and U.S. EPA figures, 9/26/01. P. 314311-314314. An envelope is attached.

254. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Comments on the Revised Draft Remedial Investigation Report, 10/25/01. P. 314315-314338. The comments are attached.

255. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Comments on Draft Feasibility Study Report, 11/21/01. P. 314339-314340.

256. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. David Hale, Blasland, Bouck & Lee, Inc., re: Comments on Revised Draft Remedial Investigation Report, 11/28/01. P. 314341-314342.

257. Meeting agenda entitled "Forging a Consensus," 12/01. P. 314343-314350. A December, 2001, matrix for identifying COCs, December, 2001, EPA comments, and an undated topic schedule table are attached.

258. Meeting sign-in sheet, 12/19/01. P. 314351-314351.

259. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. David Hale, Blasland, Bouck & Lee, Inc., re: Transmittal of draft responses to comments on the April 1999 Draft Remedial Investigation Report, 2/4/02. P. 314352-314407. The responses are attached.

260. Meeting agenda entitled, "Reaching Agreement on Comment Responses," 2/02 - 3/02. P. 314408-314408.

261 Letter to Ms. Lynn Broaddus, Delaware Natural Heritage Program, from Mr. Paul Kocak, Blasland, Bouck & Lee, Inc., re: Threatened or endangered species information, 3/28/02. P. 314409-314414. A May 7, 1997, site location map, and a March 28, 2002, letter to Ms. Mary Ratnaswamy, U.S. Fish & Wildlife Service, from Mr. Paul Kocak, Blasland, Bouck & Lee, Inc., regarding threatened or endangered species information, and an envelope are attached.

262. Electronic memorandum to Ms. Lois Ryfun, Blasland, Bouck & Lee, Inc., from Mr. Matthew Mellon, U.S. EPA, re: Transmittal of Remedial Investigation figures and anticipated changes, 3/28/02. P. 314415-314417. The figures are attached.

263. Memorandum to Mr. Matthew Mellon, U.S. EPA, Ms. Jane Patarcity and Ms. Maryann Nicholson, DuPont, from Mr. David Hale, Blasland, Bouck & Lee, Inc., re: February 28, 2002, meeting minutes, 4/12/02. P. 314418-314421.

264. Meeting agenda, 5/10/02. P. 314422-314422.

265. Letter to Mr. Paul Kocak, Blasland, Bouck & Lee, Inc., from Ms. Mary Ratnaswamy, U.S. Fish & Wildlife Service, re: Threatened or endangered species information, 6/14/02. P. 314423-314424.

266. Meeting agenda entitled, "Feasibility Study Discussions," 6/20/02. P. 314425-314427 A meeting sign-in sheet and handwritten meeting notes are attached.

267. Handwritten meeting notes, 6/25/02 P. 314428-314431. A meeting sign-in sheet is attached.

268. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. David Hale, Blasland, Bouck & Lee, Inc., re: Transmittal of the Supplemental Drainage Area Investigation Work Plan, 7/19/02. P. 314432-314438. The Work Plan is attached.

269. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Stuart Messur, Blasland, Bouck & Lee, Inc., re: Addendum to the scope of work for delineation of the lower fine-grained unit and vertical extent of non-aqueous phase liquid (NAPL), 8/7/02. P. 314439-314444. The addendum and a July 24, 2002, boring area location map, are attached.

270. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Stuart Messur, Blasland, Bouck & Lee, Inc., re: Addendum to the scope of work for delineation of the lower fine-grained unit and vertical extent of NAPL, 8/8/02. P. 314445-314450. The addendum is attached.

271. Report: Health and Safety Plan, prepared by Beazer, 10/02. P. 314451-314565. An October 25, 2002, electronic transmittal memorandum to Mr. Matthew Mellon and Mr. Eric Newman, U.S. EPA, from Mr. Kendrick Jaglal, Blasland, Bouck & Lee, Inc., is attached.

272. Report: Sampling and Analysis Plan Addendum, Former Koppers Company, Inc., Newport Site, Newport, Delaware, prepared by Blasland, Bouck & Lee, Inc., 10/02. P. 314566-314623. A November 20, 2002, memorandum to Mr. Matthew Mellon, U.S. EPA, from Ms. Cynthia Caporale, U.S. EPA, regarding a review of the addendum is attached.

273. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Conditional acceptance of Supplemental Drainage Area Investigation Work Plan, 10/17/02. P. 314624-314625.

274. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Request for submittal of revised final draft Remedial Investigation Report, 10/21/02. P. 314626-314626.

275. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Acceptance of scope of work for delineation of the lower fine-grained unit and vertical extent of NAPL and addendum, 10/21/02 P. 314627-314627.

276. Proposed meeting agenda, 11/19/02. P. 314628-314629. A meeting sign-in sheet is attached.

277. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Acceptance of Sampling and Analysis Plan Addendum and HASP update, 11/21/02. P. 314630-314630.

278. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Stuart Messur, Blasland, Bouck & Lee, Inc., re: Cutting and removal of vegetation and minimizing disturbance to the wetlands and forested areas, 12/2/02. P. 314631-314633. A facsimile transmittal memorandum is attached.

279. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Stuart Messur, Blasland, Bouck & Lee, Inc., re: Management of investigation derived waste in the form of residual sediment and drill cuttings, 12/9/02. P. 314634-314636. A March 12, 1996, letter to Mr. James Buczala, Woodward-Clyde Consultants, from Ms. Lisa Marino, U.S. EPA, regarding handling of soil cuttings is attached.

280. Internet photograph printout entitled, "Ellicott MC-2000 Mud Cat," Baltimore Dredges, LLC, 2003. P. 314637-314637.

281. Letter to Mr. Matthew Mellon, U.S. EPA, from Ms. Jane Patarcity, Beazer, re: Notification that the contractor chosen to support the Feasibility Study is Haley & Aldrich, 1/29/03. P. 314638-314649. Resumes for Mr. Michael Basel and Mr. Denis Conley, Haley & Aldrich, are attached.

282. Electronic memorandum to Mr. Peter Knight, National Oceanic and Atmospheric Administration, Mr. Bruce Plata, U.S. EPA, and Mr. Matthew Mellon, U.S. EPA, from Mr. Christopher Guy, U.S. Fish & Wildlife Service, re: Mummichog liver cancer, 1/30/03. P. 314650-314651.

283. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Robert Fisher, Beazer, re: Investigation derived waste materials, 2/3/03. P. 314652-314653. An envelope is attached.

284. Meeting sign-in sheet, 2/4/03. P. 314654-314655.

285. Meeting agenda, 2/4/03. P. 314656-314657.

286. Report: Supplemental Investigation Sampling Data Report, prepared by Blasland, Bouck & Lee, 2/21/03. P. 314658-314685. A transmittal letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Stuart Messur, Blasland, Bouck & Lee, Inc., is attached.

287. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Stuart Messur, Blasland, Bouck & Lee, Inc., re: Subsurface field activities, 2/21/03. P. 314686-314767. A summary of soil borings, a summary of geotechnical data, and boring logs, are attached.

288. Meeting agenda, 2/26/03. P. 314768-314768.

289. Meeting sign-in sheet, 2/26/03. P. 314769-314769.

290. Electronic memorandum to Mr. Stuart Messur and Mr. Kendrick Jaglal, Blasland, Bouck & Lee, Inc., Ms. Jane Patarcity, Beazer, and Ms. Maryann Nicholson, DuPont, re: Presentation of site data meeting and scheduling of a meeting for March 3, 2003, 2/27/03. P. 314770-314771.

291. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Comments on February 26, 2003, meeting regarding Feasibility Study Report, 2/28/03. P. 314772-314773.

292. Report: Feasibility Study Report, Former Koppers Company, Inc., Newport Site, Newport, Delaware, prepared by Blasland, Bouck & Lee, Inc., 4/03. P. 314774-315084.

293. Meeting sign-in sheet, 4/9/03. P. 315085-315086. Handwritten meeting notes are attached.

294. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Stuart Messur, Blasland, Bouck & Lee, Inc., re: Transmittal of the Draft Final Feasibility Study Report, 4/30/03. P. 315087-315087.

295. Report: Evaluation of Liver and Skin Tumor Prevalence in Fish from the Delaware Estuary Watershed, prepared by Mr. Fred Pinkney, U.S. Fish & Wildlife Service, 5/03. P. 315088-315099. A July 24, 2003, electronic transmittal memorandum to Mr. Matthew Mellon, U.S. EPA, from Mr. Christopher Guy, U.S. Fish & Wildlife Service, is attached.

296. Report: Remedial Investigation Report, Former Koppers Company, Inc., Newport Site, Newport, Delaware, Volume 1 of 3, prepared by Blasland, Bouck & Lee, Inc., 5/03 P. 315100-315346.

297. Letter to Mr Matthew Mellon, U.S. EPA, from Mr. Kendrick Jaglal, Blasland, Bouck & Lee, Inc., re: Revised Draft Feasibility Study Report, 6/13/03
P. 315347-315401. An April 17, 1989, memorandum to Regional Administrators, U.S EPA, from Mr. Jonathan Cannon, U.S. EPA, regarding policy for Superfund compliance with the RCRA land disposal, and a packet of Area of Contamination Policy documents, are attached.

298. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Kendrick Jaglal, Blasland, Bouck & Lee, Inc., re: Response to comments on the revised Draft Feasibility Study, 6/16/03. P. 315402-315409. An electronic transmittal memorandum is attached.

299. U.S. EPA Fact Sheet: Federal Remediation Technologies Roundtable, entitled, "Technology Cost and Performance Case Studies: Fact Sheet and Order Form," 7/03. P. 315410-315411.

300. U.S. EPA Fact Sheet: Garland Creosoting, Gregg County, Texas, entitled, "Garland Creosoting, Texas," 9/29/03. P. 315412-315416.

301. Report: Addendum to the Feasibility Study Report, Former Koppers Company, Inc., Newport Site, Newport, Delaware, prepared by TRC Companies, Inc., 10/03. P. 315417-315449

302. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Request for additional information regarding the preferred alternative presented in the Addendum to the Feasibility Study, 11/19/03. P. 315450-315451.

303. Letter to Mr. Matthew Mellon, U.S. EPA, from Ms. Jane Patarcity and Ms. Maryann Nicholson, DuPont, re: Response to comments on Addendum to Feasibility Study, 12/19/03. P. 315452-315455.

304. Letter to Mr. Steve Johnson, DNREC, from Mr. Matthew Mellon, U.S. EPA, re: Request for identification of the applicable or relevant and appropriate regulations and requirements, 2/24/04. P. 315456-315457.

305. Letter to Ms. Jane Patarcity, Beazer, from Mr. Matthew Mellon, U.S. EPA, re: Opportunity for submitting comments for inclusion in National Remedy Review Board package, 3/10/04. P. 315458-315458.

306. Memorandum to Mr. Matthew Mellon, U.S. EPA, from Mr. Christopher Guy and Mr. Fred Pinkney, U.S. Fish & Wildlife Service, re: Observation of visible rainbow sheen and brown NAPL in the surface water and sediment, 3/12/04. P. 315459-315460. An envelope is attached.

307. Letter to Mr. Matthew Mellon, U.S. EPA, from Ms. Jane Patarcity and Ms. Maryann Nicholson, DuPont, re: Comments for inclusion in National Remedy Review Board package, 3/31/04. P 315461-315469.

308. Presentation entitled, "Evaluation of the Applicability of In-Situ Thermal Remediation Technologies," undated. P. 315470-315545.

309. Letter to Mr. Matthew Mellon, U.S. EPA, from Mr. Kenneth Symms, Environmental Standards, re: Submission of the revised Human Health Risk Assessment, 4/30/99 P 315546-315546.

310. Report: Hershey Run Mummichog Histopathology Report, prepared by John Harshbarger, George Washington University Medical Center, 4/25/03. P. 315547-315553.

311. National Remedy Review Board Presentation, prepared by Matthew Mellon, U.S. EPA, 5/12/04. P 315554-315735. An April 19, 2004, electronic memorandum from Mr. Randy Sturgeon, U.S. EPA, regarding additional alternatives information, and an April, 2004, National Remedy Review Board report are attached.

312. Electronic memorandum to Mr. Matthew Mellon, U.S. EPA, from Ms. Christina Wirtz, DNREC, re: State concurrence on the Proposed Plan for Remedial Action, 9/28/04. P. 315736-315736.

313. Memorandum to Ms. JoAnn Griffith, National Remedy Review Board, from Mr. Abraham Ferdas, U.S. EPA, re: Responses to the National Remedy Review Board recommendations for the Proposed Plan, (undated). P. 315737-315742

314. Proposed Plan, Koppers Co., Inc. (Newport Plant) Superfund Site, Newport, Delaware, 10/7/04. P. 315743-315801.

315. Memorandum to Mr. Matthew Mellon, U.S. EPA, from Mr. Chris Guy and Mr. Fred Pinkney, USFWS, re: Observation of visible sheen and non-aqueous phase liquid (NAPL) in Hershey Run and the White Clay Creek in the fall of 2002 and 2003, 3/12/04. P. 315802-315802.

316. Letter to the U.S. EPA, from Mr. Colin Mackay, Ciba Specialty Chemical Corporation, re: Comments on the Proposed Remedial Action Plan, 12/2/04 P. 315803-315806.

317. Letter to Mr. Larry Johnson, U.S. EPA, from Ms. Jane Patarcity, Beazer East, Inc., re: Comments on the Proposed Remedial Action Plan, 12/6/04. P. 315807-315825.

318. Letter to Mr. Larry Johnson, U.S. EPA, from Ms. Maryann Nicholson, E.I. du Pont de Nemours and Company, re: Comments on the Proposed Remedial Action Plan, 12/6/04. P. 315826-315827.

319. Revised groundwater risk tables with correct dioxin TEC's, 2/05. P. 315828-315841. A February 9, 2005 electronic cover memorandum to Mr. Matthew Mellon, U.S. EPA, from Ms. Jane Patarcity, is attached.

320. Memorandum to Technical Memorandum - Project File, from Mr. Keith Stang, Blasland, Bouck & Lee, Inc., re: Summary of Dioxin TEC Calculation and Risk Updates, Former Koppers Company Newport, Delaware Site, 2/16/05. P. 315842-315897. A February 2, 2005 electronic cover memorandum to Mr. Matthew Mellon, U.S. EPA, from Ms. Jane Patarcity, and Attachment A: Soil/Sediment Dioxin TEC Calculations and Attachment B: Revised Soil/Sediment HHRA Tables, are attached.

321. Former Koppers Company, Inc , Newport Site, Soil and Sediment Volume Estimates, 10/05. P. 315898-315898.

322. Letter to Mr. Matthew Mellon, U.S. EPA, from Ms. Kathleen Banning, State of Delaware Department of Natural Resources and Environmental Control, re: State concurrence on the Record of Decision (ROD), 9/23/05. P. 315899-315899.

323. Record of Decision, Koppers Co., Inc., 9/30/05. P 315900-316123.

V. COMMUNITY CORRESPONDENCE/CONGRESSIONAL CORRESPONDENCE/IMAGERY

1. News Release from ATSDR entitled "ATSDR Announces Public Comment Period on Health Assessment," 12/4/92. P. 500001-500004. An ATSDR Public Notice and a distribution list are attached.

2 U.S. EPA Fact Sheet, re: Environmental work along Old Airport Road, Newark, Delaware, (undated). P. 500005-500006.

3. Letter to Mr. Matthew Mellon, U.S. EPA, from Ms Jane Patarcity, re: Request for the extention of the public comments period for the Proposed Remedial Action Plan, 10/11/04. P. 500007-500007.

4. Transcript of Public Meeting Minutes, Koppers Superfund Site, 10/21/04. P 500008-500094.

5. Newspaper article entitled,"Residents grill EPA on toxic cleanup - neighbors worry about cancer risk," The News Journal, 10/22/04. P. 500095-500096.

6. U.S. EPA Public Notice, Koppers Co., Inc. Site, re: EPA extends public comment period now October 7 - December 7, 2004, (undated) P. 500097-500097.