This property is subject to an Environmental Covenant held by the Colorado Department of Public Health and Environment pursuant to section 25-15-321, C.R.S.

ENVIRONMENTAL COVENANT

By this deed, Koppers Inc. ("Koppers") grants an Environmental Covenant ("Covenant") this 12th day of November, 2007 to the Hazardous Materials and Waste Management Division of the Colorado Department of Public Health and the Environment ("the Department" or "CDPHE") pursuant to § 25-15-321 of the Colorado Hazardous Waste Act, § 25-15-101, et seq. ("the Act"). The Department's address is 4300 Cherry Creek Drive South, Denver, Colorado 80246-1530.

DEFINITIONS

"**CDPHE**" shall mean the Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division and any successor division and department of the State of Colorado.

"**CMSR**" shall mean the Corrective Measures Study Report, dated February 13, 2003, on file with CDPHE.

"**Engineered Soil Cover**" shall mean cover materials placed over areas of contaminated soil for the purpose of providing a barrier to prevent exposure to contamination.

"The **Property**" or "**Property**" shall mean the land, improvements, and appurtenances located at 465 West 56th Avenue, in unincorporated Adams County, Colorado, more particularly described in Attachment A.

"**Owner**" shall mean Koppers and all parties having any right, title or interest in the Property, or any part thereof, their heirs, successors and assigns, and any persons using the land, as applicable.

"**State**" shall mean the State of Colorado.

"**Vegetative Cover**" shall mean soil and vegetation placed over areas of contaminated soil for the purpose of providing a barrier to prevent exposure to contamination.

RECITALS

WHEREAS, at the time of the granting of this environmental covenant, Koppers is the owner of certain property commonly referred to as Koppers Denver Facility, located at 465 West 56th Avenue, Denver, Colorado, more particularly described in Attachment A, attached hereto and incorporated herein by reference as though fully set forth (hereinafter referred to as "the Property"); and

WHEREAS, pursuant to State RCRA Permit No. CO-99-03-05-01, the Property is the subject of corrective action pursuant to the Colorado Hazardous Waste Act, Section 25-15-301, *et seq.*, C.R.S. ("CHWA"); and

WHEREAS, the purpose of this Covenant is to ensure protection of human health and the environment by limiting dermal contact and/or ingestion of impacted soils in designated areas and contaminated groundwater; and

WHEREAS, Koppers agrees to subject the Property to certain covenants and restrictions as provided in Article 15 of Title 25, Colorado Revised Statutes, which covenants and restrictions shall burden the Property and bind Koppers, its heirs, successors, assigns, and any grantees of the Property, their heirs, successors, assigns and grantees, and any users of the Property, for the benefit of the Department.

NOW, THEREFORE, Koppers hereby grants this Environmental Covenant to the Department, and declares that the Property shall hereinafter be bound by, held, sold, and conveyed subject to the following requirements set forth in paragraphs 1 through 18, below, which shall run with the Property in perpetuity and be binding on Koppers and all parties having any right, title or interest in the Property, or any part thereof, their heirs, successors and assigns, and any persons using the land. All parties having any right, title or interest in the Property, or any part thereof, their heirs, successors and assigns and any person using the land shall hereinafter be referred to in this covenant as OWNER.

ENVIRONMENTAL USE RESTRICTIONS

Unless modified or eliminated in conformance with Paragraphs 11 through 17 below, Owner hereby grants and creates the following Environmental Use Restrictions upon the Property:

1. Prohibition on Residential or Public Use. Owner shall make no residential use, including, but not limited to, any single family or multi-family residential dwelling or living unit, whether permanent or temporary, and shall not maintain, use, or operate facilities intended for public use (not including visitors to the facility), including but not limited to, playgrounds, parks, schools, daycare centers (whether independent or ancillary to a permitted use), recreational facilities of any type, except for facilities that do not disturb or alter the Engineered Soil Cover , community centers, hospitals, or adult care centers on the Property.

2. Prohibition on Agricultural Use. Owner shall not grow or store any crop for human or animal consumption or graze, feed or keep any animal for commercial or consumptive purposes on the Property.

3. Restriction on Use of Water. Owner shall not use groundwater beneath the Property, within the alluvial or Denver formations as defined in approved documents on file with CDPHE, for any purpose.

4. Prohibition on Well Construction. Owner shall not construct any groundwater wells on the Property for any purpose, except as provided for in the CMSR and associated documents. This prohibition does not include repairs or replacement of the onsite production well completed within the Arapahoe Aquifer.

5. Prohibition of Removal or Alteration of Corrective Measures Owner shall not remove or alter the physical structures of: a) the groundwater barrier wall; b) the Corrective Action Management Unit (CAMU); c) the Aerobic Treatment Curtain (ATC); d) the Anaerobic Treatment Zone (ATZ); e) zero discharge system; f) phytoremediation areas; g) groundwater monitoring wells; or h) engineered soil covers (ESCs) unless done in accordance with the CMSR or its implementing documents, or the Soil Management Plan included as Attachment B.

6. Implementation of Corrective Measures. Owner shall cooperate with Beazer East, Inc. to allow the conduct of corrective measures activities, as outlined in the CMSR and associated documents.

7. Protection of Engineered Soil Covers, Paved Areas. Owner shall cooperate with Beazer, East Inc. to allow the conduct of operation and maintenance (O&M) activities, to ensure the protectiveness of the ESCs and paved areas, as specified in the approved O&M Plan on file with CDPHE.

ACCESS AND INSPECTION

8. CDPHE and authorized representatives of CDPHE shall have access to the Property at reasonable times with prior notice for the purpose of determining compliance with the terms of this Environmental Covenant. Nothing herein shall impair any other authority CDPHE may otherwise have to enter and inspect the Property.

MODIFICATION OF ENVIRONMENTAL COVENANT

9 This Environmental Covenant runs with the land and is perpetual, unless so modified or terminated pursuant to Paragraphs 9 through 13 herein. The Owner may request that CDPHE approve a modification or termination of all or a portion of this Environmental Covenant. The request shall contain information showing that the proposed modification or termination shall, if implemented, ensure protection of human health and the environment. CDPHE shall review any submitted information and may request additional information. If CDPHE determines that the proposal to modify or terminate this Environmental Covenant will ensure protection of human health and the

environment, then CDPHE shall approve the proposal. No modification or termination of this Environmental Covenant shall be effective unless CDPHE has approved such modification or termination in writing. Information to support a request for modification or termination may include one or more of the following:

a. A proposal to perform additional remedial work;
b. New information regarding the risks posed by the residual contamination;
c. Information demonstrating that contamination has diminished;
d. Information demonstrating that the proposed modification would not adversely impact the remedy and is protective of human health and the environment; and
e. Other appropriate supporting information.

10. Required Approvals. CDPHE shall review all applications for modifying or terminating this Environmental Covenant and make a determination within 60 days after receipt of an application. Any proposed modifications must be approved in writing executed by: (a) CDPHE; and (b) the Owner of the parcel burdened by the proposed modification to this Environmental Covenant.

11. Appeals. Any determination by CDPHE shall be subject to appeal in accordance with Section 25-15-305, C.R.S. (2001).

12. Implementation of Modification(s). Any modification of this Environmental Covenant must be (a) in writing; (b) dated after the date of this Environmental Covenant; and (c) duly recorded in the real property records of the county in which the Property is located.

13. Any modification which complies with the foregoing requirements shall be deemed duly created and enforceable from and after the effective date thereof. For purposes of this Environmental Covenant, a modification may include (a) the imposition of new environmental use restrictions, (b) amendment or modification of an existing environmental use restriction, or (c) the termination of all or part of an existing environmental use restriction or all of the existing environmental use restrictions.

ENFORCEMENT RIGHTS

14. Koppers, any Owner(s), and CDPHE, individually or collectively, shall have the right, but not the obligation, to enforce this Environmental Covenant, or any term herein, pursuant to Section 25-15-322 C.R.S.

CONVEYANCES

15. Owner shall notify the Department at least fifteen (15) days in advance of any grant, transfer or conveyance of any interest in any or all of the Property affected by the Covenant. Owner agrees to incorporate either in full or by reference the Covenant in any leases, licenses, or other instruments granting a right to use the Property affected by this Covenant.

NOTIFICATION FOR PROPOSED CONSTRUCTION AND LAND USE

16. Owner shall notify the Department simultaneously when submitting any application to a local government for a building permit or change in land use.

NO LIABILITY

17. The Department does not acquire any liability under State law by virtue of accepting this Covenant.

OWNER'S COMPLIANCE CERTIFICATION

18 Owner shall execute and return a certification form provided by the Department, on an annual basis, detailing Owner's compliance, and any lack of compliance, with the terms of this Covenant.

NOTICES

18. Any document or communication required under this Covenant shall be sent or directed to:

Hazardous Waste Corrective Action Unit Leader
Hazardous Materials and Waste Management Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Plant Manager
Koppers Inc.
465 West 56th Avenue
Denver, Colorado 80216

Koppers Inc.
Corporate Environmental Affairs Department
Room 1800
436 Seventh Avenue
Pittsburgh, Pennsylvania 15219

Koppers Inc. has caused this instrument to be executed this 12th day of November, 2007.

Koppers Inc.

By: Thomas D. Lodmen

Title: Vice President and General Manager

STATE OF (Pennsylvania) ss:
COUNTY OF Allegheny)

The foregoing instrument was acknowledged before me this 12th day of November, 2007 by Thomas D. Lodmen on behalf of Koppers Inc.

Janet L. Shaffer
Notary Public

436 Seventh Avenue
Address

Pittsburgh, PA 15219

My commission expires:

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Janet L. Shaffer, Notary Public
City Of Pittsburgh, Allegheny County
My Commission Expires Nov. 5, 2009
Member, Pennsylvania Association of Notaries

Accepted by the Colorado Department of Public Health and Environment this 14th day of November, 2007.

By: Gary W. Baughman

Title: Director, HMWMD

STATE OF (COLORADO
) ss:
COUNTY OF DENVER)

The foregoing instrument was acknowledged before me this 14 day of NOVEMBER, 2007 by GARY BAUGHMAN on behalf of the Colorado Department of Public Health and Environment.

Claudette M. Lewis
Notary Public
4300 Cherry Creek Dr So
Address
Denver, CO 80246

My commission expires: OCTOBER 21, 2011

Attachment A
Koppers' Property Legal Description

Legal Description
465 West 56th Avenue
Adams County, Colorado

Parcel Number: 0182510300002

SECT,TWN,RNG:10-3-68 DESC: W2 SW4 INC A 30 FT STRIP BY 1320 FT LYING ON S SIDE EXC RR ROW AND EXC ALL LANDS N AND W OF E SIDE OF ROW OF D L AND N W RR 59/30A

Parcel Number: 0182510300003

DESC: PARC IN SE4 SE4 SEC 9 AND S2 NW4 SW4 AND SW4 SW4 SEC 10 DESC BEG AT A PT WHENCE SW COR SEC 10 BRS S 45D 47M W 69/80 FT TH N 451/22 FT TH E 20 FT TH N 105/50 FT TO A PT OF CURVE TH ALG SD CURVE TO RT A RAD OF 2252 FT AN ARC DIST OF 1430/06 FT TH W 23/78 FT TO A PT ON SELY BDRY LN D AND S L RR PROP TH S 32D 45M W ALG SD SELY BDRY LN 1190/83 FT TH S 25D 20M E 475/85 FT TH W 200 FT TH S 25D 20M E 519/91 FT TO POB 9 AND 10/3/68 4/17A

Attachment B – Soil Management Plan

ATTACHMENT B

SOIL MANAGEMENT PLAN
for

Property at 465 West 56th Avenue
Denver, CO

(Referred to as Koppers Inc. Site)

November 2007

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INTRODUCTION

This Soil Management Plan (SMP) was prepared to support the Environmental Covenant (Covenant) associated with the 60-acre industrial facility (site) located at 465 West 56th Avenue in Denver, Colorado (known as the Koppers Inc. Site at the time of the Covenant filing and referred to as "the Property" in the Covenant) (Figure 1). Beazer East Inc., the former site owner, is implementing RCRA corrective actions to address historic impacts to soil and groundwater at the site. The selected remedy approved by United States Environmental Protection Agency (USEPA) and Colorado Department of Public Health and Environment (CDPHE) included engineered soil covers (ESC), a Zero Stormwater Discharge System (ZSDS), subsurface groundwater barrier system, and a Corrective Action Management Unit (CAMU). The remedy also includes placing a land use covenant on this site to allow continued industrial and commercial operations by the property owner, but to prevent future residential development. The CDPHE approved Remedy Design Document and Operation and Maintenance (O&M) Plan for the Integrated Soil and Stormwater Design provides plans and specifications to implement the soil and stormwater control remedy.

Since soils at the site may be impacted, this SMP focuses on management of excavated soil generated by the property owner for ongoing maintenance activities such as repairing underground utilities, construction of new buildings or other facilities requiring soil excavation, etc. Koppers, Beazer, or the future property owner will also be responsible for repairing any damage as a result of their individual activities to the ESCs, ZSDS, berms, basins and other structures completed as part of these RCRA corrective actions as defined in the Operation and Maintenance Plan (Attachment C to the Covenant). This SMP may not address management of soil and water associated with RCRA corrective actions or remediation activities undertaken by Beazer that is described in other documents. Information on the site conditions and documents generated under the RCRA corrective action process can be obtained from CDPHE.

DEFINITION OF SOIL MANAGEMENT CRITERIA

In Colorado, the generation, treatment, and disposal of hazardous waste is regulated under the Colorado Hazardous Waste Regulations, 6CRR 1007-3. The implementing agency of the Colorado Hazardous Waste Regulations, the CDPHE, has established a Contained-Out Determination Procedure to facilitate the management of environmental media (soil, groundwater, surface water and sediment) that contain listed or characteristic hazardous waste. The Contained-Out Determination Procedure defines the concentration below which environmental media contaminated with listed hazardous waste may be managed as something other than hazardous waste. In the case of media that exhibit only a characteristic of hazardous waste, the media are no longer considered to "contain" hazardous waste once the characteristic is eliminated. The Contained-Out Determination Procedure for the management of environmental media can be obtained from the CDPHE website as Appendix 2 of CDPHE's Corrective Action Guidance Document.

In accordance with the Contained-Out Determination Procedure, CDPHE has provided Beazer with the following guidance regarding visual and site-specific analytical criteria for constituents in soil that constitute hazardous waste for the facility. This guidance will also apply to the property owner for ongoing maintenance activities. The implementation of these criteria is as follows.

Any soil excavated from the surface or subsurface at the site shall be monitored for visible signs of contamination. Using visual monitoring, an initial determination shall be made regarding the contaminant level, based on the following:

- Visually Contaminated – Soil that is visually contaminated, based on observed staining shall be managed as hazardous waste, unless subsequent testing demonstrates it can be managed otherwise. Soil that visibly contains free-phase hydrocarbons shall be managed as hazardous waste.

- No Visual Contamination: Soil with no visible signs of contamination shall be managed as described below based on the historical level of contamination detected in the vicinity of the excavation. Site-wide contaminant levels have been documented during several environmental investigations at the site, and are summarized in the attached Tables 1 and 2 and Figure 2.

Management of Soil Based on Documented Contaminant Levels

Soil that does not exhibit visual signs of contamination shall be managed based on documented contaminant concentrations from existing data (Tables 1 and 2 and Figure 2). No additional testing is required. These soils may fall into one of three categories: 1) soil with contaminant concentrations (as indicated in Tables 1 and 2 and Figure 2) below unrestricted use levels; 2) soil with contaminant concentrations (as indicated in Tables 1 and 2 and Figure 2) above unrestricted use levels but below levels that would require management as hazardous waste; and, 3) soil with contaminant concentrations (as indicated in Tables 1 and 2 and Figure 2) at levels that would require management as hazardous waste. These categories are discussed in detail below.

Unrestricted Use

Unrestricted use levels are based on contaminant concentrations being:

(1) less than or equal to the direct exposure health-based concentration calculated using a Residential/Unrestricted Land use scenario using either Table 1 of the Department's *Proposed Soil Remediation Objectives (SRO) Policy Document*, December 1997, as may be updated, or EPA's Region IX *Preliminary Remediation Goal Table*, for those constituents not on Table 1 of the SRO Policy document; and

(2) less than or equal to the soil concentration protective of groundwater using either Table 1 of the SRO Policy document or by total constituent analysis as described in Note 8 of Table A2-1 under the Department's *Contained-Out Determination Procedures for Environmental Media Contaminated with RCRA Hazardous Waste*, Appendix 2 of the Department's May 2002 *Corrective Action Document.*

The unrestricted use concentrations for the constituents of concern at the site are:

Pentachloraphenol:	3 mg/kg
Arsenic:	0.39 mg/kg or site background
PAHs:	benzo(a)pyrene (BAP) toxicity equivalent of 0.42 mg/kg

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Soil determined to meet the unrestricted use criteria may be managed on-site or off-site with no restrictions. NOTE: Recently placed cover or paving materials such as road gravel in impacted areas that show no signs of visual contamination may be set aside and managed as unrestricted use materials.

Restricted Use Managed as Non-Hazardous

Restricted use levels are determined using the Department's *Contained-Out Determination Procedures for Environmental Media Contaminated with RCRA Hazardous Waste*, Appendix 2 of the Department's May 2002 *Corrective Action Document.* The Contained-Out Determination Procedure defines the concentration below which environmental media contaminated with listed hazardous waste may be managed as something other than a hazardous waste. In the case of media that exhibit only a characteristic of hazardous waste, the media are no longer considered to "contain" hazardous waste once the characteristic is eliminated. Based on the Contained-out Determination Procedure, soil may be managed as restricted use, non-hazardous material, if the concentrations for the constituents of concern are below:

Pentachloraphenol:	300 mg/kg
Arsenic:	100 mg/kg or the Toxicity Characteristic concentration of 5 mg/l
PAHs:	BAP toxicity equivalent of 42 mg/kg

Soil determined to meet the restricted use, non-hazardous, criteria may be managed on-site within or proximal to the area of excavation, or disposed off-site at a solid waste disposal facility.

Soil Managed as Hazardous Waste

Soil that is either visually contaminated or has contaminant concentrations (as indicated on Tables 1 and 2 and Figure 2) that exceed the restricted use, non-hazardous, criteria above, must be managed as hazardous waste. However, additional soil samples may be obtained from the excavated soil in an attempt to demonstrate that the actual soil excavated does meet the restricted use, non-hazardous, criteria. If testing demonstrates the material is non-hazardous it should be managed as described above.

DEFINITION OF SOIL MANAGEMENT AREAS BASED ON HISTORIC DATA

Beazer has completed a comprehensive characterization of the site environmental media for human health and ecological risk assessments, and for RCRA corrective action. CDPHE has accepted the adequacy of these historic data to decide if off-site disposal (as hazardous waste) is required, should the property owner disturb or excavate soil during site maintenance or as part of building new structures.

Tables 1 and 2 present the soil sample data collected at the site. Samples that exceed the CDPHE hazardous waste criteria are indicated in shaded or bold font in Tables 1 and 2. Figure 2 presents a map of the site subdivided into approximately 100 polygons that contain at least one soil sample. Based on the corresponding soil data in each polygon, Figure 2 presents a graphical, spatial depiction of the areas with constituents in surface and subsurface soils within the three defined levels (unrestricted use, restricted use, and above the hazardous waste criteria). Current testing would be required to determine if specific soils excavated from within

the areas designated above the restricted use criteria can be managed as other than hazardous waste.

PROJECT IMPLEMENTATION GUIDELINES

Prior to and during soil excavation, the following guidelines should be considered. Detailed procedures will depend on the nature of the specific project.

- Site personnel must be familiar with the Covenant, SMP, and O&M Plan requirements.
- Identify the area of the planned project and compare the location to the historic data in Tables 1 and 2 and Figure 2.
- Determine if the planned project is within an unrestricted use, restricted use, or hazardous waste defined area.
- If the planned project is within unrestricted or restricted use areas, proceed with the project as defined following procedures identified above. If the planned project is determined to be in a "non-hazardous" restricted use area, dispose of excavated material within or proximal to the area of excavation. Alternately, dispose of material offsite at an approved solid waste disposal facility.
- If the planned project is within an area defined in Tables 1 and 2 and Figure 2 as exceeding the non-hazardous restricted use levels defined above per the Contained-Out Determination Procedure, then:
    - Manage excavated soil as hazardous waste, or
    - Resample soil in the planned project area (either before or after excavation) for pentachlorophenol, arsenic, and PAHs to determine if constituent levels still exceed the non-hazardous restricted use levels. If constituent levels are below the non-hazardous restricted use levels listed above, then the excavated soil can be managed as non-hazardous waste. If sampling occurs after excavation, the material must be properly containerized or staged per CO hazardous waste regulations pending receipt of the results.
- If the planned project is within an area defined in Tables 1 and 2 and Figure 2 as exceeding the non-hazardous restricted use levels per the Contained-Out Determination Procedure as described above, then excavation or other work involving contact with soils should be completed under the direction of HAZWOPER trained personnel. Health and safety practices should be identified including but not limited to: communication of potential health and safety implications, use of proper PPE, proper containerization or staging of excavated material to avoid cross-contamination, equipment decontamination zones, and work area access restrictions.
- Excavated material considered hazardous should be placed in approved containers and managed offsite at an approved disposal facility pursuant to RCRA.

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- Containers to manage and separate visually stained soil if they are encountered should be available during any excavation activity. Appropriate precautions should be used when managing this material.

- Consider potential health and safety implications when planning onsite excavation activities to address worker safety and potential unforeseen conditions.

COORDINATION WITH EXISTING REMEDIAL FACILITIES

In the process of completing their RCRA corrective action for groundwater containment, Beazer completed a barrier wall to direct groundwater to an in-situ treatment facility. Beazer also obtained authorization to construct a CAMU with the boundaries shown in Figure 2 to allow onsite management of materials generated from the remedial activities. As a condition of the CAMU construction, the only allowable disturbance in the CAMU is for approved corrective action, such as installation of monitoring wells, capping, or other remedial action. Within the CAMU boundary, CDPHE will need to authorize any invasive site improvements or maintenance actions. Potential invasive construction or maintenance activities that may disturb the CAMU, barrier wall, or ZSDS should be reviewed with CDPHE prior to implementation.

The Remedy Design Document and O&M Plan for the Integrated Soil and Stormwater Design also describe how the various soil cover and surface water management facilities need to be maintained and repaired by Beazer, Koppers, or any future property owner. The soil remedy uses four different types of engineered soil covers that are described in the O&M Plan. The various ESC area locations are shown on Figure 1. Soil excavation that damages any new ESC facility must be repaired to the original specification for the ESC area in accordance with the O&M Plan. Prior approval is not required for completion of construction or maintenance activities within the ESC areas. Proper documentation should be maintained by the property owner to satisfy the requirements of the annual certification in the Covenant. Other O&M requirements are included in the O&M Plan.

RECORDKEEPING AND REPORTING

Documentation of activities subject to the SMP and the O&M Plan is outlined in the Covenant. As required in the Covenant, the property owner shall execute and return an annual certification to CDPHE detailing compliance or lack of compliance with the terms of the Covenant. In addition, the property owner shall notify CDPHE simultaneously when submitting any application to a local government for a building permit or change in land use.

Table 1
Shallow Soil (0-2 feet bgs) Data Compared to CDPHE Unrestricted Use and Hazardous Waste Criteria

Location	Date	Depth	Units	Arsenic	BAP Toxicity Equivalents	Pentachlorophenol
B-1	16-Jan-89	1.5	mg/kg	8.98	0.315	0.11
B-11	23-Jan-90	2	mg/kg		***70.1***	15
B-12	23-Jan-90	2	mg/kg		***65.6***	***589***
B-3	17-Jan-89	1.5	mg/kg	4.8	0	0.114
B-4	17-Jan-89	1.7	mg/kg	75.2	0.201	15.0
B-6	18-Jan-89	1.5	mg/kg	10.4	***46.5***	139.0
B-7	17-Jan-89	1.5	mg/kg	2.7	0.214	38.8
B-8	16-Jan-89	1.5	mg/kg	13	0.425	238
CSF-1	10-Nov-93	0.5	mg/kg		0.602	18
CSF-3	10-Nov-93	0.5	mg/kg		0.041	11
CSF-4	7-Nov-93	1	mg/kg	29.5	0.875	42
CSF-5	7-Nov-93	1	mg/kg	8.3	0.012	1.6
CSF-6	10-Nov-93	0.5	mg/kg	66.2		
CSF-7	7-Nov-93	1	mg/kg	43.2	0.764	4.8
CSF-8	7-Nov-93	1	mg/kg	26.5	0.425	18
CSF-9	7-Nov-93	1	mg/kg	17.6	0.157	1.9
CSF90-1	23-Jan-90	1.5	mg/kg	45.2	10.7	74.5
CSF90-10	1-Feb-90	2	mg/kg	9.8	12.2	70.7
CSF90-11	1-Feb-90	2	mg/kg	***165***	***354***	120
CSF90-12	1-Feb-90	2	mg/kg	***443***	***79.5***	52.8
CSF90-13	1-Feb-90	2	mg/kg	***112***	14.8	6.07
CSF90-14	1-Feb-90	2	mg/kg	***109***	1.97	2.41
CSF90-15	1-Feb-90	2	mg/kg	28.6	1.12	0.807
CSF90-16	1-Feb-90	2	mg/kg	***364***	1.37	1.48
CSF90-17	1-Feb-90	2	mg/kg	***321***	1.03	***15300***
CSF90-18	1-Feb-90	2	mg/kg	***644***	5.45	17.6
CSF90-2	26-Jan-90	1.5	mg/kg	11.9	0.091	0.29
CSF90-3	26-Jan-90	1.5	mg/kg	4.3	2.29	0.428
CSF90-4	23-Jan-90	2	mg/kg	84	5.49	123
CSF90-8	1-Feb-90	2	mg/kg	13.6	0.105	2.25
CT-1	18-Nov-93	0.5	mg/kg	24.8	0.068	1.9
CT-2	18-Nov-93	0.5	mg/kg	17.4	1.45	5.8
CT-3	18-Nov-93	0.5	mg/kg	11	0.17	0.6
CT-4	19-Nov-93	0.5	mg/kg	***164***	0.839	0.55
CT-5	18-Nov-93	0.5	mg/kg	***129***	3.42	31
CT-6	19-Nov-93	0.5	mg/kg	20.4	0.654	8.9
CT-7	18-Nov-93	0.5	mg/kg	61.8	0.057	4.5
DT-1	15-Nov-93	0.5	mg/kg		0.01	1.8

WB-2 Pattern and bold font identify samples that are below the CDPHE Unrestricted Use levels which are:
Arsenic - 0.39 mg/kg or below site background
PAHs: BAP Toxicity Equivalents - 0.42 mg/kg
Pentachlorophenol - 3 mg/kg

B-12 Shaded cells and bold font identify samples that exceed CDPHE Hazardous Waste Criteria which are:
Arsenic - 100 mg/kg or Toxicity Characteristic concentration > 5 mg/l
PAHs: BAP Toxicity Equivalents - 42 mg/kg
Pentachlorophenol - 300 mg/kg

Table 1
Shallow Soil (0-2 feet bgs) Data Compared to CDPHE Unrestricted Use and Hazardous Waste Criteria

Location	Date	Depth	Units	Arsenic	BAP Toxicity Equivalents	Pentachlorophenol
DT-2	15-Nov-93	0.5	mg/kg		14.7	***720***
DT-3	15-Nov-93	0.5	mg/kg		22.4	54
DT-4	10-Nov-93	0.5	mg/kg	40.3	15.8	190
DT-5	9-Nov-93	0.5	mg/kg		0.137	1.8
DT-6	16-Nov-93	0.5	mg/kg		1.027	47
DT-7	15-Nov-93	0.5	mg/kg		0.026	10
IF-1	2-Nov-93	0.5	mg/kg		27.3	230
IF-10	4-Nov-93	0.5	mg/kg		19.3	***340***
IF-2	2-Nov-93	0.5	mg/kg		1.077	8.6
IF-3	3-Nov-93	0.5	mg/kg		0.05	0.83
IF-3	3-Nov-93	2	mg/kg		0	0.91
IF-4	3-Nov-93	0.5	mg/kg		3.47	36
IF-5	2-Nov-93	0.5	mg/kg		2.18	6.6
IF-6	3-Nov-93	0.5	mg/kg		0.91	13
IF-7	3-Nov-93	0.5	mg/kg		0.462	0.96
IF-8	3-Nov-93	0.5	mg/kg		0.221	0.43
IF-9	4-Nov-93	0.5	mg/kg		***79.2***	140
NL-1	5-Nov-93	0.5	mg/kg	18.2	0.093	0.67
NL-2	6-Nov-93	0.5	mg/kg	46.6	22.2	160
NL-2	20-Nov-93	2	mg/kg	23.9	13.9	93
NL-3	5-Nov-93	0.5	mg/kg	***195***	6.87	41
NL-4	5-Nov-93	0.5	mg/kg	33.3	2.96	25
PW-1	16-Nov-93	0.5	mg/kg	1.4	0.712	1.8
PW-2	16-Nov-93	0.5	mg/kg	32	0.766	4
PW-3	16-Nov-93	0.5	mg/kg	2	0.003	1
PW-4	19-Nov-93	0.5	mg/kg	8.6	2.50	4.3
PW-5	17-Nov-93	0.5	mg/kg	22.1	0.073	4.3
PW-6	16-Nov-93	0.5	mg/kg	85.3		
PW-6	17-Nov-93	0.5	mg/kg	***119***	0.041	9
PW-7	17-Nov-93	0.5	mg/kg	67.8		
PW-8	20-Nov-93	0.5	mg/kg	***142***	0.708	***340***
S-01	29-Mar-04	0.5	mg/kg		0.996	5.1
S-02	29-Mar-04	0.5	mg/kg			59
S-03	29-Mar-04	0.5	mg/kg		1.99	10
S-04	29-Mar-04	0.5	mg/kg			88
S-05	29-Mar-04	0.5	mg/kg		0.259	0.63
S-06	29-Mar-04	0.5	mg/kg		4.14	1.7
S-07	29-Mar-04	0.5	mg/kg			3
S-08	26-Mar-04	0.5	mg/kg			14
S-09	26-Mar-04	0.5	mg/kg		1.19	5.5

WB-2 Pattern and bold font identify samples that are below the CDPHE Unrestricted Use levels which are: Arsenic - 0.39 mg/kg or below site background
PAHs: BAP Toxicity Equivalents - 0.42 mg/kg
Pentachlorophenol - 3 mg/kg

B-12 Shaded cells and bold font identify samples that exceed CDPHE Hazardous Waste Criteria which are: Arsenic - 100 mg/kg or Toxicity Characteristic concentration > 5 mg/l
PAHs: BAP Toxicity Equivalents - 42 mg/kg
Pentachlorophenol - 300 mg/kg

Table 1
Shallow Soil (0-2 feet bgs) Data Compared to CDPHE Unrestricted Use and Hazardous Waste Criteria

Location	Date	Depth	Units	Arsenic	BAP Toxicity Equivalents	Pentachlorophenol
S-10	26-Mar-04	0.5	mg/kg			22
S-11	26-Mar-04	0.5	mg/kg			***6600***
S-12	29-Mar-04	0.5	mg/kg			36
S-13	26-Mar-04	0.5	mg/kg		0.417	0.87
S-14	26-Mar-04	0.5	mg/kg		0.763	2.8
S-15	26-Mar-04	0.5	mg/kg			18
S-16	26-Mar-04	0.5	mg/kg		0.206	1.6
S-17	29-Mar-04	0.5	mg/kg		16.4	49
S-18	26-Mar-04	0.5	mg/kg			3
S-19	29-Mar-04	0.5	mg/kg			20
S-20	29-Mar-04	0.5	mg/kg	23.5	3.49	59
S-21	29-Mar-04	0.5	mg/kg	6.4		36
S-22	29-Mar-04	0.5	mg/kg	40.6		4.4
S-23	29-Mar-04	0.5	mg/kg	7	0.293	11
S-24	29-Mar-04	0.5	mg/kg	12.4	1.22	16
S-25	29-Mar-04	0.5	mg/kg	8.5		2.1
S-26	29-Mar-04	0.5	mg/kg	13.8	1.82	12
S-27	29-Mar-04	0.5	mg/kg	22.7		20
S-28	29-Mar-04	0.5	mg/kg	32.8	7.32	17
S-29	29-Mar-04	0.5	mg/kg	12.1		2.4
SL-1	6-Nov-93	0.5	mg/kg	34	2.82	26
SL-10	8-Nov-93	0.5	mg/kg	28.5	0.869	21
SL-11	8-Nov-93	0.5	mg/kg		2.19	44
SL-12	8-Nov-93	0.5	mg/kg		7.49	90
SL-13	6-Nov-93	0.5	mg/kg		14.4	***390***
SL-2	8-Nov-93	0.5	mg/kg		0.844	1.8
SL-3	7-Nov-93	0.5	mg/kg		0.418	2.9
SL-4	8-Nov-93	0.5	mg/kg		16.2	150
SL-5	7-Nov-93	0.5	mg/kg		21.9	180
SL-6	6-Nov-93	0.5	mg/kg		17.6	120
SL-7	6-Nov-93	0.5	mg/kg		4.1	10
SL-9	5-Nov-93	0.5	mg/kg		0.093	0.68
SP-8	20-Nov-93	0.5	mg/kg		0.324	240
SS-1	17-Nov-93	0.5	mg/kg	16.7	2.97	21
SS-10	17-Nov-93	0.5	mg/kg	9.5	8.87	45
SS-11	17-Nov-93	0.5	mg/kg	50.2	2.38	0.98
SS-12	17-Nov-93	0.5	mg/kg	17.5	0.583	0.99
SS-2	17-Nov-93	0.5	mg/kg	38.5	0.419	2.9
SS-3	17-Nov-93	0.5	mg/kg	37	0.006	
SS-4	17-Nov-93	0.5	mg/kg	29.6	0.342	2.5
SS-5	17-Nov-93	0.5	mg/kg	7.1	0.936	
SS-6	17-Nov-93	0.5	mg/kg	75.9	2.08	2.2
SS-7	17-Nov-93	0.5	mg/kg	66.5	4.46	9.1
SS-8	17-Nov-93	0.5	mg/kg	16.4	0.171	4.8
SS-9	17-Nov-93	0.5	mg/kg	8.6	0.142	4.8
WB-1	17-Nov-93	0.5	mg/kg		21.0	87

WB-2 Pattern and bold font identify samples that are below the CDPHE Unrestricted Use levels which are:
Arsenic - 0.39 mg/kg or below site background
PAHs: BAP Toxicity Equivalents - 0.42 mg/kg
Pentachlorophenol - 3 mg/kg

B-12 Shaded cells and bold font identify samples that exceed CDPHE Hazardous Waste Criteria which are:
Arsenic - 100 mg/kg or Toxicity Characteristic concentration > 5 mg/l
PAHs: BAP Toxicity Equivalents - 42 mg/kg
Pentachlorophenol - 300 mg/kg

Table 1
Shallow Soil (0-2 feet bgs) Data Compared to CDPHE Unrestricted Use and Hazardous Waste Criteria

Location	Date	Depth	Units	Arsenic	BAP Toxicity Equivalents	Pentachlorophenol
WB-2	17-Nov-93	0.5	mg/kg		0.162	0.86
WB-3	17-Nov-93	0.5	mg/kg		0.478	8.4
WB-4	17-Nov-93	0.5	mg/kg		0.404	
WB-5	17-Nov-93	0.5	mg/kg		0.82	1.7
WB-6	17-Nov-93	0.5	mg/kg		1.25	11
WD-1	2-Nov-93	0.5	mg/kg	83.2	***226.7***	***1800***
WD-2	2-Nov-93	1.8	mg/kg	3.3	10.0	***510***

WB-2 Pattern and bold font identify samples that are below the CDPHE Unrestricted Use levels which are:
- Arsenic - 0.39 mg/kg or below site background
- PAHs: BAP Toxicity Equivalents - 0.42 mg/kg
- Pentachlorophenol - 3 mg/kg

B-12 Shaded cells and bold font identify samples that exceed CDPHE Hazardous Waste Criteria which are:
- Arsenic - 100 mg/kg or Toxicity Characteristic concentration > 5 mg/l
- PAHs: BAP Toxicity Equivalents - 42 mg/kg
- Pentachlorophenol - 300 mg/kg

Table 2
Subsurface Soil (2-8 feet bgs) Data Compared to CDPHE Unrestricted Use and Hazardous Waste Criteria

Location	Date	Depth	Units	Arsenic	BAP Toxicity Equivalents	Pentachlorophenol
B-1	16-Jan-89	3.5	mg/kg	1.96	0	0.112
B-11	23-Jan-90	8	mg/kg		27.7	29.4
B-12	23-Jan-90	3.5	mg/kg		***62.0***	152
B-12	23-Jan-90	5	mg/kg		19.2	132
B-2	16-Jan-89	3	mg/kg	1.4	0	0.112
B-4	17-Jan-89	3.6	mg/kg	2.77	0	0.112
B-5	16-Jan-89	2.5	mg/kg	25.6	0.06	255
B-5	19-Jan-89	5.5	mg/kg	2.72	0	0.493
B-6	18-Jan-89	3.5	mg/kg	2	0.096	0.11
B-6	18-Jan-89	6	mg/kg	2.4	0	0.11
B-7	17-Jan-89	6.5	mg/kg	1.8	0	0.114
B-8	16-Jan-89	4.5	mg/kg	1.2	0	0.13
CSF-1	10-Nov-93	6	mg/kg		0	0.94
CSF-3	10-Nov-93	7.4	mg/kg		0.6	31
CSF-6	10-Nov-93	4	mg/kg	3.7		
CSF-6	10-Nov-93	6	mg/kg	11		
CSF-6	10-Nov-93	8	mg/kg	5.4		
CSF90-2	26-Jan-90	5.5	mg/kg	2.9	0	0.118
CSF90-2	26-Jan-90	7.5	mg/kg	1.7	0	0.112
CSF90-3	26-Jan-90	5.5	mg/kg	2	0.014	0.107
CSF90-3	26-Jan-90	7.5	mg/kg	1.6	0	0.103
CSF90-4	23-Jan-90	5.5	mg/kg	2.3	0	0.154
CSF90-4	23-Jan-90	7.5	mg/kg	2.2	0	0.115
CT-1	18-Nov-93	8	mg/kg	3.4	0.001	0.91
CT-2	18-Nov-93	7.8	mg/kg	2.9	0	0.92
CT-4	19-Nov-93	5.5	mg/kg		0.008	140
DT-1	15-Nov-93	5.8	mg/kg		0.004	0.82
DT-5	9-Nov-93	8	mg/kg		3.63	56
DT-6	16-Nov-93	6	mg/kg		0.006	0.27
DT-7	15-Nov-93	3.4	mg/kg		0	0.96
IF-1	2-Nov-93	3.8	mg/kg		2.99	54
IF-1	2-Nov-93	4	mg/kg		3.06	46
IF-4	3-Nov-93	5	mg/kg		0.068	0.93
IF-5	2-Nov-93	3.8	mg/kg		0	1.9
IF-6	3-Nov-93	3.1	mg/kg		0	2.3
IF-7	3-Nov-93	5.2	mg/kg		11.5	59
IF-8	3-Nov-93	4.2	mg/kg		3.53	43
IF-9	4-Nov-93	2.5	mg/kg		8.95	5.1
IF-9	4-Nov-93	7	mg/kg		6.44	7
NL-1	5-Nov-93	4	mg/kg	2.6	0.01	2
NL-2	20-Nov-93	4	mg/kg	54	***53.5***	160
NL-2	6-Nov-93	6	mg/kg	20.5	6.16	220
NL-3	5-Nov-93	4	mg/kg	1.8	3.86	250
NL-3	5-Nov-93	7	mg/kg		0	

B-12 Shaded cells and bold font identify samples that exceed CDPHE Hazardous Waste Criteria
which are: Arsenic - 100 mg/kg or Toxicity Characteristic concentration > 5 mg/l
PAHs: BAP Toxicity Equivalents - 42 mg/kg
Pentachlorophenol - 300 mg/kg

Table 2
Subsurface Soil (2-8 feet bgs) Data Compared to CDPHE Unrestricted Use and Hazardous Waste Criteria

Location	Date	Depth	Units	Arsenic	BAP Toxicity Equivalents	Pentachlorophenol
NL-4	5-Nov-93	5.99	mg/kg	2	0.001	0.89
PW-1	16-Nov-93	7.6	mg/kg	0.66	0	0.82
PW-4	19-Nov-93	5.5	mg/kg	45.2	0.008	140
PW-5	17-Nov-93	7.8	mg/kg	4.2	0	1.9
SB-6	18-Jan-89	7	mg/kg	2.1	15.3	***403***
SL-1	6-Nov-93	4	mg/kg	2.1	0	0.94
SL-10	8-Nov-93	4	mg/kg	1.9	0	
SL-11	8-Nov-93	7.7	mg/kg		0	0.96
SL-12	8-Nov-93	7.1	mg/kg		0	0.99
SL-13	6-Nov-93	7	mg/kg		5.51	23
SL-4	8-Nov-93	5	mg/kg		1.957	17
SL-6	6-Nov-93	7	mg/kg		12.1	49
SL-7	6-Nov-93	7.5	mg/kg		22.1	5.9
SL-9	5-Nov-93	7.5	mg/kg		0	0.96
SP-8	20-Nov-93	7.6	mg/kg		0.062	96
WB-1	17-Nov-93	4	mg/kg		0.015	0.92
WB-2	17-Nov-93	5.6	mg/kg		0	0.86
WB-3	17-Nov-93	6.7	mg/kg		0	0.85
WB-4	17-Nov-93	8	mg/kg		0	0.93
WB-5	17-Nov-93	7.7	mg/kg		0	0.84
WB-6	17-Nov-93	8	mg/kg		0.059	1.8
WD-2	2-Nov-93	2.6	mg/kg	2.9	4.75	24

B-12 Shaded cells and bold font identify samples that exceed CDPHE Hazardous Waste Criteria
which are: Arsenic - 100 mg/kg or Toxicity Characteristic concentration > 5 mg/l
PAHs: BAP Toxicity Equivalents - 42 mg/kg
Pentachlorophenol - 300 mg/kg

NOTE: No areas were below the unrestricted use values.

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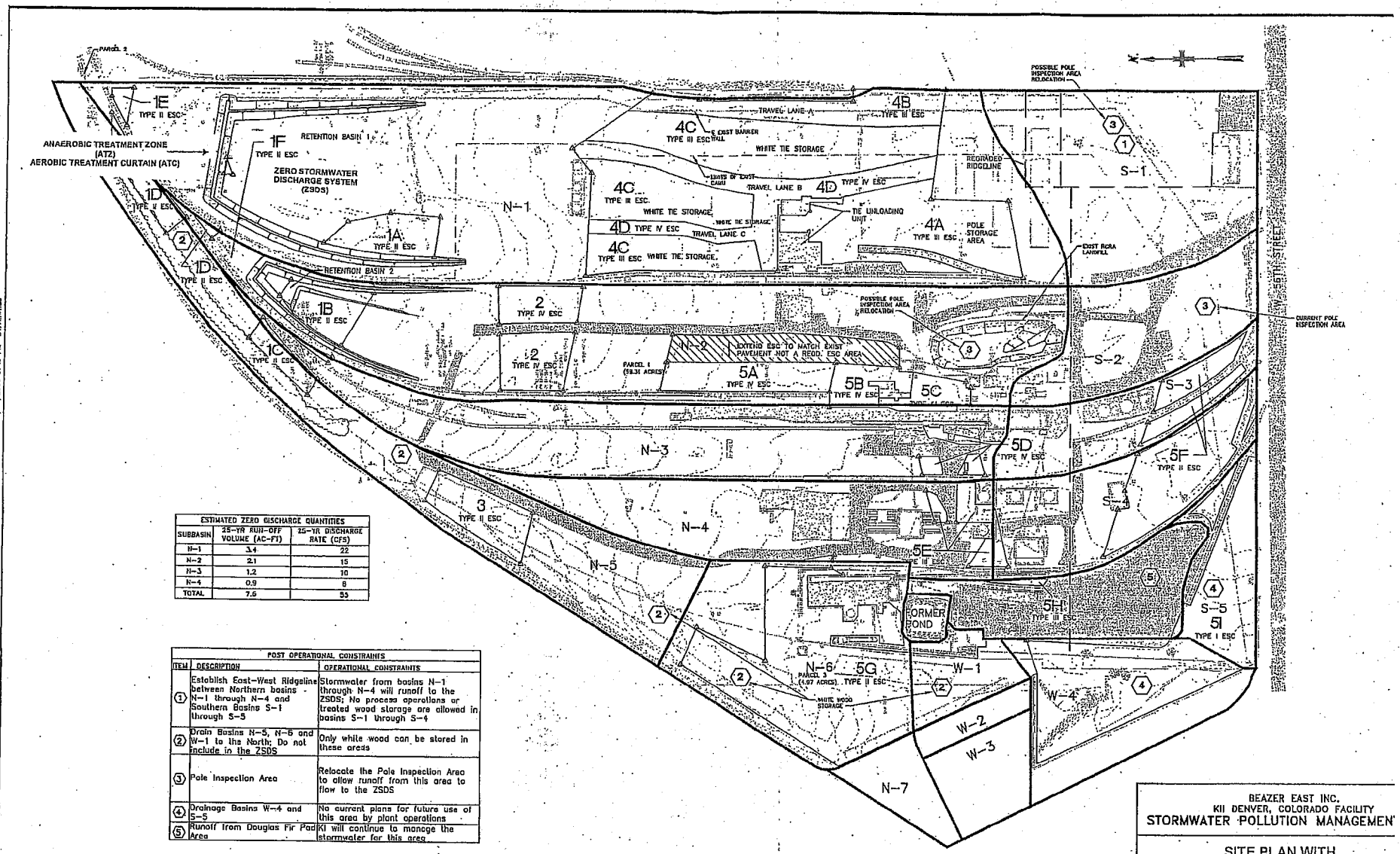

ESTIMATED ZERO DISCHARGE QUANTITIES		
SUBBASIN	25-YR RUN-OFF VOLUME (AC-FT)	25-YR DISCHARGE RATE (CFS)
N-1	3.4	22
N-2	2.1	15
N-3	1.2	10
N-4	0.9	8
TOTAL	7.6	55

POST OPERATIONAL CONSTRAINTS		
ITEM	DESCRIPTION	OPERATIONAL CONSTRAINTS
1	Establish East-West Ridgeline between Northern basins - N-1 through N-4 and Southern Basins S-1 through S-5	Stormwater from basins N-1 through N-4 will runoff to the ZSDS; No process operations or treated wood storage are allowed in basins S-1 through S-4
2	Drain Basins N-5, N-6 and W-1 to the North; Do not include in the ZSDS	Only white wood can be stored in these areas
3	Pole Inspection Area	Relocate the Pole Inspection Area to allow runoff from this area to flow to the ZSDS
4	Drainage Basins W-4 and S-5	No current plans for future use of this area by plant operations
5	Runoff from Douglas Fir Pad Area	KI will continue to manage the stormwater for this area

BEAZER EAST INC.
KII DENVER, COLORADO FACILITY
STORMWATER POLLUTION MANAGEMENT

SITE PLAN WITH
REMEDIAL STRUCTURES

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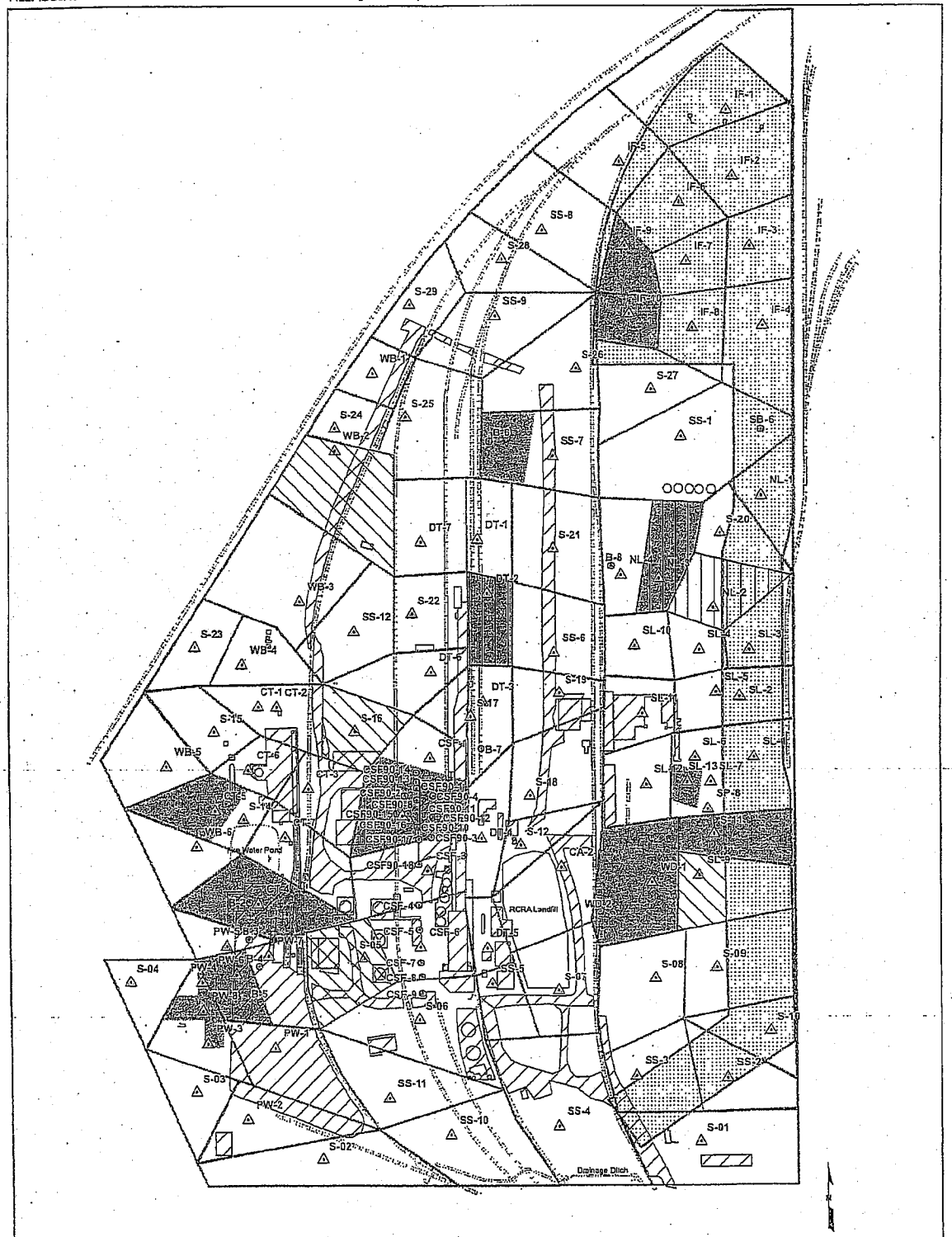

Explanation

- Surface soil 0-2 feet > HW criteria
- Sub-surface soil 2-8 feet > HW criteria
- CAMU boundary
- Concrete/Asphalt surfaces
- Unrestricted Use
- Subsurface(2-8 feet) or composite samples
- Discrete surface(0-0.5 feet) samples
- Site Boundary
- Secondary Containment
- Railroad

HISTORIC DATA COMPARED TO CDPHE UNRESTRICTED USE AND HAZARDOUS WASTE CRITERIA
Koppers Inc. Facility
Denver, CO

BROWN AND CALDWELL	Project No.	Figure
	133197	2

Attachment C – Operation & Maintenance Plan

(Attachment 5 to the Remedy Design Document and O&M Plan for the Integrated Soil and Stormwater Design)

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Pages: 0 Karen Long, Adams County, CO

Operation & Maintenance (O&M) Plan
Soil & Stormwater Remedy Design
Denver KI Facility
Denver, Colorado

Beazer East, Inc.
Pittsburgh, PA

August 2006

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Attachment 5

Operation & Maintenance Plan

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1. INTRODUCTION (PERMIT SECTION V.B.10.A)

The Koppers, Inc. (KI) Facility (Site) is located on 465 West 56th Avenue in Adams County, Denver, Colorado. The Site is a 65-acre active wood treating facility that has been in operation for more than 70 years. The KI Site treats wood products utilizing preservative solutions that contain petroleum, coal-tar derivatives, and inorganic preservatives. Impacts to surface soils resulted from wood-treating operations (i.e., pole wash, drip-track, etc.) and from the storage of recently treated lumber.

The remedy activities will consist of the construction of engineered soil covers (ESCs) in the process area and other impacted locations through out the Site, and a zero stormwater discharge system (ZSDS) at the north end of the Site. The primary performance objective of the various ESC designs is to prevent direct dermal contact with impacted soils by site workers and visitors. The construction of the ZSDS is to further reduce the potential risks and to prevent the off-site flow of stormwater runoff from historically impacted areas of the Site.

Implementing proper operation and maintenance (O&M) requirements for the constructed system is important in order to promote the continual functioning of the remedy measures following the construction, which will maintain the performance objectives. This O&M Plan details the requirements of operation and maintenance for the soil and stormwater corrective measures.

2. CORRECTIVE MEASURES AND SYSTEM COMPONENTS (PERMIT SECTION V.B.10.B)

Corrective measures involved in the currently proposed remedy activities includes both soil and stormwater remedies. The following describes each remedy and the critical system components.

2.1 Soil Corrective Measure

The soil corrective measure will involve placement of ESC over impacted areas. Details and horizontal limits of the ESC areas are illustrated on the Attachment 1 – Contract Drawings. The main objective of placement of ESCs over impacted areas is to mitigate potential current and future unacceptable risks due to potential direct contact exposure to and inhalation of site-related constituents to onsite maintenance, commercial, and construction workers from surface and subsurface soils.

There are five ESC areas as shown in the Contract Drawings. Some of the major ESC areas are again divided into several sub-areas because of different types of ESC designed for varies traffic loading and sub-grade conditions. The key components of the ESC design include four types of ESCs:

- Type I ESC for general fill - A non-woven geotextile overlain by a 6-inch layer of local borrow material that will support vegetative growth.
- Type II ESC for light/medium traffic - A non-woven geotextile overlain by a 6-inch layer of compacted well graded road base material that consists of sufficient gravel to resist live load from equipment operation, while including sufficient fines to achieve compaction requirement.
- Type III ESC for medium/heavy traffic - A woven geotextile overlain by a combination of a 6-inch layer of compacted well graded road base material followed by a top layer of 4-inch top wearing gravel course. The well graded road base consists of sufficient gravel to resist live load from equipment operation, while including sufficient fines to achieve compaction requirement. The woven geotextile is used besides to separate the materials between the road base and subgrade, it also provides added strength for confining the road base material above and re-distributes lateral load stress to prevent excessive rutting.
- Type IV ESC for heavy traffic - A woven geotextile overlain by a combination of a 4-inch layer of Geoweb filled with well graded road base material followed by a layer of 1-inch top wearing gravel course. The road base filled Geoweb system can further confine the road base material together with the woven geotextile and re-distribute the lateral stress through the interlock strength between the gravel fill and Geoweb and thus reducing the vertical stress to the sub-grade supporting material.

2.2 Stormwater Corrective Measure

The stormwater corrective measure will consist of the construction of a ZSDS. Onsite stormwater will be retained, naturally evaporated, and infiltrated from two stormwater retention areas on the north side of the Site. Details of the ZSDS system design are shown on the Contract Drawings.

Key components of the ZSDS consist of mainly two retention basins on the north end of the Site together with several culverts across railroad tracks to direct onsite stormwater flows to the retention basins. The construction of the two retention basins will involve installation of berms around three sides in each basin area.

The primary retention basin, Retention Basin #1, is designed to hold a stormwater runoff capacity of a 25-year, 24-hr storm event from the area directly south (i.e., N-1 watershed) and other adjacent watersheds (i.e., N-2 through N-4 watersheds). The secondary Retention Basin #2 is to help in directing the stormwater from watersheds N-2 through N-4 as well as adding to the design capacity of stormwater runoff for Retention Basin #1. A riser spillway in Retention Basin #2 discharges runoff to Retention Basin #1 through a corrugated metal pipe (CMP). The riser/CMP connection can also function as siphon channel balancing flows between the basins during heavy storms.

An emergency spillway is also provided at the southwest corner of Retention Basin #1 to handle runoff exceeding the 25-yr, 24-hr storm capacity.

3. NORMAL OPERATION AND MAINTENANCE PROCEDURES (PERMIT SECTION V.B.10.C)

- Following completion of the ESCs installation, the work will be inspected for all ESCs in traffic areas (i.e., Types II, III & IV ESC) for any ruts (Figure 1) during their normal business hours. Ruts are usually caused by repeated turning-wheel traffic to the surficial material. Shallow ruts shall be repaired by respreading the adjacent surface course material.

- The ZSDS will be observed during normal business operations to assure that the culverts and riser spillway are not blocked by any obstructions. Minor obstructions shall be removed.

- A general inspection will be performed quarterly for both the ESCs and ZSDS in the first year. This general inspection will be for the evaluation of the overall operations of the systems.

- Following the first year, an annual inspection will be performed for both the ESCs and ZSDS. The inspection will be conducted for the purpose of evaluating the structural integrity of the key components of each system. The inspection will look for cracks, wears in the surface course, evidence of subsidence or failure, low area fill with water, separation from structures, or visible exposure of lower layer such as bottom geotextile. Some of these potential damages or failures are shown in Figure 1. An annual O&M report will be provided to describe the condition of the remedy, describe the maintenance activities completed during the year, and detailed proposed activities for the next year.

4. MAINTENANCE AND REPAIRS/REPLACEMENT (PERMIT SECTION V.B.10.D)

Minor damages (such as ruts) or erosion for ESCs or ZSDS that do not impact the overall structural integrity or exposure of impacted material, or minor obstructions in stormwater runoff system will be repaired by in a timely manner.

5. WASTE MANAGEMENT PRACTICES (PERMIT SECTION V.B.10.E)

The designs of the ESCs are not expected to generate any waste during its normal operations. If potentially impacted soil is exposed or generated during any repair excavation operation, it will be backfilled and placed beneath new ESC during the repair operation.

6. O&M CONTINGENCY PROCEDURES (PERMIT SECTION V.B.10.F)

The ESC designs are based on anticipated current and future traffic and existing subgrade conditions. Acceptable factor of safety is provided as part of the design considerations. Therefore, a "complete system breakdown" is most likely not expected. However, if any complete failure from unforeseeable conditions occurs, such as the complete collapse of subgrade causing wide spread exposure (more than 10 feet wide) of covered potentially impacted soil, the following procedures will be implemented:

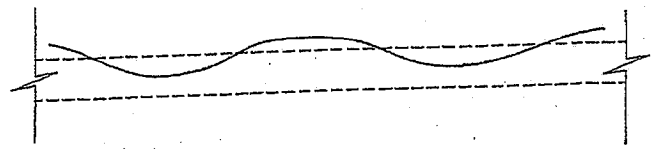
- The area will be blocked and isolated from site workers and visitors;
- The State will be notified;
- An investigation will be initiated within a reasonable time to determine the reasons of failure; and
- Written report of the investigation will be submitted for recommended corrective action.

For the ZSDS, a complete system breakdown is not expected. The retention basins are designed with a freeboard of at least one foot that will yield an approximately 49% extra capacity. An emergency spillway is also provided to handle the overflow from a 25-year, 1-hr storm event while the basins are in full design capacity. Inspection should be carried out to examine any excessive erosion or damages following any occurrence of overflows through the emergency spillway.

POTENTIAL O&M SCENARIOS

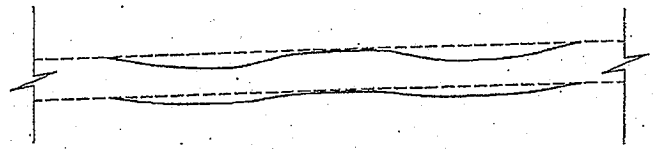
REPAIRS

- GRADE & RE-SPREAD TO MATCH EXISTING



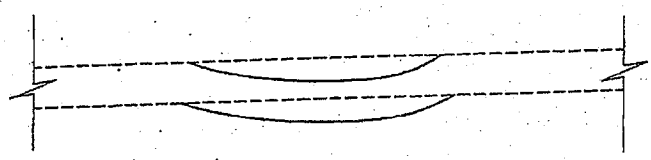
RUTS

- GRADE & ADD COURSE AGGREGATE



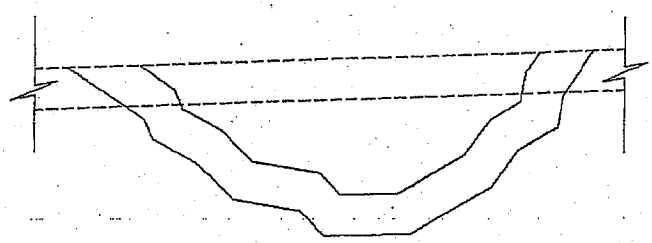
TIRE WEAR COURSE AGGREGATE

- FILL IN & COMPACT TO MATCH UPGRADIENT & DOWNGRADIENT ELEVATION



SETTLEMENT OF DRAINAGE SWALES

- OVEREXCAVATE, STABILIZE SUBGRADE & PLACE FILL & COMPACT



SUBGRADE FAILURE

BEAZER EAST INC.
KI DENVER, COLORADO FACILITY
ESC DESIGN

POTENTIAL O&M SCENARIOS

BBL® an ARCADIS company

FIGURE 1

6/2/05 11:01:-85-HSI LAYER: ON=*, OFF=*REF*
C:\WIP\3901205\39065C05.DWG SAVED:8/11/2006 9:05 AM LAYOUT:Layout1 PAGESETUP:---- PENTABLE:PLTHALF.CTB PRINTED:8/11/2006 5:03 PM BY:HINNISS
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