United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R06-88/045
September 1988

EPA

Superfund
Record of Decision:

South Cavalcade Street, TX

50272-101

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12. Sponsoring Organization Name and Address U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460	13. Type of Report & Period Covered 800/000
	14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 66-acre South Cavalcade site is located in northeast Houston, Texas. The surrounding areas are a mixture of residential, commercial, and industrial properties. Stormwater runoff flows to two stormwater drainage ditches, which flow into Hunting Bayou, a limited aquatic habitat as classified by Texas Water Quality Standards. The site was used as a wood preserving and coal tar distillation facility from 1910 to 1962. The wood preserving facility consisted of an operations area, a drip track, and treated and untreated wood storage areas. The operations area included wood-treating cylinders, chemical storage tanks, and a waste water lagoon. Creosote and metallic salts were used in the operation. Subsequently, the site was sold, divided into smaller tracts, and resold to the current owners. The site is currently used by three commercial trucking companies, which have erected four buildings on the northern and southern parts of the site. In 1983, the Houston Metropolitan Transit Authority investigated the site for potential mass transit use and found evidence of buried creosote. Beginning in November 1985, EPA sampled all environmental media and found two discrete areas of contamination at the site corresponding to the former locations of the wood treating operations and coal tar plant in the southern portion of the site, and a pond previously existing in the northern portion of the site. PAHs, VOCs, metals and (See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision
South Cavalcade Street, TX
First Remedial Action - Final
Contaminated Media: gw, soil, sediments
Key Contaminants: VOCs (benzene, toluene, xylenes,) PAHs, metals (arsenic, chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 71
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

16. ABSTRACT (continued)

components of creosote were detected in the soil, sediments, and ground water. The primary contaminants of concern affecting the ground water, soils, and sediments are VOCs including benzene, toluene, and xylenes, other organics including PAHs, and metals including arsenic, chromium, and lead.

The selected remedial action for this site includes: excavation and onsite washing of 19,500 yd^3 of soil, replacing the soil in the excavated areas and capping, and treating wash water in the ground water treatment system; in situ soil flushing of 10,500 yd^3 of soil; ground water pump and treatment of 50,000,000 gallons using physical/chemical separation, pressure filtration, and carbon adsorption with re-injection into the aquifer or, if necessary, discharge to the onsite drainage ditch which flows into Hunting Bayou; offsite incineration or recycling of all non-aqueous phase liquids separated out from the ground water; and ground water monitoring. Alternatively, in situ biological treatment of soil and ground water will be considered if a potentially responsible party can demonstrate its equivalent or superior performance and implementability costs. The estimated present worth cost for this remedial action is $13,000,000.

RECORD OF DECISION

EPA

REGION 6

SOUTH CAVALCADE STREET SITE

HOUSTON, TEXAS

REMEDIAL ALTERNATIVE SELECTION

STATEMENT OF PURPOSE

This decision document presents the selected remedial action for the South Cavalcade Street site in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986; and the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300, November 20, 1985.

The State of Texas (through the Texas Water Commission) has been provided an opportunity to comment on the technology and degree of treatment proposed by the Record of Decision and has no objection to the selected remedy (See Appendix D).

STATEMENT OF BASIS

This decision is based upon the administrative record for the South Cavalcade site. The attached index identifies the documents which comprise the administrative record. (See Appendix E).

DESCRIPTION OF THE REMEDY

The selected remedy will treat the health- and environment-threatening contamination resulting from historical wood preserving operations at the site. Upon review of the information contained in the administrative record, EPA has determined that soil remediation using a combination of soil washing and in situ soil flushing and groundwater remediation using physical/chemical separation followed by filtration and activated carbon adsorption best fulfills the statutory selection criteria. Alternatively, if a potentially responsible party offers to implement an in situ biological treatment process for groundwater and can demonstrate that this process can be implemented and operated at an efficiency equal to or better than activated carbon, then this method will be used to remediate groundwater. The following is a summary of the proposed remedy:

Soil Remediation: During the initial stages of the remedial design, contaminated soil areas will be sampled to better define areas which require remediation. All areas will be remediated which either exceed the risk-based or leaching potential-based remedial goals. The risk-based goals is 700 ppm based on ingestion and direct contact with soils. The leaching potential-based goal will be determined by the EPA Toxicity Characteristic Leaching Procedure test. There are approximately 30,000 cubic yards which may need remediation.

In the southeast corner of the site, approximately 19,500 cubic yards of contaminated soils will be excavated and transported to the soil washing facility which will be constructed in the center portion of the South Cavalcade site. Wash water from the unit will be treated for removal of contaminants in the groundwater treatment system. The cleansed soils will be placed into the excavations and capped to maintain soil stability.

In the other parts of the site, contaminated soils will be remediated using in situ soil flushing. The contaminants which travel into the groundwater will be extracted and treated in the carbon adsorption wastewater treatment system.

Groundwater Remediation: Groundwater will be remediated through extraction and treatment of contaminated groundwater, with reinjection to increase the hydraulic gradient and flow velocities. Approximately 50 million gallons of groundwater will need to be processed several times to recover and treat the non-aqueous phase liquids. Groundwater will be treated to drinking water standards and no detectable carcinogenic PAHs. Groundwater collection will continue until the groundwater contaminants have been recovered to the maximum extent possible. This point will be determined during the Remedial Action based upon operational experience in using the collection and treatment system. After this point is reached, the groundwater collection will cease and any remaining contamination be allowed to naturally attenuate to background levels.

Groundwater will be extracted and re-injected in a series of three groundwater extraction lines and two groundwater injection lines in the southern part of the site, and a minimum of one extraction line and reinjection line in the northern part. These wells will be screened in the shallow aquifer (approximately 10 - 20 feet below grade) and in the intermediate discontinuous sand lenses (approximately 50 feet below grade). The actual number of lines, locations and spacings of wells and well lines will be refined during remedial design.

The groundwater will be treated at an onsite wastewater treatment plant constructed in the center portion of the site. Groundwater will be pumped into a physical/chemical separator followed by a pressure filter and an activated carbon adsorption unit. Any non-aqueous phase liquids collected and separated from the groundwater will be recycled as creosote or incinerated offsite. The water will be treated to levels equal to Maximum Contaminant Levels and no detectable carcinogenic PAHs. Cleansed groundwater will be re-injected into the aquifer along with surfactants to help recover the contaminants. Any excess water will be discharged to the drainage ditch leading into the off-site Hunting Bayou in accordance with an NPDES permit.

Alternate Remediation Plan: If a potentially responsible party can show that in situ biological treatment of soil and groundwater will provide equal or better performance and can further ensure that the implementability questions can be resolved, EPA will consider this remedial method. In this case, the performance goals and groundwater extraction system will be identical to EPA's selected remedy, but the actual method of treatment will differ. Groundwater will be treated above ground in the physical/chemical separator and injected with nutrients and oxygen (if necessary). The treated groundwater will be added to the contaminated soil and re-injected to encourage biological degradation of contaminants under the ground. Any excess water will be discharged into the city sewer system in accordance with a pretreatment permit and treated in a city municipal treatment plant.

Operation and Maintenance: The need for future operation and maintenance should be minimized since the primary sources of contamination will be removed through treatment. Site operation and maintenance will include installing a well screened in the 500 foot sand, monitoring groundwater wells and monitoring ambient air during remediation. The groundwater monitoring program will continue for at least 30 years unless it can be shown during the Remedial Action that some shorter length of time is appropriate. This sampling program will monitor the effectiveness of the selected remedy and provide the data necessary. If the monitoring shows leaching from soils now under existing structures, then the site will need to be revisited to determine if further remediation is necessary.

Additional site maintenance would include, but not necessarily limited to, inspections of surface vegetation, ensuring proper drainage, and proper operation of any actions such as groundwater treatment which may extend beyond the time required for the source control remedy. The details of these activities will be defined in the Operation and Maintenance Plan of the remedial design. The monitoring data will be evaluated during the Agency's 5-year review, in accordance with CERCLA Section 121 (c), to determine if any corrective action is necessary.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the preference for treatment that reduces toxicity, mobility or volume as a principal element. Finally, it is determined that this remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

September 26, 1988
Date

Robert E. Layton Jr.
Robert E. Layton Jr., P.E.
Regional Administrator

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

SOUTH CAVALCADE STREET SITE

HOUSTON, TEXAS

SEPTEMBER 1988

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION VI, DALLAS, TEXAS

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1. SITE LOCATION AND DESCRIPTION

The South Cavalcade Street site is located in northeast Houston, Texas about one mile southwest of the intersection of Interstate Loop 610 and U.S. Route 59 (Figure 1). The site boundaries are Cavalcade Street to the north, Collingsworth Street to the south, and the Missouri and Pacific railroad lines to the east and west. The site is rectangular in shape with a base of approximately 600 feet, an height of 4,800 feet, and an area of 66 acres.

The site is generally flat. It is drained by two stormwater drainage ditches which flank the site on the east and west sides, and drain water into a flood control ditch which discharges into Hunting Bayou, a tributary of the Houston Ship Channel. Hunting Bayou is currently classified in the Texas water quality standards as a limited aquatic habitat.

The site is now used by three commercial trucking companies (Merchants Fast Motor Lines, Transcom Lines, and Palletized Trucking) which have erected four buildings on the northern and southern parts of the site. The central part of the site is not currently used. The surrounding areas are residential, commercial, and industrial properties. The nearest residential area is directly to the west. Commercial properties are located along the major thoroughfares as well as on-site.

2. SITE HISTORY

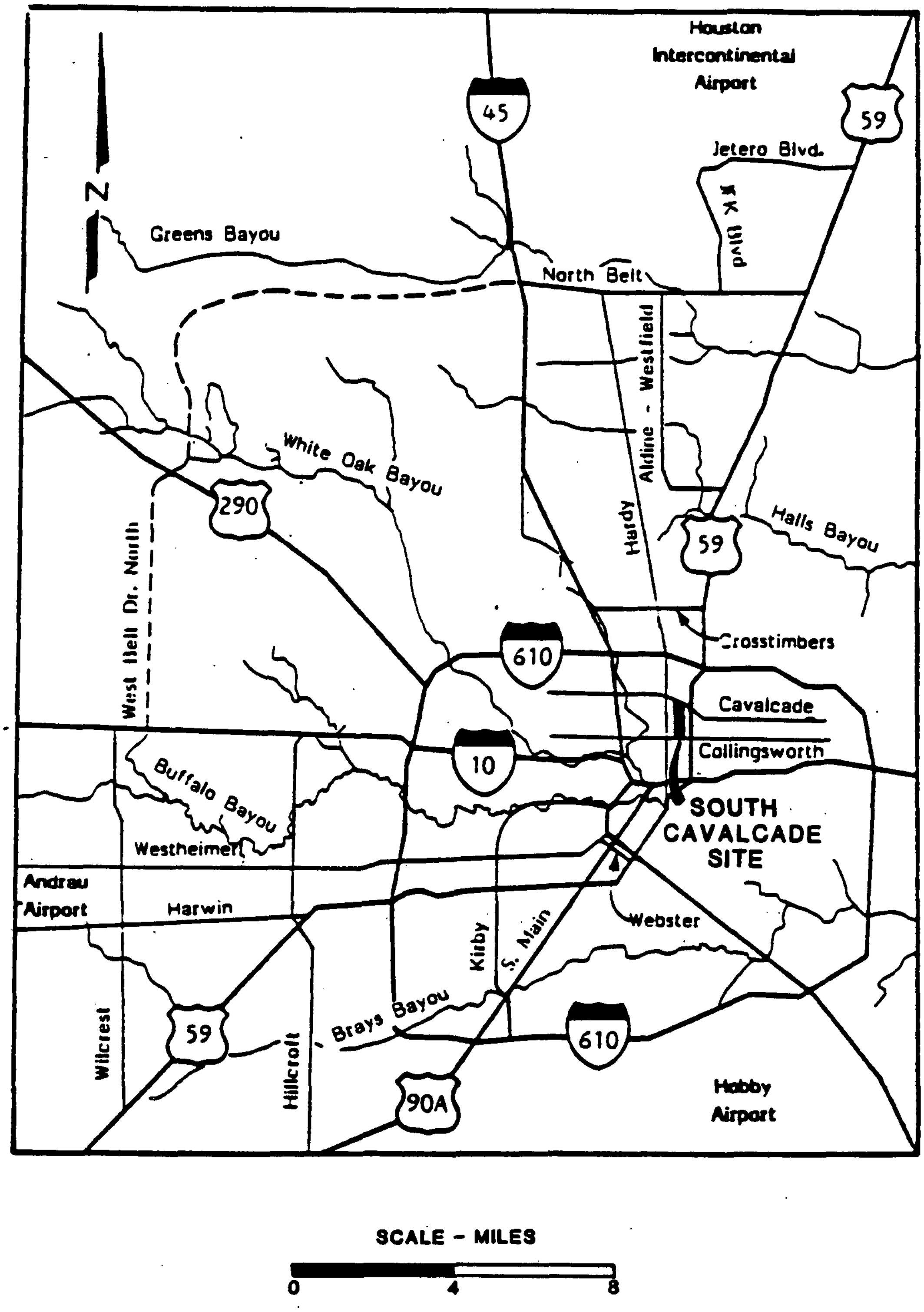
2.1 PREVIOUS SITE USE

The South Cavalcade site was used as a wood preserving and coal tar distillation facility from 1910 to 1962. The wood preserving facility consisted of an operations area, a drip track, and treated and untreated wood storage areas. The operations area included wood treating cylinders, chemical storage tanks, and a wastewater lagoon; this area was located in the southwestern part of the site. Creosote and metallic salts were used in the operation. The drip track ran diagonally from the operations area to the northeast, and ended before the central part of the site. The coal tar plant was located in the southeastern part of the site.

In 1962, the Koppers Company ceased operation of the facility, and sold the site to Merchants Fast Motor Lines. The site was later sold, subdivided, and resold to the current property owners. Figure 2 shows current site ownership.

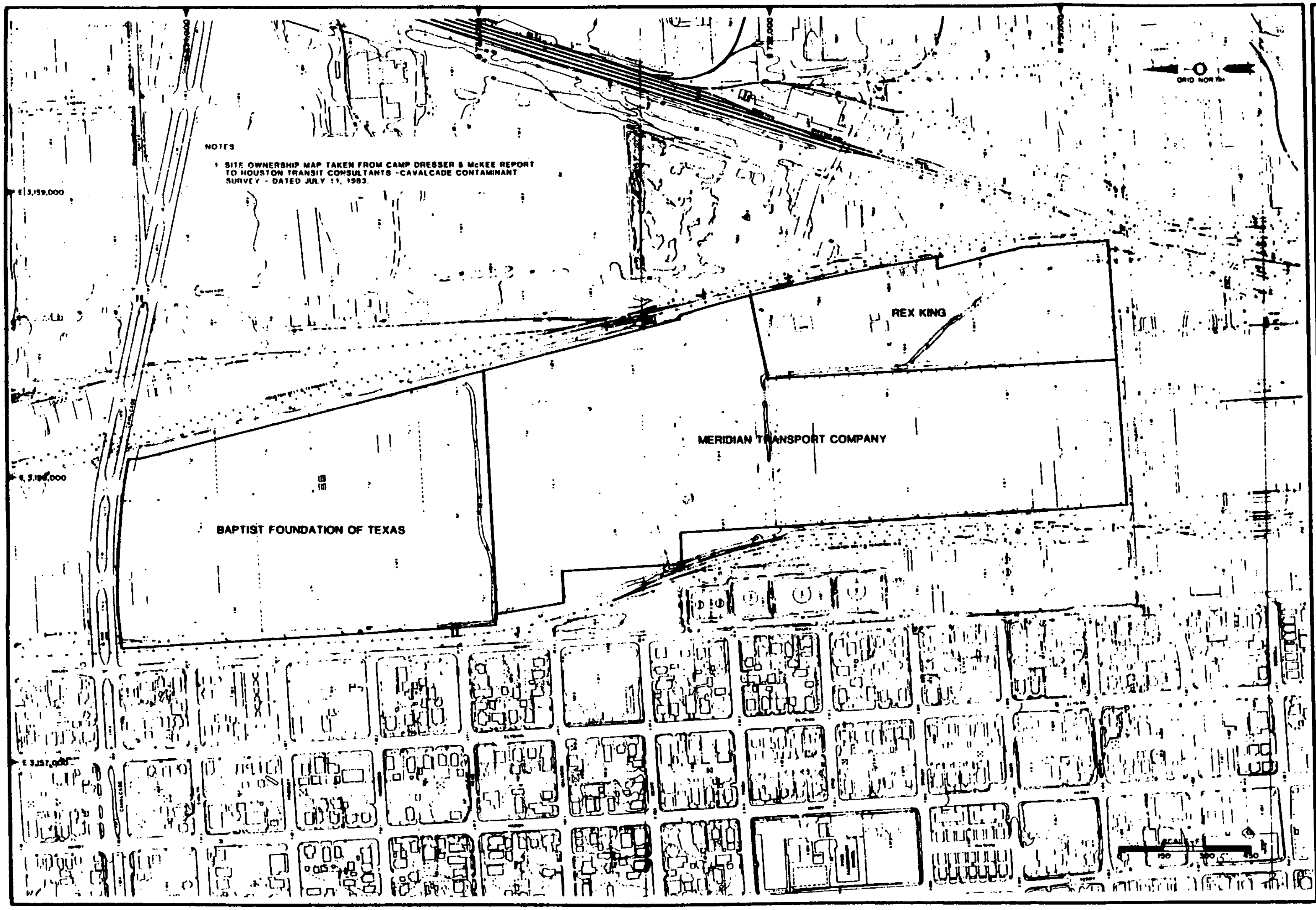
2.2 RESPONSE AND REMEDIAL ACTIVITIES

In 1983, the Houston Metropolitan Transit Authority investigated the site for potential mass transit use and found evidence of buried creosote. The Texas Department of Water Resources conducted a further study and determined that the site may pose a threat to public health and the environment. Based on this



SITE VICINITY MAP

FIGURE 1



NOTES

1 SITE OWNERSHIP MAP TAKEN FROM CAMP DRESSER & McKEE REPORT TO HOUSTON TRANSIT CONSULTANTS -CAVALCADE CONTAMINANT SURVEY - DATED JULY 11, 1983.

SITE OWNERSHIP MAP
SOUTH CAVALCADE SITE
HOUSTON, TEXAS

KOPPERS COMPANY, INC.

FIGURE NO
PROJECT NO 89-317
DATE 0-23-87
ENGINEER
DRAWN BY

information, TDWR referred the site to EPA for inclusion on the National Priorities List (NPL). EPA proposed the site to be added to the NPL in October 1984; the site was formally promulgated in June 1986.

EPA began the Remedial Investigation and Feasibility Study (RI/FS) in November of 1985. The Remedial Investigation included investigations into contamination in soils, groundwater, surface water and sediments, and air. The Feasibility Study evaluated several methods for remediating the site problems including containment and treatment technologies. The RI/FS ended in August of 1988 with the publishing of the reports on each.

2.3 ENFORCEMENT

EPA identified four potentially responsible parties (PRPs) in the initial stages of the RI. EPA issued an Administrative Order on Consent to the Koppers Company in 1985 to conduct a RI/FS.

EPA mailed copies of the proposed plan of action for this site to the PRPs on August 19, 1988. EPA will continue its enforcement activities by sending a Special Notice letter to the PRPs before the initiation of the remedial design. Should the PRPs decline to conduct future remedial activities, EPA will either take enforcement action or will provide funding for these activities while seeking cost recovery for all EPA-funded response actions from the PRPs.

3. SITE CHARACTERISTICS

The Remedial Investigation characterized local geology and hydrogeology and investigated four different types of environmental media at the South Cavalcade site: soils, groundwater, surface water and sediments, and air. The samples collected during this period were analyzed for substances characteristic of wood preserving and coal tar facilities: polynuclear aromatic hydrocarbons (PAHs), volatiles (benzene, ethylbenzene, toluene, and xylenes) and metals (arsenic, chromium, copper and zinc). The analytical results from the sampling are described in the Remedial Investigation report dated August, 1988. A brief summary is presented below.

3.1 GEOLOGY AND HYDROGEOLOGY

The South Cavalcade site is situated on the Quaternary Gulf Coast Plain of Texas. This region is comprised of a series of sedimentary depositional plains which are composed of channel fill deposits. The South Cavalcade site is situated within the surface sediments of the Beaumont Formation, and consists of sandy to silty clays. Below this is the Lissie Formation which is composed of fluvial and deltaic deposits.

Regionally, there are three principal aquifers in the Coastal Plain. These are the Chicot, Evangeline and Jasper. The Chicot and Evangeline aquifers are the uppermost units and are approximately 1800 feet in thickness. Below the Evangeline aquifer is the Burkeville Confining System, which in turn is underlain by the saline Jasper aquifer. Both the Chicot and Evangeline are fresh water aquifers which are used as water supplies in coastal areas of Texas.

Locally, in the vicinity of the South Cavalcade site, the upper five geologic units have been characterized as follows:

Unit	Geology	Average Depth (ft)
1	Deltaic Deposits	0 - 21
2	Fluvial/Deltaic Deposits	21 - 50
3	Deltaic Deposits	50 - 125
4	Fluvial/Deltaic Deposits	125 - 200
5	Pre-Deltaic Deposits	below 200

A cross section of the upper three units is shown in Figure 3.

The uppermost water bearing unit at the South Cavalcade site is approximately 11 feet in thickness and begins approximately 6 to 10 feet below grade. This unit is continuous across the site. Horizontal flow velocity in this layer is approximately 16 feet per year towards the west. Small, localized sand units are present at approximately 45 feet, but these are not extensive water yielding units. A thin sand (less than 10 feet) is present at approximately 115 to 127 feet of depth. A deep aquifer zone is encountered between depths of 174 and 200 feet; water within this zone and deeper zones flows to the south. A downward vertical gradient exists between the uppermost water bearing unit and the deep aquifer zone. Vertical groundwater seepage rates should typically be limited by the relatively low permeability of the clayey confining strata. However, local seepage is greater due to secondary soil structures (i.e. fissures, silt seams, sand layers, slickensides). Vertical groundwater seepage rates were estimated at approximately 1.8 feet per year.

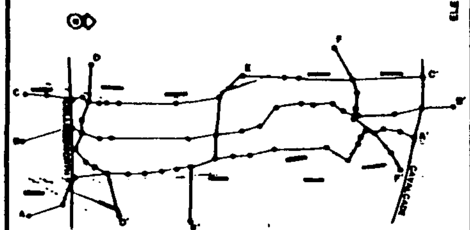
3.2 SURFACE AND SURFICIAL SOILS

Surface and surficial soils comprise the top six feet of soil at the South Cavalcade site. Surface soils are defined to be in the upper 0.5 foot. Surface and surficial soils approximately delineate the unsaturated soils of the vadous zone.

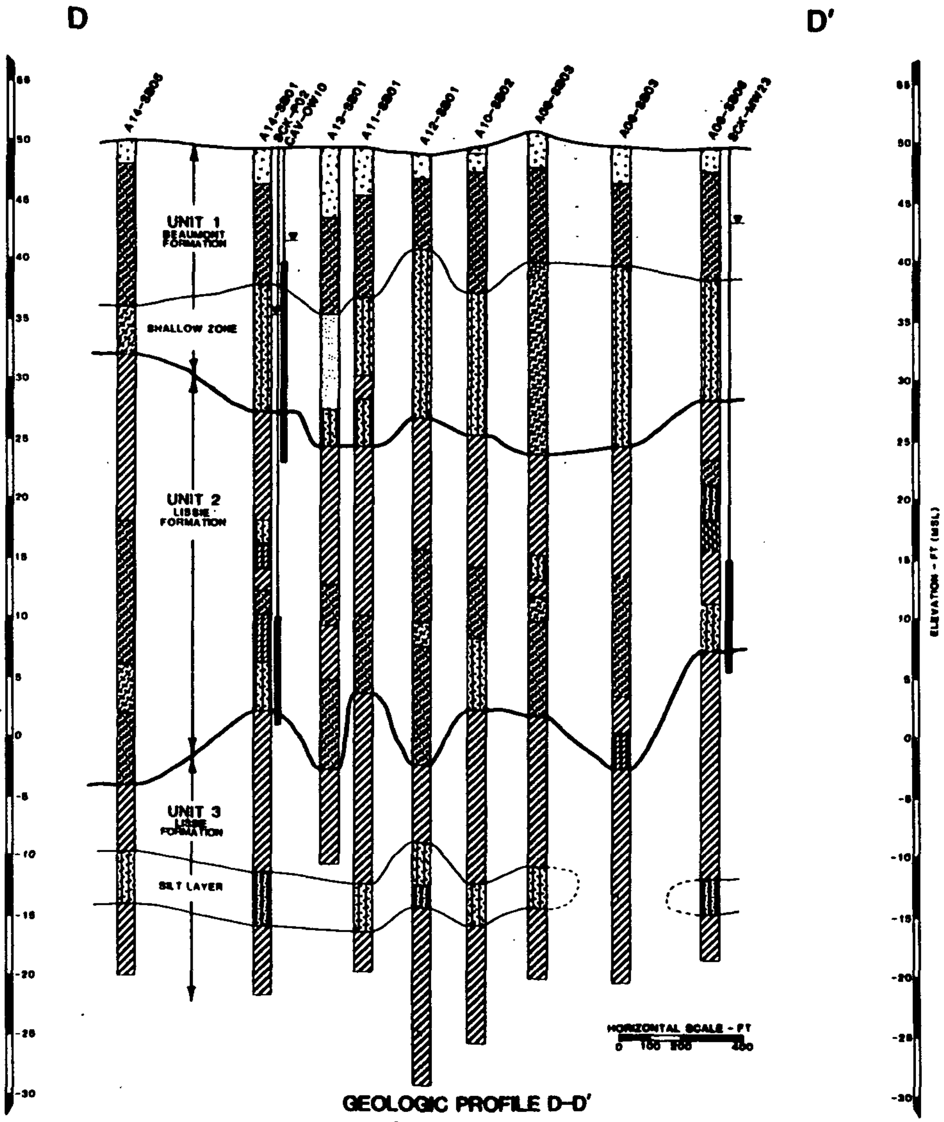
Soil staining showing potential residual organic concentrations was seen at 15 of 139 auger boring locations and at 29 of 82 soil boring locations. Based on observations at these locations, a surficial soils quality map was developed to show the approximate areal distributions of both surface and surficial visual soil staining. This is shown in Figure 4.

NOTES

1. SOIL BORINGS DENOTED WITH RM PREFIX FROM McCLELLAND ENGINEERS (MEI) REPORT TO HOUSTON TRANSIT CONSULTANTS-GEOTECHNICAL INVESTIGATION-RECONNAISSANCE STUDY, CAVALCADE YARD AND SHOP, METRO-STAGE ONE, RRS (VOL VII) DATED MAY 20 1983.
2. APPROXIMATE GROUND SURFACE ELEVATIONS REFERENCED TO MEAN SEA LEVEL DATUM, NATIONAL GEODETIC SURVEY, 1973 ADJUSTMENT
3. VERTICAL EXAGGERATION IS 40 TIMES
4. SOIL TYPE BASED ON VISUAL FIELD CLASSIFICATION AND NOT VERIFIED BY LABORATORY TESTING
5. APPROXIMATE LOCATION OF INTERPRETED PECORE FAULT TAKEN FROM McCLELLAND ENGINEERS REPORT NO 0181-0840-2 DATED SEPTEMBER 30, 1982
6. SOIL BORINGS DENOTED WITH CAV PREFIX FROM CAMP DRESSER & McKEE REPORT TO HOUSTON TRANSIT CONSULTANTS - CAVALCADE CONTAINMENT SURVEY - VOLUME I - ENGINEERING REPORT DATED JULY 11, 1983.
7. ALL GROUNDWATER LEVELS WERE MEASURED ON AUGUST 20, 1987



PROFILE ALIGNMENT SCHEMATIC
NOT TO SCALE



GEOLOGIC PROFILE D-D'

REFERENCE DRAWINGS:
FIGURE 3-4

NOTE - SUBSOIL PROFILE INTERPOLATED BETWEEN BORINGS ACTUAL CONDITIONS MAY VARY FROM THOSE ILLUSTRATED

DENOTES DEPTH OF GROUNDWATER MONITORING ZONE

SOIL TYPE

- FILL
- CLAY
- SANDY CLAY
- SILTY CLAY
- SAND
- CLAYEY SAND
- SILTY SAND
- SILT
- CLAYEY SILT
- SANDY SILT

LEGEND:

SCS - South Cavalcade Site (HRA)
CAV - Cavalcade Site (CDM)
P - Piezometer (HRA)
AXX - Area Number
SB - Soil Boring
OW - Observation Well (CDM)
MW - Monitoring Well (HRA)
RP - Metro Reconnaissance Boring (MEI)
RM - Metro Maintenance Yard Boring (MEI)

GENERALIZED GEOLOGIC PROFILE
SOUTH CAVALCADE SITE
HOUSTON TEXAS
KOPPERS COMPANY, INC

PROJECT NO.

DATE

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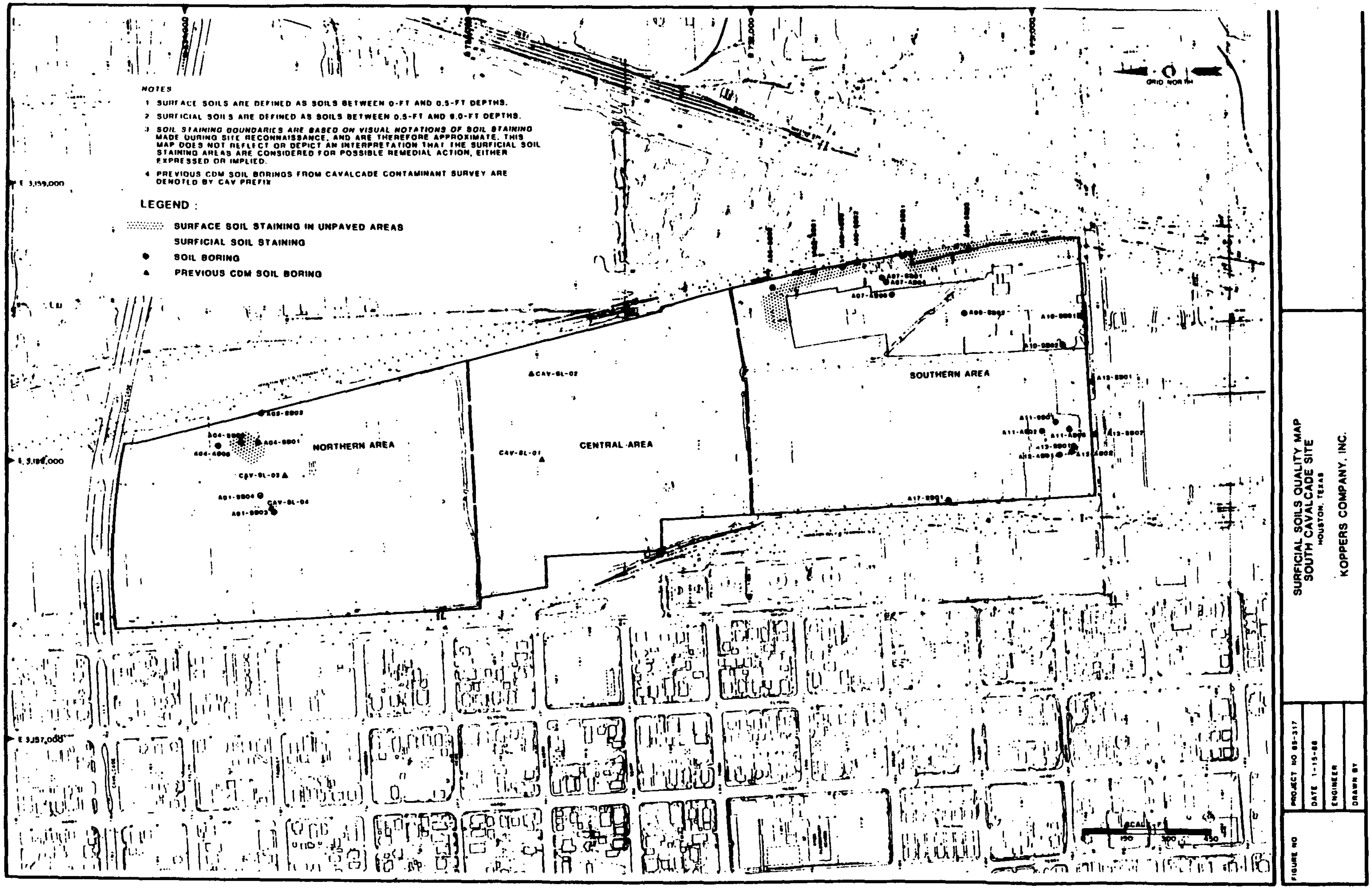
FIGURE NO.


NOTES
1 SURFACE SOILS ARE DEFINED AS SOILS BETWEEN 0-FT AND 0.5-FT DEPTHS.
2 SURFICIAL SOILS ARE DEFINED AS SOILS BETWEEN 0.5-FT AND 6.0-FT DEPTHS.
3 SOIL STAINING BOUNDARIES ARE BASED ON VISUAL NOTATIONS OF SOIL STAINING MADE DURING SITE RECONNAISSANCE, AND ARE THEREFORE APPROXIMATE. THIS MAP DOES NOT REFLECT OR DEPICT AN INTERPRETATION THAT THE SURFICIAL SOIL STAINING AREAS ARE CONSIDERED FOR POSSIBLE REMEDIAL ACTION, EITHER EXPRESSED OR IMPLIED.
4 PREVIOUS CDM SOIL BORINGS FROM CAVALCADE CONTAMINANT SURVEY ARE DENOTED BY CAV PREFIX
LEGEND :
SURFACE SOIL STAINING IN UNPAVED AREAS
SURFICIAL SOIL STAINING
SOIL BORING
PREVIOUS CDM SOIL BORING
GRID NORTH
E 3,159,000
E 3,158,000
E 3,157,000
NORTHERN AREA
CENTRAL AREA
SOUTHERN AREA
SURFICIAL SOILS QUALITY MAP
SOUTH CAVALCADE SITE
HOUSTON, TEXAS
KOPPERS COMPANY, INC.
PROJECT NO 85-317
DATE 1-15-88
ENGINEER
DRAWN BY
FIGURE NO

Visually stained surface and surficial soils in the southern portion of the site correspond to the former locations of the coal tar plant and wood treating operations. The stains in the northern area correspond to a pond observed in the 1964 aerial photograph of the site. There are approximately 5.5 acres of visually stained surficial soils on the site with approximately 50% of this in unpaved areas.

A total of four surface/surficial soil samples were analyzed for semivolatile organic compounds and select inorganics. Total surficial soil PAH concentrations ranged from below detectable limits to 8567 mg/kg. Copper, chromium, arsenic, zinc, and lead concentrations exceeded background levels. Table 1 shows the maximum concentrations of site contaminants in surface and surficial soils.

No surficial soil contaminant source areas, such as hydrocarbon-saturated soils and NAPLs, were disclosed from an electromagnetic geophysical survey, shallow auger boring program, or soil boring program.

3.3 GROUNDWATER

A total of 65 groundwater samples including duplicates were analyzed from shallow and deep water bearing zones for HSL volatile and semivolatile organic compounds, pesticides and PCBs, and select inorganics.

As shown in Figure 5, the distribution of subsurface constituents appears to form two discrete areas, one at the northern portion of the site and the other in the southern portion of the site. The northern distribution area generally corresponds to the location of a 1964 aerial photograph anomaly. The contamination is primarily on-site, although there is a small area off-site. The average attenuation depth of organic compounds in the soils in the northern site area is about 52 feet.

The southern area encompasses the locations of the former process areas. Again, most of the contamination is on-site with some off-site migration to the south and southwest. The average attenuation depth of organic compounds in the soils in the southern site area is about 58 feet.

Table 2 shows the maximum concentrations found in the groundwater. The primary compounds in the shallow aquifer were PAHs, which ranged in concentration from below detection limits to observed non-aqueous phase creosote at several wells. Aromatic volatile organic compounds (benzene, toluene, ethylbenzene, styrene and xylene) were detected in 7 of 18 monitoring wells. Metals were also detected in the groundwater and were highest in concentration in the southern area of the site, near the former coal tar process area. A total of three wells had measurable concentrations of four pesticides, although no specific pesticide distribution pattern was evident.

TABLE 1

SOIL CONCENTRATIONS[1]

Contaminant	Maximum Concentration Above 6 ft	Below 6 ft	Health Based Levels[2]
Arsenic	9	28	300
Chromium	10	47	>500,000
Copper	5	20	>500,000
Lead	30	45	420,000
Zinc	3480	250	>500,000
Acenaphthylene	nd[3]	nd	
Acenaphthene	440	570	
Anthracene	560	240	
Benzo(a)anthracene	340	93	
Benzo(a)pyrene	210	nd	
Benzo(b&k)fluoranthene	290	61	
Benzo(g,h,i)pyrene	77	nd	
Chrysene	310	76	
Dibenzo(a,h)anthracene	na	nd	
Fluoranthene	1,600	420	
Fluorene	490	440	
Ideno(1,2,3-cd)pyrene	nd	nd	
2-Methylnaphthalene	68	780	
Naphthalene	950	1,900	
Phenanthrene	2,100	940	
Pyrene	1,200	280	
Total PAHs	8,567	5,020	
Carcinogenic PAHs	1,150	230	91

(1) units of mg/kg unless otherwise noted

(2) based on risk calculations for commercial exposure equal to the reference dose or 10^{-6} cancer risk

(3) na = not analyzed; nd = not detected

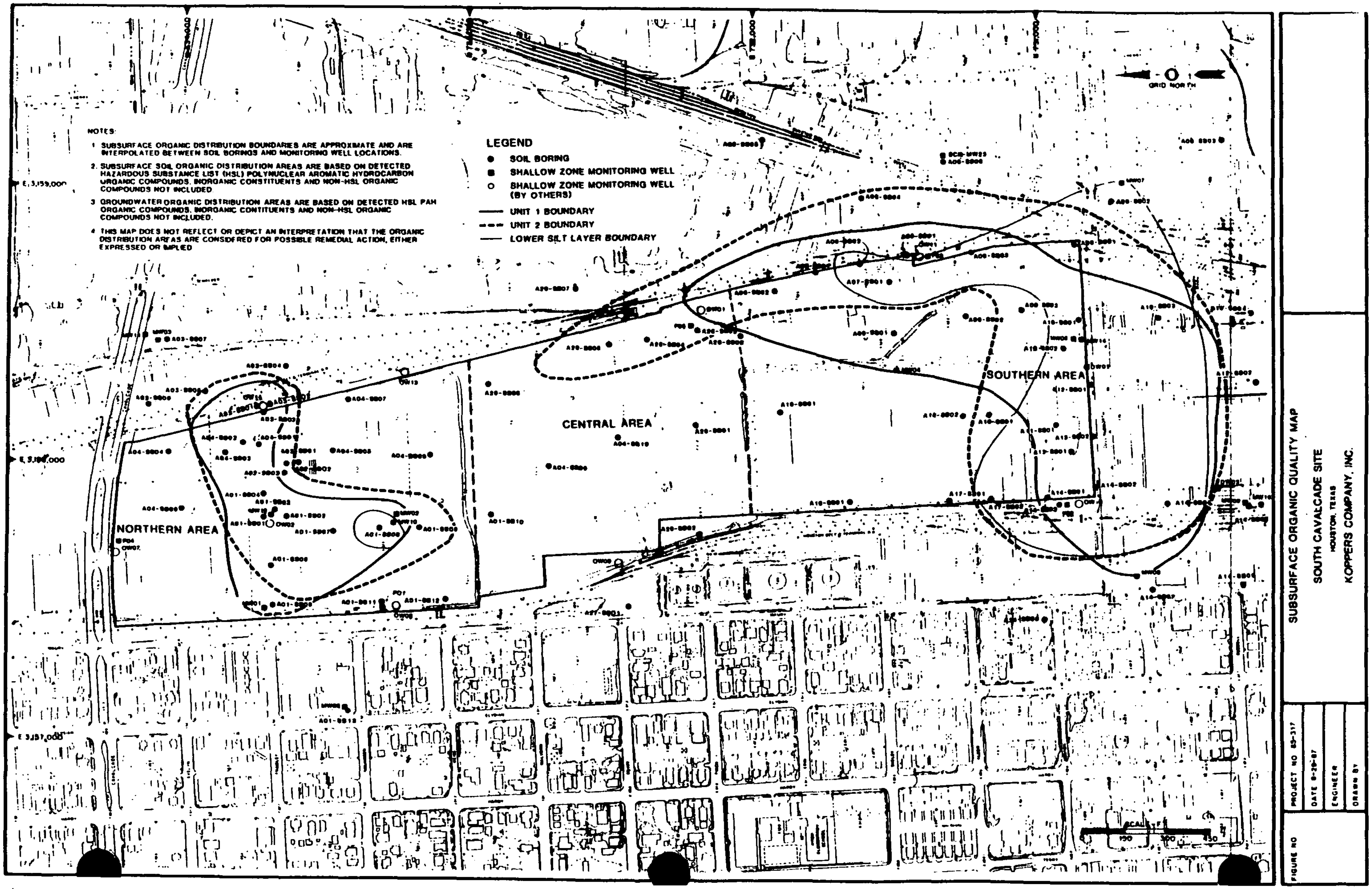

NOTES:
1 SUBSURFACE ORGANIC DISTRIBUTION BOUNDARIES ARE APPROXIMATE AND ARE INTERPOLATED BETWEEN SOIL BORINGS AND MONITORING WELL LOCATIONS.
2. SUBSURFACE SOIL ORGANIC DISTRIBUTION AREAS ARE BASED ON DETECTED HAZARDOUS SUBSTANCE LIST (HSL) POLYNUCLEAR AROMATIC HYDROCARBON ORGANIC COMPOUNDS. INORGANIC CONSTITUENTS AND NON-HSL ORGANIC COMPOUNDS NOT INCLUDED.
3 GROUNDWATER ORGANIC DISTRIBUTION AREAS ARE BASED ON DETECTED HSL PAH ORGANIC COMPOUNDS. INORGANIC CONTITUENTS AND NON-HSL ORGANIC COMPOUNDS NOT INCLUDED.
4 THIS MAP DOES NOT REFLECT OR DEPICT AN INTERPRETATION THAT THE ORGANIC DISTRIBUTION AREAS ARE CONSIDERED FOR POSSIBLE REMEDIAL ACTION, EITHER EXPRESSED OR IMPLIED
LEGEND
SOIL BORING
SHALLOW ZONE MONITORING WELL
SHALLOW ZONE MONITORING WELL (BY OTHERS)
UNIT 1 BOUNDARY
UNIT 2 BOUNDARY
LOWER SILT LAYER BOUNDARY
GRID NORTH
NORTHERN AREA
CENTRAL AREA
SOUTHERN AREA
SUBSURFACE ORGANIC QUALITY MAP
SOUTH CAVALCADE SITE
HOUSTON, TEXAS
KOPPERS COMPANY, INC.
FIGURE NO
PROJECT NO 85-317
DATE 8-28-87
ENGINEER
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TABLE 2

GROUNDWATER CONCENTRATIONS[1]

Contaminant	Maximum Concentration	Federal and State Standards[2]	BAT Monthly Discharge Limits[3]
Arsenic	522	50	
Chromium	450	50	1,110
Copper	1,340	1,000	1,450
Lead	260	50	320
Zinc	1,180	5,000	1,050
Benzene	930	5	57
Ethylbenzene	470	680	142
Toluene	1,000	2,000	28
Xylenes	1,100	440	
Acenaphthylene	610		19
Acenaphthene	2,600,000		19
Anthracene	550,000		19
Benzo(a)anthracene	500,000		19
Benzo(a)pyrene	570		20
Benzo(b&k)fluoranthene	1,200		19
Benzo(g,h,i)pyrene	100		
Chrysene	1,600		19
Dibenzo(a,h)anthracene	nd		
Fluoranthene	2,600,000		22
Fluorene	1,800,000		19
Ideno(1,2,3-cd)pyrene	nd		
2-Methylnaphthalene	1,300,000		
Naphthalene	7,100,000		19
Phenanthrene	4,900,000		19
Pyrene	1,900,000		20
Total PAHs	21,950,000		
Carcinogenic PAHs	500,000	0.003	

(1) units of micrograms per liter

(2) final and proposed primary and secondary drinking water standards except for 10^{-6} risk level for carcinogenic PAHs

(3) based on organic chemical, plastics, and synthetic fibers effluent guidelines for physical/chemical treatment

(4) nd = not detected

NOTE: All PAHs exceed the solubility constraint; data shows presence of non-aqueous phase liquid

The same contaminants at lower concentrations were observed in the next lower water bearing zone. However, this contamination is not continuous across the site.

Groundwater samples from deep zone monitoring wells did not indicate detectable concentrations of either semi-volatile or volatile organics above detection limits of 1 ug/l. PAHs were not seen above a detection level of 1 ng/l.

3.4 SURFACE WATER AND SEDIMENTS

A total of 18 surface water samples were collected in drainage ditches which border the site and are within the property limits. Data from these samples are shown in Table 3. Surface water data indicate that no PAH compounds were detected, while volatile organics (acetone and methylene chloride) were detected at two sample locations. However, these two compounds are believed to be due to laboratory cross-contamination. Several metals were detected in surface water samples (arsenic, zinc, lead, iron, copper, and nickel), with only arsenic exceeding the maximum contaminant level (MCL).

Five sediment samples were collected and chemically analyzed from the drainage ditches. PAH components were detected in each sample, with concentrations ranging from 2.3 mg/kg to 236 mg/kg. The highest PAH concentration was detected in the southern end of the site and is apparently related to trucking activity there. Volatile organic compounds were also found, but were limited to acetone and methylene chloride, typical laboratory solvents. Detected sediment metal concentrations at all of the on-site sample locations were similar to background condition.

3.5 AIR

Two phenolic compounds were observed upwind of the site at concentrations equaling or exceeding downwind levels and at levels typical of the Houston area. No site related compounds were found.

4. SITE RISKS

The potential risks from contaminated soil, groundwater, and sediments were calculated based on present site use and plausible future development conditions. Both carcinogenic and non-carcinogenic risks were calculated. The carcinogenic risks are theoretical quantifications of the excess lifetime cancer risk, that is, the incremental probability of cancer compared to the probability if no exposure occurred. For example, a 10^{-6} excess extra cancer risk represents an exposure that could result in one extra cancer case per million people exposed. Non-carcinogenic risks are determined by comparing potential exposures to contaminant specific reference doses. The reference dose is an estimate of a level that would not be expected to cause adverse effects in sensitive people.

TABLE 3

SURFACE WATER AND SEDIMENT CONCENTRATIONS[1]

Contaminant	Drainage Ditch Water	Drainage Ditch Sediments	Aquatic Water Standards[2]
Arsenic	56	30	360
Chromium	nd[3]	360	2,450
Copper	17	89	28
Lead	30	540	139
Zinc	140	3300	167
Benzene	nd	nd	5,300
Ethylbenzene	nd	nd	32,000
Toluene	nd	nd	17,500
Xylenes	nd	nd	
Acenaphthylene	nd	nd	
Acenaphthene	nd	nd	1,700
Anthracene	nd	nd	
Benzo(a)anthracene	nd	5.6	
Benzo(a)pyrene	nd	30	
Benzo(b&k)fluoranthene	nd	59	
Benzo(g,h,i)pyrene	nd	41	
Chrysene	nd	10	
Dibenzo(a,h)anthracene	nd	nd	
Fluoranthene	nd	32	3,980
Fluorene	nd	nd	
Ideno(1,2,3-cd)pyrene	nd	30	
2-Methylnaphthalene	nd	nd	
Naphthalene	nd	nd	680
Phenanthrene	nd	nd	
Pyrene	nd	44	
Total PAHs	nd	236	
Carcinogenic PAHs	nd	170	

(1) units of mg/kg for sediments, micrograms/l for water

(2) based on Texas water quality standards for acute toxicity, and federal ambient criteria for those contaminants for which there are no state standards

(3) na = not analyzed; nd = not detected

4.1 EXPOSURE PATHWAYS

The principal exposure pathways through which humans might potentially become exposed to contaminants at this site are defined in chapter 2 of the FS report as:

- inadvertent ingestion, dust inhalation, and direct contact with surficial soils by utility or construction workers;
- inadvertent ingestion and direct contact with surface soils by on-site commercial occupants;
- inadvertent ingestion and direct contact with drainage ditch sediments by trespassing children;
- inadvertent ingestion and direct contact with surface soils by future residents if the site is ever developed;
- ingestion of groundwater if contamination continues to migrate of if water supply wells are ever installed on-site.

The first three pathways represent current exposures resulting from normal commercial activity, likely industrial development, and occasional trespassing by children. People also could become exposed on a more frequent basis if the site is ever developed for residential purposes. This development would destroy the existing buildings and parking lots which would expose the contaminants now under those structures. The actual exposure in this case is not known because the contaminant levels under the structures cannot be monitored. Therefore, the exposure caused by future residential development could be higher.

The groundwater exposure pathway represents only a future scenario. There are no water supply wells in the upper aquifers within one mile of the site. On-site and neighboring residents are all served by the city water supply which originates from either a deeper well located more than 10 miles off-site or else a reservoir located over 20 miles from the site. The future groundwater pathway can become complete if migration of dense NAPLs continues or if an on-site well is installed.

4.2 POTENTIAL HEALTH RISKS

The exposure to site contaminants is of concern because some of the chemicals are potential carcinogens (ie. benzene, arsenic, and benzo(a)pyrene) or are otherwise toxic to humans (xylenes, toluene, and other metals). Some of these exceed health based reference doses, cancer risks, and drinking water standards (Tables 1 and 2).

EPA assessed the above pathways and contaminant concentrations in relation to risks to human health if no remedial action is taken. These risks are reported in the FS report and are summarized below as the aggregate risk to each receptor group from all site contaminants and pathways. These risks are upper bound estimates of potential effects on human health based on data collected during the Remedial Investigation; the true risks are most likely lower but could be higher if contaminant concentrations in some areas are higher than those sampled during the Remedial Investigation.

Receptor Group	Maximum Noncarcinogenic Hazard Index	Maximum Excess Lifetime Risk of Cancer
On-site Commercial Occupants	<0.01	$4x10^{-7}$
Utility Workers	<0.01	$2x10^{-7}$
Construction Workers	<0.01	$4x10^{-6}$
Trespassing Children	<0.01	$1x10^{-6}$
Potential Future Residents	<0.01	$1x10^{-5}$
Groundwater Users	5.6	$6x10^{-2}$

4.3 REMEDIAL GOALS

EPA concluded from the risk assessment that potential public health hazards exceeded EPA's maximum level for leaving contamination at a site. Using the exposure scenario which considers continued commercial use of the site, target remedial levels for selected chemicals were developed:

Environmental Medium	Contaminant	Remedial Level
Surface and Surficial Soils	Carcinogenic PAHs	700 ppm and no leaching potential
Groundwater	Carcinogenic PAHs	no detection
Groundwater	Benzene	5 ug/l
Groundwater	Ethylbenzene	142 ug/l
Groundwater	Toluene	28 ug/l
Groundwater	Xylene	440 ug/l
Groundwater	Arsenic	50 ug/l
Groundwater	Chromium	50 ug/l
Groundwater	Copper	28 ug/l
Groundwater	Lead	50 ug/l
Groundwater	Zinc	100 ug/l

The remedial level for soils was selected to prevent against an additional risk of cancer from exposure to soils of greater than 1 in 100,000 (10^{-5}) for on-site commercial occupants and also ensure against any non-carcinogenic hazards. The 10^{-5} cancer risk level was selected as appropriate for a commercial site where only a few people may ever become exposed. In addition, the cancer potency for carcinogenic PAHs may be overstated in the risk assessment. The actual potencies can be lower by 10 to 100 times; this would reduce the estimated cancer risk by 10 times at a minimum. The remedial level will also assure that contaminants will not continue to leach into the groundwater.

The remedial levels for groundwater were selected to comply with Federal drinking water standards, NPDES BAT requirements, and Texas water Quality standards which are relevant and appropriate requirements (see Appendix B for the list of ARARs) or reflect existing background groundwater concentration levels. The remedial level for carcinogenic PAHs was selected to assure that, in conjunction with other contaminants, the overall risk to potential consumers of groundwater will be less than 10^{-4}. A higher risk level was used for groundwater because the aquifers to be remediated are not being used as water supplies, nor are likely to be used because there are available water sources in the area. The actual risk will be lower as natural adsorption reduces the concentration of PAHs and metals. Levels were developed for copper and zinc based on the principle of keeping the hazard index less than 1.

From the Remedial Investigation results, approximately 3 acres of soil above 6 feet in depth and 50 million gallons of groundwater exceed these levels. Figures 4 and 5 show the areas of surficial soil and groundwater where remediation may be needed.

5. COMMUNITY RELATIONS HISTORY

Community concern of either area residents or local officials is very low at the site. The site is used by three trucking firms and is in a light industrial area. Therefore, citizen awareness and concern about the site is limited.

EPA held the first community meeting on September 11, 1985, to discuss the reasons for listing the site on the NPL and to present the schedule for the site investigation. Fact sheets were periodically mailed to local residents and interested parties to describe the field activities.

On August 12, 1988, EPA issued a press release and the Proposed Plan fact sheet. The press release was mailed to all news organizations in the Houston area; the fact sheet was mailed to 75 residents, the three on-site trucking firms, and local officials. Extra copies of the fact sheet were provided to the five local repositories for display.

In accordance with Section 117 of CERCLA, both the press release and fact sheet announced the comment period which began on August 22 and ended on September 19, 1988. A public meeting was held on August 29, 1988, at the Ryan Civic Center. Approximately 39 area citizens and local officials attended. The Responsiveness Summary which outlines all public comments and/or questions and EPA's replies is included in Appendix A.

6. SCOPE AND ROLE OF ACTION WITHIN SITE STRATEGY

The remedial activities at the South Cavalcade site have not been separated into operable units. Therefore, the site problems, remedial alternatives, and selected remedy described in this Record of Decision consider all contaminated media identified at the site.

7. ALTERNATIVE EVALUATION

In conformance with the National Contingency Plan (NCP), EPA screened initial remedial approaches to determine which might be appropriate for this site. The Feasibility Study describes the details of this evaluation. From these possible remedies, seven soil and four groundwater alternatives were chosen for detailed evaluation. The soil and groundwater alternatives are evaluated separately, and the best alternative from each will be combined to form the selected remedy. One other alternative, No Action, was also evaluated to comply with the requirements of the NCP.

7.1 DESCRIPTION OF ALTERNATIVES

Alternative #1: No Action

The no action alternative consists of continued groundwater and soil monitoring. Groundwater monitoring of PAHs, volatile organics and metals will occur twice a year. This monitoring scenario will be implemented to track the progress of the groundwater plume in the shallow ground-water zone and, for cost estimating purposes, will be assumed to continue for 30 years. Replacement of some monitoring wells may be required. The no action alternative also includes adding a notice to the deeds of each property.

Under the No Action alternative, contaminants will remain in the environment and continue to migrate vertically towards drinking water aquifers. Additionally, shallow groundwater aquifers will continue to be degraded through leaching of chemical compounds in the contaminated soils.

The costs are $95,000 capital, $31,000 annual operation and maintenance (O/M), and $384,000 present worth.

Soil Remediation Alternatives

There are several common elements to all soil remediation alternatives which include:

- Initial monitoring during the initial stages of the remedial design to more precisely define the areas of contaminated soil above the stated remedial action goals;

- Soils remediation only in areas which are accessible (soils under existing buildings or parking lots will not be remediated); and

- Restrictions on land use by adding a deed notice.

Alternative #2: In Situ Stabilization followed by Capping

Under this alternative, accessible soils with contamination above remedial goals will be chemically stabilized to prevent leaching of contaminants. The stabilization process will mechanically loosen the contaminated soils, adjust the soil moisture content, and then thoroughly mix soil with a stabilizing agent. The loosening and mixing would be conducted in place using construction equipment such as augers. The primary stabilizing agent would be determined during bench scale tests during remedial design. Once mixed, the material would be compacted with the top layer sloped to shed water. The compacted mixture would solidify in place and mechanically lock the contaminants within the soil. Following completion of the stabilization, a concrete cap would be built over the treated area and sloped to drain.

Alternative 2 can be completed in approximately 12 months. The costs are estimated at $14,300,000 capital, $50,000 annual O/M, and $14,800,000 present worth.

Alternative #3: Excavation with Disposal at Off-site Landfill

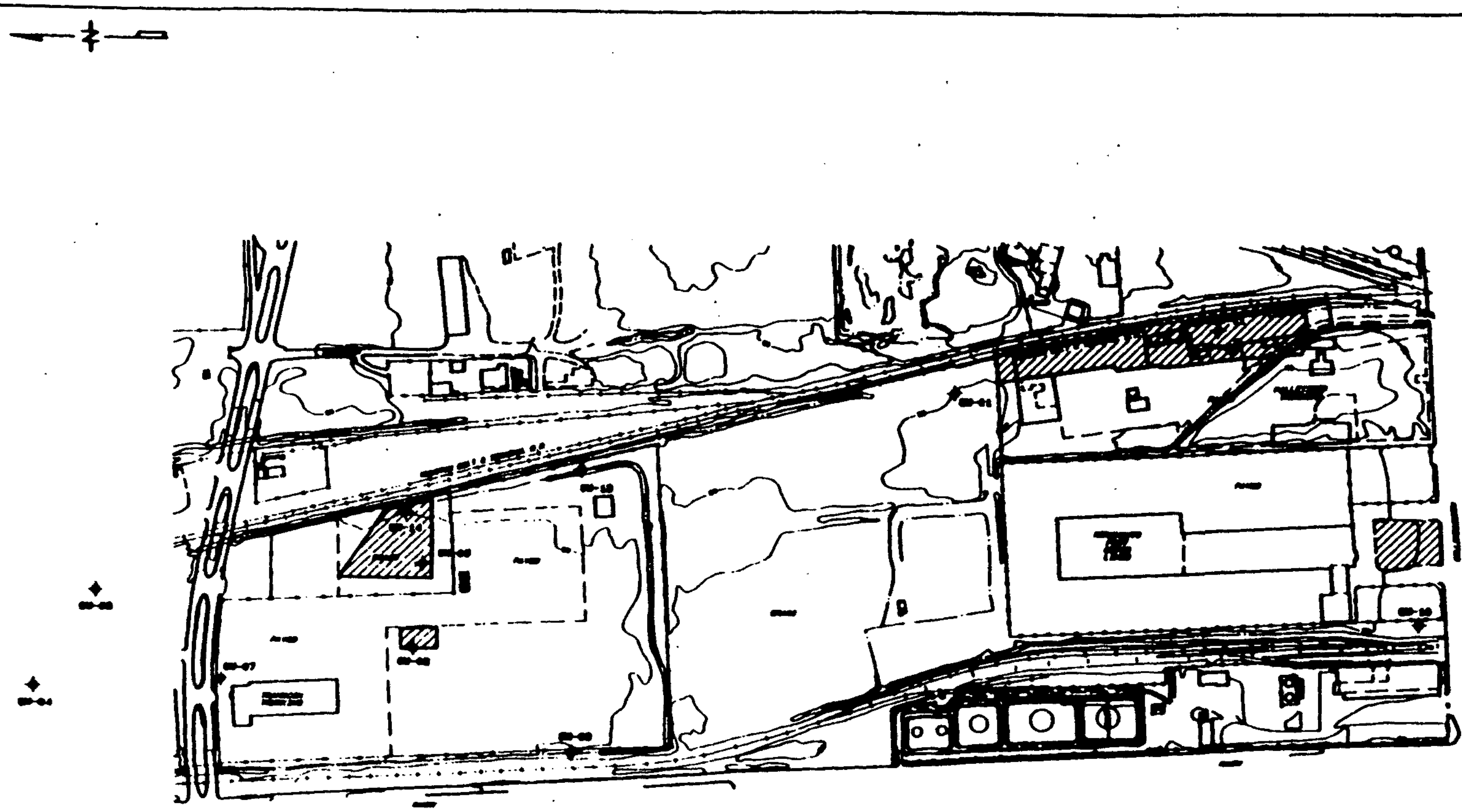
This alternative would excavate accessible soils containing contaminants above remedial action goals. Approximate areas requiring excavation are shown in Figure 6 and will be further delineated during the remedial design. Excavated material, estimated to be 30,000 cubic yards, would be transported to an off-site waste disposal facility. Following excavation, fill material will be placed in the excavated areas, and a minimum of 6 inches of soil cover would be placed on top of the fill material.

The contaminated soils will be removed and placed in a secure off-site landfill permitted to receive and dispose of these materials. The disposal facility will have appropriate state and federal permits.

Off-site disposal of contaminated soils should take approximately 38 months to complete. Costs are estimated at $10,000,000 capital and $10,000,000 present worth. No O/M would be required.

Alternative #4: Excavation with On-site Soil Washing

This alternative also involves excavation of contaminated soils areas as described in alternative #3. In this alternative, the excavated materials will be hauled to an on-site soil washing facility for treatment by washing the contaminants from the soil into a liquid medium. Laboratory results from a soil washing



LEGEND

APPROXIMATE AREA TO BE EXCAVATED.

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

SCALE (FEET)

FIGURE

SOIL EXCAVATION AREAS
SOUTH CAVALCADE, TX

KOPPERS COMPANY, INC.

study conducted during the Feasibility Study prove the removal efficiency and the optimum surfactant dosage for the site soils. In some cases, multiple washings may be required to reduce the contaminant concentrations to acceptable levels. The decontaminated soil will be redisposed in the excavation areas.

The soil washing unit will be constructed on-site within the central portion of the South Cavalcade site. After contact with the soil, the washing solution will be treated for removal of the contaminants and then recycled for additional soil washing. Wash waters from the process will be treated in the selected groundwater treatment system (see alternatives 9 through 12).

This alternative should take approximately 5 years to complete. The approximate costs for this remedy are $10,000,000 capital and present worth. No O/M would be required.

<u>Alternative #5: On-site Incineration of Soils</u>

This alternative would require an incinerator to be transported to or built in the central part of the site. Contaminated soils would be excavated as described in alternative #3, and transported to the incinerator to be burned. There are several ways to incinerate soils. In general, an incinerator first heats the contaminated soils to drive off hydrocarbon contaminants and then thermally destroys the contaminants. Upon completion, the incinerator will be removed from the site. The resulting ash, if shown to be non-hazardous by testing, would be placed back into the excavation areas and covered by a concrete cap. If the ash is found to be hazardous, it would be transported to an approved disposal facility.

This alternative should take between 2 to 4 years to complete. The approximate costs for this alternative are $10,000,000 capital and present worth. No O/M would be required.

<u>Alternative #6: In Situ Bioreclamation</u>

The in situ bioreclamation process for the South Cavalcade site vadose zone soils would treat the contaminated soil through the following steps. Water with appropriate chemical additives will be allowed to percolate though the contaminated soil areas. The enriched water will provide nutrients for the indigenous microorganisms, which will biodegrade the contaminants. The water will eventually flow into the groundwater where any contaminants that remain will be handled by one of the groundwater treatment alternatives. The percolation system will consist of near surface perforated pipe located over the contaminated soil areas to saturate the currently unsaturated soil zone.

This alternative should take between 5 - 10 years to complete. Costs are estimated to be $483,000 capital, $5,000 annual O/M, and $530,000 present worth.

Alternative #7: In Situ Soil Flushing

Under this alternative, contaminated soil areas would be remediated through an in situ soil flushing process. This flushing is a chemical-physical process of extracting contaminants from the soil matrix. A water solution, containing surfactants or other chemicals, is continuously passed through contaminated soil to release the contaminants. Once in solution, the contaminants are free to move out of the contaminated soil zone. The contaminants will in effect be leached out of the soil and travel into the groundwater. The contaminants which travel into the groundwater will be handled by one of the groundwater treatment alternatives. Treatment areas and methods are basically the same as for alternative #6 (In Situ Bioreclamation).

This alternative should also take between 5 - 10 years to complete. Estimated costs are $483,000 capital, $5,000 annual O/M, and $530,000 present worth.

Alternative #8: Excavation and Off-site Incineration

The partial excavation and off-site transportation process will be identical to that described in alternative #3. However, the excavated soils will be contained in 20 gallon plastic containers which is a requirement of the nearest off-site facility capable of handling the primary contaminants in the soils.

This alternative should take about 66 months to complete. Costs are estimated at $62,000,000 capital and present worth. No O/M would be required.

Groundwater Remediation Alternatives

There are three common elements to all groundwater remediation alternatives which are described as follows:

Long-term Groundwater Monitoring

In order to ensure the success of the selected groundwater remedial alternative, long-term monitoring will be required throughout the 30 year implementation time period. Additionally, due to the extended remediation period, some monitoring wells may need to be replaced. Monitoring of potential leaching of contaminants under buildings and parking lots would also be performed.

Groundwater Extraction and Re-injection System

All groundwater remedial alternatives involve construction of a series of groundwater extraction and re-injection lines to facilitate remediation of shallow water bearing sands (above 50 feet). The physical arrangement of these lines will be as follows for all groundwater alternatives. For the southern portion of the South Cavalcade site, the following components are proposed (details to be refined during the remedial design):

- A collection system will be located along the southeast corner of the property, and is intended to collect contaminant migration from the former coal tar operation.

- A second collection system will be located on the southern property border, located such that it intercepts contaminant migration from the former wood treating operations. In addition, this collection system will be designed to prevent contaminant migration past the southern portion of the site.

- A third collection line will be located along the southwestern property boundary, and would be similar in design to the other two collection systems. This collection system will intercept groundwater prior to leaving this portion of the site. West and downgradient from this extraction line would be two lines of re-injection wells.

For the northern portion of the facility, groundwater will be collected along a pumping line located on the eastern boundary. A re-injection system will be located upgradient along the eastern property line.

<u>Disposal of Non-Aqueous Phase Liquids</u>

Non-aqueous phase liquids (NAPLs) collected during groundwater remediation will be separated from groundwater and either sent to an off-site hazardous waste incinerator with appropriate federal and state permits, or recycled and used as a creosote product.

<u>Alternative #9: In Situ Biological Treatment of Groundwater</u>

With in situ biological treatment, extracted groundwater will be first treated in a physical/chemical separation treatment unit which will separate toxic metals and NAPLs from the groundwater. Most of the groundwater effluent will flow into a nutrient tank where appropriate additives will be added including oxygen and nutrients to promote microorganism growth and surfactants to help release contaminants from soil. This treated water will then be re-injected into the shallow aquifer through the re-injection system previously described. Naturally occurring micoorganisms would biologically destroy residual groundwater contaminants. The remaining portion of the extracted groundwater not re-injected would be discharged to the City of Houston's POTW.

This alternative should take approximately 30 years to complete. The approximate cost for this remedy is $3,500,000 capital, $325,000 annual O/M, and $6,500,000 present worth.

<u>Alternative #10: Carbon Adsorption and Filtration of Groundwater</u>

This groundwater treatment option consists of a chemical physical separation unit for the recovery of NAPLs followed by a high pressure filter to remove metal contaminants and suspended matter. Water from the filtration unit would flow to a carbon adsorption unit. Most of the effluent will be re-injected. Excess treated effluent from the carbon adsorption unit will be discharged to the adjacent drainage ditch which flows into Hunting Bayou. Surface water discharge will meet NPDES discharge requirements.

This alternative should take approximately 30 year to complete. Costs are estimated at $3,800,000 capital, $482,222 annual O/M, and $8,300,000 present worth.

Alternative #11: Carbon Adsorption, Air Stripping, and Filtration of Groundwater

This groundwater treatment option will be identical to option #10 except for the addition of an air stripping column. The air stripping unit will be installed to more effectively remediate volatile organic compounds in the groundwater and reduce activated carbon usage rate.

This alternative should take approximately 30 years to complete. Costs are estimated at $4,026,000 capital, 480,000 annual O/M, and 8,500,000 present worth.

Alternative #12: Aerated Tank Treatment of Groundwater

In addition to physical/chemical separation process for recovery of NAPLs, this treatment alternative will use an aerobic biological treatment system (activated sludge) to remove organic contaminants. Following the physical/chemical separation process, the groundwater will be pumped through the activated sludge system consisting of an aeration tank followed by a clarifier. Treated water will be re-injected into the aquifers. Excess treated groundwater will be discharged into adjacent drainage which flows into Hunting Bayou. Surface water discharge will meet NPDES discharge requirements.

This alternative should take approximately 30 years to complete. Costs are estimated at $4,490,000 capital, $454,000 annual O/M, and $8,700,000 present worth.

7.2 EVALUATION OF ALTERNATIVES

OSWER Directive 9355.0-21 prescribes nine criteria which EPA considers in selecting a remedy for a CERCLA site. These criteria address the specific requirements of Section 121(b)(1) of SARA.

EPA has assessed the degree to which each remedial alternative meets the nine selection criteria; Tables 4 and 5 summarize this assessment. For clarification, soils and groundwater remedial alternatives are discussed separately. The following values were used to compare the remedy selection criteria.

TABLE 4

COMPARISON OF SOIL REMEDIAL ALTERNATIVES
. SOUTH CAVALCADE STREET SITE

	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6	ALT 7	ALT 8
COMPLY WITH ENVIRONMENTAL LAWS	-	0	0	0	0	0	0	0
REDUCE								
TOXICITY	-	-	-	0	+	0	0	+
MOBILITY	-	0	0	0	+	0	0	+
VOLUME	-	-	-	0	0	0	0	0
SHORT-TERM EFFECTIVENESS	-	+	-	0	0	-	-	-
LONG-TERM EFFECTIVENESS	-	-	-	0	+	0	0	+
IMPLEMENTABILITY	+	-	+	0	-	0,-	0,-	+
COST(1)								
CAPITAL	0.10	14.3	10.0	7.0	10.4	0.5	0.5	62.0
O & M	0.03	<0.1	0.0	0.0	0.0	<0.1	<0.1	0.0
PRESENT WORTH(2)	0.38	14.8	10.0	7.0	10.4	0.5	0.5	62.0
COMMUNITY ACCEPTANCE	-	0	0	0	-	0	0	0
PROTECTION OF HUMAN HEALTH & THE ENVIRONMENT	-	-	-	0	0	0	0	0

Symbols:
- \+ = Compared to others, alternative exceeds criterion.
- 0 = Alternative can be designed to meet the criterion.
- \- = Compared to others, alternative will need special efforts to meet the criterion.

Notes: (1) Units of million dollars, reflects the maximum range of the cost estimates

(2) Based on 30 years at 10% interest

TABLE 5

COMPARISON OF GROUNDWATER REMEDIAL ALTERNATIVES
SOUTH CAVALCADE STREET SITE

	ALT 1	ALT 9	ALT 10	ALT 11	ALT 12
COMPLY WITH ENVIRONMENTAL LAWS	-	0	0	0	0
REDUCE					
TOXICITY	-	0	0	0	0
MOBILITY	-	0	0	0	0
VOLUME	-	0	0	0	0
SHORT-TERM EFFECTIVENESS	-	-	-	-	-
LONG-TERM EFFECTIVENESS	-	0	0	0	0
IMPLEMENTABILITY	+	-	0	-	0
COST(1)					
CAPITAL	0.10	3.50	3.81	4.03	4.49
O & M	0.03	0.33	0.48	0.50	0.45
PRESENT WORTH(2)	0.38	6.50	8.30	8.50	8.70
COMMUNITY ACCEPTANCE	-	0	0	0	0
PROTECTION OF HUMAN HEALTH & THE ENVIRONMENT	-	0	0	0	0

Symbols:
- \+ = Compared to others, alternative exceeds criterion.
- 0 = Alternative can be designed to meet the criterion.
- \- = Compared to others, alternative will need special efforts to meet the criterion.

Notes: (1) Units of million dollars, reflects the maximum range of the cost estimates

(2) Based on 30 years at 10% interest

+ Alternative would exceed a criterion compared to other alternatives.

0 Alternative can meet the selection criterion.

- Alternative would not meet the criterion without special efforts.

The rationale for the ratings assigned in this table follows:

CONSISTENCY WITH OTHER ENVIRONMENTAL LAWS

Appendix B identifies the Federal and State applicable or relevant and appropriate requirements (ARARs) for each alternative.

No Action & Soil Remedial Alternatives:

No Action is rated as "-" because it violates the intent of SARA Section 121 regarding the selection of a remedy and does not comply with the National Contingency Plan provisions to respond to a release.

All soil treatment alternatives are rated "0" since they can be designed to meet ARARs.

Groundwater Remedial Alternatives:

All groundwater alternatives have been rated "0" because each can be designed to meet all ARARs.

REDUCTION OF TOXICITY, MOBILITY AND VOLUME

No Action & Soil Remedial Alternatives:

No Action is rated as "-" because it does not reduce toxicity, mobility, or volume of the contaminants at the site. However, natural biodegradation will eventually reduce some contamination.

Off-site Landfill is rated as "-" for toxicity and volume of site contaminants, and as "0" for mobility since the contaminants will be placed in a secure landfill. In addition, the volume may increase if fly ash needs to be added to the soils to adsorb excess water before disposal.

In Situ Stabilization is rated as "-" for toxicity and volume, and as "0" for mobility since contaminants will be at least temporarily prevented from leaching. This alternative will actually increase the volume of the contaminated soil.

Soil Washing, In Situ Bioreclamation, and In Situ Soil Flushing are rated as "0" because the toxicity and leaching potential of contaminants at the South Cavalcade site would be reduced, and the contaminated soil volume would be reduced.

On-site and Off-site Incineration are rated as "+" for toxicity and mobility since they will provide the greatest reductions, and "0" for volume since the volume of contaminated soils being treated will be the same as for other treatment alternatives.

Groundwater Remedial Alternatives:

In Situ Biological Treatment and Activated Sludge Treatment have been rated as "0" because a significant reduction in organic contaminants can be achieved through biodegradation. Additionally, the physical/chemical separation will result in significant reductions in metals in the groundwater. NAPLs will be separated and either permanently destroyed through incineration or will be recycled as a creosote product.

Carbon Adsorption and Carbon Adsorption with Air Stripping are also rated as "0" because a significant reduction in organic contamination can be achieved through adsorption onto carbon. Once adsorbed, the carbon will be recycled through incineration. Significant and permanent reductions will also be achieved in metals and NAPLs as described above.

SHORT-TERM EFFECTIVENESS

No Action & Soil Remedial Alternatives:

No Action is rated as "-" because no existing exposure pathway will be remediated and current health risks will remain.

In Situ Stabilization is rated as "+" because the remedy can be quickly completed (10 - 12 months).

In Situ Bioreclamation and In Situ Soil Flushing are rated as "-" because of the extended time period to complete (5 - 10 years).

Soil Washing and On-site Incineration are rated "0" because, although excavation and materials handling could pose additional health risks to the health of on-site workers during remediation, these can be controlled by adherence to health and safety requirements and dust suppression if required.

Off-site Incineration and Off-site Landfilling are rated as "-" because, as for all alternatives involving excavation, on-site workers may be exposed to additional contaminants during excavation and handling, and there is always a risk for spills with off-site transportation of waste.

Groundwater Remedial Alternatives:

All groundwater alternatives have been rated as "-" due to the extensive time period of remediation (estimated to be 30 years). Additionally, there is a small potential risk in all alternatives that on-site workers will become exposed to contaminants in the extracted groundwater.

LONG-TERM EFFECTIVENESS AND PERMANENCE

No Action and Soil Remedial Alternatives:

No Action is rated as "-" because the potential human health and environmental risks would not be abated.

Off-site Landfill is rated as "-" because long-term monitoring and maintenance at the off-site landfill is required to ensure that contaminants are not released into the environment.

In Situ Stabilization is also rated as "-" due to the uncertainty regarding the permanent fixation of the organic contaminants in the stabilized soils.

In Situ Bioreclamation, Soil Washing, and In Situ Soil Flushing are rated as "0" because these alternatives in conjunction with a groundwater remediation will permanently destroy organic contaminants to below the remedial action goals.

On-site and Off-site Incineration are rated as "+" because they could destroy organic contaminants well below remedial action goals.

Groundwater Remedial Alternatives:

All groundwater remedial alternatives are rated as "0" because they can all be designed to remediate groundwater to defined remedial goals through permanent destruction of contaminants.

IMPLEMENTABILITY

No Action & Soil Remedial Alternatives:

No Action, Off-site Disposal, and Off-site Incineration are rated as "+" because they can be implemented without major capital acquisitions.

Soil Washing is rated as "0" because it can be implemented with known equipment and has already been tested with site soils.

In Situ Soil Flushing and In Situ Bioreclamation are essentially the same as the groundwater alternatives. They are rated as "0" for remediating soils in the northern and southwestern parts of the site because of the similarities with the groundwater alternatives, but as "-" in the southeastern corner because addition of water there can drive site contaminants under a railroad line and thereby make them inaccessible for remediation.

On-site Incineration and In Situ Stabilization are rated as "-". On-site Incineration requires consultation with the Texas Air Control Board for design specifications and operation requirements. In Situ Stabilization requires a significant amount of testing to identify the optimal stabilization agent for the site contaminants and soils.

<u>Groundwater Remedial Alternatives</u>:

In Situ Biological Treatment is rated as "-" due to uncertainties over the ability to discharge untreated contaminated groundwater to a City of Houston POTW. Currently the City of Houston prohibits the discharge into its treatment facilities of any priority pollutants. PAHs and benzene are priority pollutants and are contained in the groundwater. Additionally, implementation of this alternative would require that a re-injection line be installed on the southeast side across the railroad tracks adjacent to the site. It may not be possible to cross the tracks with the treatment system lines due to the railroad's right of way.

Carbon Adsorption with Air Stripping is also rated as "-". The air stripper presents a potential for air emissions. This alternative requires consultation with the Texas Air Control Board for design specifications and operation requirements.

All other groundwater alternatives were rated as "0" because the technologies involved have been used before with commercially available products.

<u>COST</u>

Tables 4 and 5 also list the estimated costs for each remedial action alternative including capital, operation and maintenance, and present worth costs. Replacement costs are factored into the operation and maintenance costs. The No Action alternative has the lowest present worth cost of all alternatives. The soil alternatives, in increasing order of cost, are In Situ Soil Flushing, In Situ Bioreclamation, Soil Washing, Off-site Landfill, On-site Incineration, In Situ Stabilization, and Off-site Incineration. The groundwater alternatives, in increasing order of costs, are In Situ Biological Treatment, Carbon Adsorption, Carbon Adsorption with Air Stripping, and Activated Sludge Treatment.

<u>COMMUNITY ACCEPTANCE</u>

Overall, the neighboring residents do not oppose remediation of the site unless an on-site incinerator is used. Therefore, all alternatives are rated as "0" except No Action and On-site Incineration which are rated as "-".

STATE ACCEPTANCE

The Texas Water Commission (TWC), the State regulatory agency for CERCLA sites, was briefed on all remedial alternatives on July 10, 1988. The TWC notified EPA by letter that the TWC had no objections to the selected remedy (see Appendix D).

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

No Action & Remedial Alternatives:

No Action is rated as "-" because it does not provide adequate protection from the potential risks involved with leaving untreated soils at the South Cavalcade site.

Off-site Landfill is rated as "-" because it may not be a permanent remedy and therefore only offers temporary protection to human health and the environment by containment.

In Situ Stabilization is rated as "-" due to the uncertainty with the long-term fixation of organic contaminants, and therefore, the potential remains for eventual leaching of these contaminants into drinking water aquifers.

Soil Washing, In Situ Soil Flushing, In Situ Bioreclamation, On-site Incineration and Off-site Incineration are rated as "0" because contamination in the soils will be destroyed to protective levels at or below the remedial action goals.

Groundwater Remedial Alternatives:

All groundwater alternatives are rated as "0" because they will all greatly reduce the concentrations of the primary constituents of concern in the groundwater, thereby reducing the possibility of long-term exposure and future site remediation. These alternatives pose only minimal threats to public health and the environment in the vicinity of the site.

8. SELECTED REMEDY

Based on the available data and analyses identified in the administrative record, EPA is selecting a combination of soil washing (alternative #4) and soil flushing (alternative #7) as the most appropriate solution for remediating contaminated soils, and activated carbon adsorption (alternative #10) as the most appropriate solution for remediating contaminated groundwater at the South Cavalcade site.

8.1 DESCRIPTION OF THE REMEDY

Soil Remediation: During the initial stages of the remedial design, contaminated soil areas will be sampled to better define areas which require remediation. All areas will be remediated where contaminants in soils exceed either the risk-based or leaching potential-based remedial goals. The risk-based goal is 700 ppm based on ingestion and direct contact with soils as previously presented in section 4.3. The leaching potential-based goal will be determined by the EPA Toxicity Characteristic Leaching Procedure (TCLP) test. EPA believes that the TCLP test will require removal of total PAHs at levels above 150 ppm because the leaching test during the Feasibility Study demonstrated leaching at this level. There are approximately 30,000 cubic yards which may need remediation.

In the southeast corner of the site, approximately 19,500 cubic yards of contaminated soils will be excavated and transported to the soil washing facility which will be constructed in the center portion of the South Cavalcade site. Wash water from the unit will be treated for removal of contaminants in the groundwater treatment system. The cleansed soils will be returned to the excavations and capped with concrete to maintain soil stability.

In the other parts of the site, contaminated soils will be remediated using in situ soil flushing. The contaminants which travel into the groundwater will be extracted and treated in the carbon adsorption waste water treatment system.

<u>Groundwater</u> <u>Remediation</u>: Groundwater will be remediated through extraction and treatment of contaminated groundwater, with re-injection to increase the hydraulic gradient and flow velocities. Approximately 50 million gallons of groundwater will need to be processed several times to recover and treat the NAPLs. Groundwater collection will continue until the groundwater contaminants have been recovered to the maximum extent possible. This point will be determined during the Remedial Action based upon operational experience in using the collection and treatment system, and it must be as close to drinking water standards and no detectable carcinogenic PAHs to the maximum extent possible. After this point is reached, the groundwater collection will cease and any remaining contamination be allowed to naturally attenuate to background levels.

Groundwater will be extracted and re-injected in a series of three groundwater extraction lines and two groundwater injection lines in the southern part of the site, and a minimum of one extraction line and re-injection line in the northern part. These wells will be screened in the shallow aquifer (approximately 10 - 20 feet below grade) and in the intermediate discontinuous sand lenses (approximately 50 feet below grade). The actual number of lines, locations and spacings of wells and well lines will be refined during remedial design.

The groundwater will be treated at an on-site wastewater treatment plant constructed in the center area of the site. Groundwater will be pumped into a physical/chemical separator followed by a pressure filter and an activated carbon filter. Any NAPLs collected and separated from the groundwater will be recycled as creosote or else incinerated off-site. The water will be treated to the remedial goals previously listed. Cleansed groundwater will be re-injected into the aquifer along with surfactants to help recover the contaminants. Any excess water will be discharged to the drainage ditch leading into the off-site Hunting Bayou in accordance with an NPDES permit.

Alternate Remediation Plan: If a potentially responsible party (PRP) can show that In Situ Biological Treatment of soil and groundwater will provide equal or better performance, and if the PRP can further ensure that the implementability questions can be resolved, EPA will consider these alternatives (#6 and #9). In this case, the performance goals and the groundwater extraction system will be identical to EPA's selected remedy, but the actual method of treatment will differ. Groundwater will be treated above ground in the physical/chemical separator and injected with nutrients and oxygen (if necessary). The treated groundwater will be added to the contaminated soil areas and re-injected into the aquifer system to encourage biological degradation of contaminants under the ground. Any excess water will be discharged into the city sewer system in accordance with a pretreatment permit and treated in a city municipal treatment plant.

Operation and Maintenance: The need for future operation and maintenance should be minimized since the primary sources of contamination will be removed through treatment. Site operation and maintenance will include installing a well screened in the 500 foot sand, monitoring groundwater wells, and monitoring ambient air during remediation. The groundwater monitoring program will continue for at least 30 years unless it can be shown during the Remedial Design, based on the results of the pilot groundwater collection system, that some shorter length of time is appropriate. This sampling program will monitor the effectiveness of the selected remedy and provide the data necessary to trigger future corrective action, if necessary. If the monitoring shows leaching from soils now under existing structures, then the site will need to be revisited to determine if further remediation is necessary.

Additional site maintenance would include, but not necessarily be limited to, inspections of surface vegetation, ensuring proper drainage, and proper operation of any actions such as groundwater treatment which may extend beyond the time required for the source control remedy. The details of these activities will be defined in the Operation and Maintenance Plan of the remedial design. The monitoring data will be evaluated during the Agency's 5-year review, in accordance with SARA Section 121 (c), to determine if any corrective action is necessary.

Protection Achieved: This remedial goal prevents against an excess lifetime increased cancer risk of $8x10^{-6}$ for likely on-site exposure to soil and $4x10^{-5}$ for groundwater users, and keeps exposure to non-carcinogenic compounds below the reference dose.

EPA is using these cancer risks as a remedial goal instead of $1x10^{-6}$ because of the cancer potency factors for carcinogenic PAHs and the liklihood for exposure. EPA considered all potentially carcinogenic PAHs to be as potent as benzo(a)pyrene because the agency has not published cancer potency factors for the other PAHs. EPA recognizes that the other potentially carcinogenic PAHs may be less potent by factors of 10 to 100 times, and is now in the process of developing cancer potency factors for other PAHs. In addition, the site is already extensively developed for use as an industrial areas, and a 10^{-5} risk level or less is typically used for industrial areas. Also, the contaminated aquifer is not presently used as a water supply, nor will it likely be used because there are other available sources of water in the area.

8.2 STATUTORY DETERMINATIONS

Section 121 of SARA requires the selected remedy to be protective of human health and the environment, be cost effective, use permanent solutions and alternative treatment or resource recovery technologies to the maximum extent possible, be consistent with other environmental laws, and prefer treatment which significantly reduces the toxicity or mobility of the hazardous substances as a principle element. EPA believes that the selected remedy best fulfills the statuatory and selection criteria as compared to the other solutions evaluated herein.

Protection of Human Health and Environment

The selected remedy will reduce soil contamination to prevent an additional risk of cancer of $8x10^{-6}$, prevent any non-carcinogenic hazards, and prevent continued leaching of creosote compounds from soils into groundwater. It does this by treating the soils. For groundwater, it also prevent an additional risk of cancer of $4x10^{-5}$, prevents any non-carcinogenic hazards, and prevents the continued off-site migration of contaminated groundwater. It does this by treatment; therefore, the risks will not increase in the future due to a failure of the remedy. Short-term risks will be controlled by suppressing dust, enclosing excavations in temporary domes (if necessary), and requiring the fence around the site be maintained throughout remediation.

Cost Effective

The present worth of the selected remedy is $13 million and is the lowest cost of all alternatives which either meet or exceed the nine evaluation criteria. EPA believes that remedies with higher costs do not provide any further benefits. EPA also believes that remedies with lower costs may cause incomplete remediation. Therefore, EPA believes that the overall effectiveness of the selected remedy is a reasonable value for the costs.

Permanent Solutions to Maximum Extent Possible

EPA believes the selected remedy is the most appropriate solution for meeting the remedial goals by providing the best balance among the evaluation criteria for the alternatives. This remedy provides effective protection of human and environmental receptors over the short- and long-term, protects against off-site and deeper migration of groundwater, is readily implemented, is cost effective, permanently treats those contaminants in soils or groundwater, and recycles (if possible) recovered creosote. Soils are treated by desorption, and groundwater is treated by physical/chemical and activated carbon treatment. However, long-term monitoring and maintenance of the groundwater collection and treatment system will be necessary due to length of time necessary to cleanse the groundwater and the unknown potential for soils under existing structures to leach.

Consistent with Other Environmental Laws

The selected remedy can be designed to attain other environmental laws. The laws applicable or relevant and appropriate to CERCLA activities are called ARARs. Appendix B lists all the ARARs which were initially identified for this site in the Feasibility Study. The specific ARARs for the selected remedy are described below:

National Primary Drinking Water Standards: Groundwater treatment performance will attain all final Maximum Contaminant Levels (MCL). Table 2 listed the MCLs for contaminants found on the site.

National Secondary Drinking Water Standards: Groundwater treatment performance will attain all final secondary drinking water standards. Table 2 listed these for contaminants found on the site.

Maximum Contaminant Level Goals (MCLGs): This is not an ARAR, but is another factor to be considered. Groundwater treatment performance will attain the MCLGs for those contaminants where the MCLs have yet to be promulgated.

Underground Injection Control Regulations: The wells through which treated groundwater will be re-injected into the aquifer will be designed to comply with the Class V well regulations.

Water Quality Criteria: Discharge of excess treated water (that not re-injected) will comply with these criteria for compounds not regulated by state water quality standards. The discharge, after dilution with Hunting Bayou, must not exceed these criteria.

National Pollutant Discharge Elimination System: Discharge of excess treated water will comply with Best Available Technology (BAT) and water quality standards. The BAT treatment performance is considered equal to that required for the Organic Chemical, Plastics, and Synthetic Fibers (OCPSF) effluent guidelines which were promulgated by EPA for discharges from organic chemical facilities including those manufacturing creosote-type products. The discharge will not exceed these criteria. In addition, the discharge, after dilution with Hunting Bayou, must not exceed the water quality standards. A permit will be required because the point of discharge will be off-site.

National Pretreatment Standards: Discharge of excess treated water will comply with these standards by also complying with Best Available Technology for OCPSF facilities. Pretreatment requirements for these facilities are equal to those for BAT.

Occupational Safety and Health Act: Remedial action will be conducted consistent with the OSHA regulations for personnel protection and safety.

Hazardous Materials Transportation Act: Off-site transport of recovered creosote will require handling in a manner consistent with this act.

RCRA Standards Applicable to Generators and Transporters of Hazardous Waste: Off-site transport of recovered creosote for incineration or recycling will require manifesting.

Releases from Solid Waste Management Units (40 CFR 264(F)): Groundwater not recovered will comply with the levels required by this regulation.

Tanks (40 CFR 264(J)): Tanks temporarily storing recovered creosote will be designed to comply with this regulation.

Land Disposal Restrictions: Restrictions have yet to be promulgated for CERCLA soils and debris contaminated with RCRA wastes. Despite the absence of regulations, the treatment methods used as parts of the remedial action satisfies the statutory requirement to "...substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized."

Texas Allowable Limits of Metals in Drinking Water: Groundwater treatment performance will attain these levels.

Texas Water Quality Standards for Surface Waters: Discharge of excess treated water will comply with these standards. The discharge, after dilution with Hunting Bayou, must not exceed these standards.

Texas Prohibition of Air Contaminants which Adversely Affect Human Health: Soil disturbance will be minimized during remediation to assure compliance with these regulations. If necessary, an inflatable dome can be constructed over the soil areas to contain any release. Air will be monitored during remediation to observe compliance.

Texas Storage of Volatile Organic Compounds: Tanks temporarily storing recovered creosote and associated volatile compounds will be designed to comply with this regulation.

Texas Oil/Water Separators: The oil/water separator in the groundwater treatment system will be designed to control volatile emissions as required by this regulation.

Texas Vacuum Producing Systems: The groundwater recovery system uses a vacuum. This system will be designed to prevent emissions requiring incineration under this regulation.

Preference for Treatment as a Principal Element

The principal threats at this site are potential exposure to contaminated soils and potential future exposure to contaminated groundwater. The selected remedy uses treatment for the remediation of both soils and groundwater. Soil washing and in situ soil flushing will desorb carcinogenic PAHs and metals from soils and allow for eventual treatment with the recovered groundwater. Oil/water separation, filtration, and activated carbon adsorption will remove contaminants from groundwater.

8.3 FUTURE ACTIONS

The selected remedy completes the remediation of the principal threats at the site. EPA will send a Special Notice to all potentially responsible parties to offer them the opportunity to conduct the Remedial Design and Remedial Action. The proposed schedule for remediation, assuming that Remedial Design and Remedial Action negotiations were to fail, is as follows:

Approve Remedial Action by Signing the Record of Decision	September 1988
Start Remedial Design	December 1988
Complete Remedial Design	December 1990
Start Remedial Action	March 1991

APPENDIX A

RESPONSIVENESS SUMMARY

South Cavalcade Street
Community Relations Responsiveness Summary

This Community Relations Responsiveness Summary has been prepared to provide written responses to comments submitted regarding the proposed plan of action at the South Cavalcade Street Superfund site. The summary is divided into two sections:

Section I: Background of Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during the remedial planning activities at the South Cavalcade Street site.

Section II: Summary of Major Comments Received. The comments are summarized and EPA's responses are provided.

I. Background of Community Involvement and Concerns

Reported citizen concern regarding this site has been minimal. No known public interest groups have been formed, and concern about the site is very limited. Media coverage of the site has been scarce.

In August 1985, EPA held a meeting to announce the start of the remedial investigation. Thirty-one citizens attended; however, few attendees lived in the immediate area. Progress reports were issued in April and July of 1987. These two updates did not generate any comments, questions or concerns.

II. Summary of Major Comments Received

The press release and Proposed Plan fact sheet announcing the public comment period and public meeting were released on August 12, 1988. The comment period began on August 22, 1988, and ended on September 19, 1988. The public meeting was held with area residents and local officials on August 29, 1988, at the Ryan Civic Club. The purpose of this meeting was to explain the results of the Remedial Investigation and to outline the various alternatives presented in the Feasibility Study. Thirty nine citizens attended the meeting, and eight people made oral statements or asked questions. Two letters containing written comments were received from potentially responsible parties.

Overall, the residents, on-site businesses and local officials do not oppose the proposed plan. During the public comment period, there were comments and questions regarding the following:

Comment #1: What are the current health problems at the site?

EPA Response: EPA conducted a risk assessment using the data from the site. From this assessment, EPA calculated a maximum additional risk of cancer of $1x10^{-5}$ and no non-carcinogenic health threats from exposure to soils. EPA also calculated a risk of cancer of $1x10^{-2}$ and potential non-carcinogenic health threats from exposure to groundwater in the upper aquifers if this water is ever used as a source of drinking water. In addition, the levels of benzene, arsenic, chromium, and lead in the groundwater may exceed drinking water standards.

Comment #2: Why was this site added to the Superfund list?

EPA Response: EPA was concerned about continued migration of site contaminants into deeper aquifers which are now used as sources of drinking water.

Comment #3: How will the proposed remedy protect the health of the community and minimize the risk to health?

EPA Response: The proposed remedy will achieve the remedial goals for soils and groundwater. The goals for exposure to soils are to prevent an additional risk of cancer from exceeding 1×10^{-5} and to prevent any non-carcinogenic health threats. The goals for groundwater achieve drinking water quality in the groundwater. These goals will be achieved throughout the site.

Comment #4: Will you hold any more meetings about the proposed alternatives or if you decide to use another alternative which was discussed at the public meeting?

EPA Response: The public meeting on August 29, 1988, is the only public meeting which will be held about the proposed remedy and the alternatives evaluated during EPA's studies. One objective of the public meeting is to hear the public's opinions about all alternatives. Therefore, EPA will not hold another meeting if one of the discussed alternatives is selected.

Comment #5: How will you continue to advise people about the decision about the site and any future activities or decisions?

EPA Response: EPA will continue to inform all people who have shown an interest in the site about the decision and future activities. EPA will mail informational fact sheets to all people who have given EPA their address and will hold public meetings as needed to explain future activities. EPA will continue to inform the public until the site has been completely remediated.

Comment #6: How does EPA know that soil washing will work at this site?

EPA Response: EPA has seen this remedy used or selected at other sites where polynuclear aromatic hydrocarbons (PAHs) are the primary contaminants. This shows that soil washing is a process which can remove PAHs if site conditions are favorable. In addition, the Koppers Company conducted a test using soils from the South Cavalcade site which showed that site contaminants can be effectively washed from soils.

Comment #7: Will you continue to conduct studies to determine if the proposed remedy will work?

EPA Response: EPA will conduct further studies only to refine the design of the selected remedy. EPA is not proposing to continue to study the site with the objective of deciding whether the selected remedy will work.

Comment #8: How likely is it that bioreclamation of the aquifers will be used?

EPA Response: EPA requested comments on bioreclamation because one potentially responsible party (PRP) has proposed using this method to remediate the aquifer. This method will only be used if any PRP offers to construct and operate this method, and if the PRP can solve the implementation problems of this method.

Comment #9: Creosote needs to heated to 400 degrees to be used. How will EPA heat the creosote in the groundwater?

EPA Response: The creosote-type contaminants in the groundwater migrated there without being heated. The Koppers Company was able to easily collect samples of these contaminants during the Remedial Investigation. Therefore, EPA believes that these contaminants can be removed from groundwater without needing to add heat.

Comment #10: Did you consider the geology of Houston when you considered the soil washing and groundwater pump and treat system? Did you consider that PAHs aren't extremely mobile and will adhere to soils?

EPA Response: EPA considered the local geology and the nature of PAHs by requiring tests of soil washing and groundwater pumping. The Koppers Company during the Feasibility Study conducted a laboratory test which showed that PAHs can be washed off of soils. The Koppers Company also conducted a pump test which showed that groundwater can be extracted.

EPA also recognizes that PAHs are not very mobile in soils. Typically the PAHs will not migrate very far because clay soils will prevent migration. However, the soils under the South Cavalcade site contain small fractures called slickenslides which offer a path for PAHs to migrate downwards with only a minimum of adsorption onto soil.

Comment #11: Do you intend to implement any type of pump and treat system to stop contaminant migration in groundwater while you conduct further studies on the site?

EPA Response: EPA does not believe that the groundwater contamination will significantly migrate during the time the remedy is designed and installed. The contamination has only migrated 60 feet downwards in approximately 70 years. The horizontal groundwater velocity is less than 20 feet per year. The contamination should not significantly migrate in one more year.

Comment #12: Can you accurately predict the progress of the bioreclamation process, and what reassurance do you have that the process itself is not hazardous to the environment? Are there chlorinated hydrocarbons or pentachlorophenol at the site?

EPA Response: PAHs consist of large molecules containing carbon and hydrogen arranged in a series of rings. Bioreclamation would detoxicify PAHs by breaking the rings to form smaller molecules which are not hazardous. Since there are no chlorinated organics including pentachlorophenol at the South Cavalcade site, bio-reclamation would not cause any toxic chlorinated organic compound to be formed.

Comment #13: We want signs posted on the site indicating the toxic wastes which may be present.

EPA Response: EPA does not believe that signs of this type are warranted at the South Cavalcade site. The health-threatening contamination is mostly underground; people will not contact the contamination unless they dig in the contaminated areas. All three property owners have been notified of these areas and know not to dig in these areas without taking reasonable precautions. The site is already secured by a 10 foot fence which prevents the general public from going onto the site.

Comment #14: We feel that the area is too highly populated to have an on-site incinerator there. It would further damage the air quality around our neighborhoods.

EPA Response: EPA evaluated on-site incineration as one of several alternatives for remediating soils. However, EPA did not propose on-site incineration for use at this site, partially because of the present air quality problems in Houston.

Comment #15: We feel that all the soil should be taken out completely, incinerated off-site, and be replaced with good soil.

EPA Response: EPA did not propose off-site incineration for two reasons. First, there is always a risk when transporting hazardous substances to an off-site location. Second, off-site incineration is more than 10 times as expensive as other alternatives which are just as effective for cleaning soils to levels which are not health-threatening.

Comment #16: We feel that if you are going to wash the soil, there is only so much you can wash out of the soil.

EPA Response: The Koppers Company conducted a study to determine the ability to wash contaminants out of soils. This study was reported in the Feasibility Study and showed that contaminants can be removed to well below the remedial goal for this site. Therefore, EPA believes that all contaminants posing an unacceptable risk can be removed from the soil.

Comment #17: What alternatives are proposed for the site?

EPA Response: EPA proposed a combination of soil washing and in situ soil flushing for remediating the soils, and extraction and treatment using physical/chemical and activated carbon treatment for groundwater. These are the alternatives labeled as 4, 7, and 10 in the fact sheet.

Comment #18: Will the remediation be bidded out to a contractor?

EPA Response: Eventually, there will be construction at the site which will be bidded out. Under the Superfund law, either EPA or a potentially responsible party (PRP) under EPA's supervision will conduct the remediation. Therefore, either EPA or a PRP will request bids sometimes in the future.

Comment #19: When do you anticipate to start remediation?

EPA Response: EPA anticipates making a decision on the site remedy in September of 1988. After that, the Superfund law allows for a 120 day period during which a potentially responsible party can offer to conduct the remedy. The design of the remedy will take about eight to ten months. Therefore, the actual remediation should not start until about fall of 1989.

Comment #20: Is any of the buildings going to be torn down? Are you going to tear up any of the concrete?

EPA Response: EPA is proposing to only remediate those soils which are not under existing buildings or concrete. The soils under these structures are not accessible; therefore, there is no exposure by workers to these contaminants. The concrete and buildings prevent water from leaching into the soils and re-mobilizing contaminants. The contaminated groundwater under the structures can be extracted with wells; therefore, there is no need to destroy the buildings and concrete at this time.

Comment #21: If there are contaminants underneath the concrete or buildings, wouldn't they continue to contaminate groundwater?

EPA Response: The contaminants will leach only if rainwater is allowed to percolate through the soils to re-mobilize the contaminants. One way of preventing this is to cover contaminated soils with an impervious cap such as concrete. The concrete and buildings provide an effective cap. Therefore, EPA does not believe that these contaminants will continue to leach.

Comment #22: How long will you continue to monitor to see if contaminants under the structures will continue to leach? How soon after you clean up the aquifer will you be able to tell if contaminants are leaching?

EPA Response: EPA will continue to monitor groundwater throughout the groundwater remediation so that EPA can observe if the site contaminants are continuing to migrate. Monitoring could continue for up to 30 years or even longer. A reasonable estimate of this time cannot be calculated until the extraction and treatment system is installed and operating. According to the Superfund law, EPA will review the site data every five years to determine if contaminants are continuing to leach and to refine the duration of continued monitoring.

Comment #23: How much of the contaminated soil is actually under the concrete?

EPA Response: The site consists of 64 acres. There are 5.5 acres which contain contamination which may need remediation. Approximately 3 acres of these soils are under the concrete and buildings.

Comment #24: Is it the cost of tearing down the buildings and concrete or the concern for destruction of businesses which is your reason for leaving contaminants on-site?

EPA Response: EPA is not proposing to tear down the buildings or concrete only because this activity would disrupt the on-site businesses. Some of the contamination is located under the only access to the site which the trucking firms need for continued operation. EPA will tear down the structures to remediate this contamination only after EPA has solid information showing that the contaminants under the structures will continue to leach. EPA will continue to monitor the groundwater during remediation to determine if the contaminants are leaching.

Comment #25: Has there been any idea of drilling through the concrete to see whether or not there is contamination in the groundwater?

EPA Response: As part of the site Remedial Investigation, the Koppers Company did drill through parts of the concrete to determine whether there was contamination under the concrete. Only a few holes were drilled because the drilling activity had to stay out of the way of trucking operations. This activity did identify the areas of contamination under the concrete. These areas were shown on a slide during the public meeting and are also shown on figure 6-1 in the Remedial Investigation report.

Comment #26: Does your branch of EPA deal with existing operating plants, or just abandoned plants?

EPA Response: The Superfund part of EPA deals only with those sites which are abandoned. There is also a part of EPA which deals with active hazardous wastes sites; this is the Resource Conservation and Recovery Act (RCRA) part of EPA.

Comment #27: There was a creosoting company on Oliver Street. SP Railroad had a plant on Wallaceville Road. General American Tank Farm used to store their creosote at Galena Park. There was a creosoting plant at Crosstimbers and Hardy. Have you done anything to clean those up?

EPA Response: There is a group inside EPA and the Texas Water Commission (TWC) which investigates all sites for inclusion on the Superfund list. There are approximately 30,000 sites across the country which are being or will be investigated, and there are roughly 1000 on the Superfund list. If EPA or TWC finds evidence at these sites that contaminants may pose a threat to human health, then these sites may be added to the Superfund list.

Comment #28: At the intersection of Crosstimbers and Hardy, a company put a lot of creosote-type contaminants under a plastic sheet under the Hardy Toll Road. Why can't EPA do something like this at the South Cavalcade site?

EPA Response: The Superfund law requires EPA to select a remedy with a preference for treatment as a principal element in the remedy. The law also requires EPA to comply with other environmental laws. The action taken by a company at the Crosstimbers and Hardy site did not use treatment nor does it comply with EPA regulations for disposal of hazardous wastes. Therefore, EPA cannot use the approach taken by that company.

In addition, EPA is now investigating the Crosstimbers and Hardy site to determine if there is just cause for including that site in the Superfund program.

Comment #29: The Koppers Company had a site in Texarkana. What are you going to do there?

EPA Response: EPA is in the process of determining the remedy for that site. EPA evaluated several alternatives and proposed soil washing for contaminated soils with extraction and treatment using activated carbon for groundwater. This remedy is very similar to the proposed remedy for the South Cavalcade site.

Comment #30: Are former site owners still responsible if they no longer own the property?

EPA Response: Under the Superfund law, current property owners and former owners at the time when hazardous substances leaked or otherwise were released into the environment can be liable. At this site, the Koppers Company was the property owner at the time when hazardous substances could have leaked into the groundwater. Therefore, EPA identified the Koppers Company as one of the potentially responsible parties.

Comment #31: What if site owners excavate and remove the contaminated soil, add a building, or extend the concrete slab?

EPA Response: EPA has contacted the site occupants to ask them to keep EPA informed about any activity at the site. EPA notified the site occupants that, if they developed any area which needs some remediation, they would be partially responsible for some of the costs for remediating that area of the site.

In addition, EPA will be requiring the site owners to add a notice to their deeds expressing that hazardous substances are located under concrete and buildings. EPA will require this to notify any potential purchaser of the site about this contamination.

Finally, EPA considers part of the soils on the site to be hazardous and therefore subject to EPA regulation. If EPA found that a site owner excavated and disposed contaminated soil before the remediation began, EPA would take enforcement action against that owner. However, EPA does not believe that it is in the interest of any site owner to do this at this time because the costs of that action to the site owner could be greater than the costs of remediating the soils using EPA's proposed remedy.

Comment #32: Have you approached the present owners with your proposal? What do they say?

EPA Response: EPA mailed information to each site business and met with them prior to the August 29, 1988, public meeting. Two of the businesses had no objection to the proposed remedy as long as it would not interfere with their operations. The other business feels that a concrete cap would solve the soil problems at their property.

EPA reassured all three businesses that they would be consulted in the design of the remedy so that interference with the business operations could be minimized.

Comment #33: What can the community do if the owners are not cooperating in the cleanup?

EPA Response: Under Section 310(a)(1) of the Superfund law, citizens have the right to file suit against any potentially responsible party to require that party to remediate a site. This section of the law also limits these suits to those sites where EPA has yet to take any enforcement action. At the South Cavalcade site, EPA has taken action leading to eventual remediation of the site.

Comment #34: Koppers re-emphasizes the need to sample the soils within areas targeted for potential remediation during the Remedial Design phase to determine the actual areas needing remediation.

EPA Response: EPA will require in the Record of Decision that the soils in these areas be sampled for this purpose. This was stated in the Feasibility Study, and it was also discussed in the Proposed Plan and during the public meeting.

Comment #35: Koppers proposes that some flexibility be included in the Record of Decision definition of the leaching potential of these soils to incorporate the results of such sampling.

EPA Response: EPA will require in the Record of Decision that the Toxicity Characteristic Leaching Procedure (TCLP) be used in assessing leaching potential. The interpretation of the endpoint of the TCLP test can be developed during the Remedial Design.

Comment #36: Koppers re-emphasizes that remediation of the upper aquifer will be achieved to the maximum extent practical as stated in the Feasibility Study report. The EPA has suggested that removal of the non-aqueous phase liquids is a remediation goal. It is not clear what EPA means by this term and as such it is uncertain whether this can be practically accomplished. However, Koppers suggests that the measure by which the parties determine compliance with the response objective be flexible so to allow for operational experience to bring practicality to the decision.

EPA Response: EPA observed, during the Remedial Investigation, an oily substance in some of the groundwater samples. EPA considers this substance to be a "non-aqueous phase liquid". EPA believes that this liquid needs to be removed from the aquifer to prevent the continued downward migration of sinking substances into aquifers usable as sources of drinking water. EPA will assess the means for determining when the non-aqueous phase liquid has been effectively removed during the Remedial Design.

Comment #37: Koppers proposes to investigate bioreclamation of surface, surficial and subsurface soils at the same time it considers in situ biological treatment of the groundwater. If the studies undertaken during the Remedial Design prove to be effective, Koppers agrees with EPA that in situ biological treatment should be considered as the remedial action of preference.

EPA Response: EPA presented this option in the Proposed Plan and during the public meeting. EPA will include in situ biological treatment in the Record of Decision as an alternative remedial action in the case a potentially responsible party elects to construct and operate this method of treatment.

Comment #38: Koppers further proposes that the selection between groundwater treatment options be made during the Remedial Design phase so that the most cost effective option which meets the discharge criteria and remediation goals can be chosen.

EPA Response: EPA believes that the differences between the groundwater treatment options (alternatives #10, #11, and #12) are distinct. Alternative #11, Carbon Adsorption with Air Stripping, has the potential for air emissions of volatile organics. The air in the Houston area is already over acceptable state and federal air quality levels. Alternative #12 is approximately $400,000 more expensive than EPA's selected remedy; EPA believes that the selected remedy will be less expensive even after further studies into the alternatives.

Comment #39: Merchants Fast Motor Lines feels that EPA has not provided a reasonable opportunity for public comments with respect to the South Cavalcade Street site, and requests that the comment period be extended for an unspecified duration. Merchants received a copy of the Feasibility Study on August 23, 1988. The public comment period ends on September 19, 1988. Merchants feels that the 30 day comment period is insufficient to review the six volumes comprising the Remedial Investigation and

Feasibility Study reports. Merchants also believes that EPA required that the Feasibility Study report to be written in a 30 day period.

EPA Response: EPA provided a 30 day comment period for the Remedial Investigation and Feasibility Study reports. This period is in agreement with proposed EPA regulations for public comment on these reports, and it exceeds the existing regulation which calls for a 21 day comment period. EPA notes that Merchants had the reports for the full 30 days.

EPA also notes that the four of the six volumes of the reports are appendices which contain supporting information for the two volumes which comprise the analysis of the site. EPA feels that 30 days is sufficient for review of the two volumes which contain the substance of the analyses.

EPA disagrees with the contention that the Feasibility Study report was written in 30 days. EPA had negotiated a schedule with the Koppers Company which required that action on the Feasibility Study report begin upon submittal of the draft Remedial Investigation report in February of 1988. EPA acknowledges that it required that Koppers take no more than 30 days to revised the draft Feasibility Study report to comply with EPA's comments. However, EPA notes that this 30 day requirement was negotiated with Koppers in March of 1985, and it is also a standard clause in EPA agreements with potentially responsible parties who conduct RI/FS studies for EPA.

Comment #40: Merchants feels that the Record of Decision should provide for flexibility by requiring re-evaluation of the selected remedial alternative and consideration of new alternatives following investigations during the Remedial Design. Merchants suggest that the investigations should include additional soil samples, pump test, and unspecified other investigations.

EPA Response: EPA rejects the suggestion that other alternatives should be considered during the Remedial Design. EPA believes that a wide range of alternatives were evaluated during the Feasibility Study, and that further analysis would not result in a different remedial alternative being selected.

EPA will conduct additional studies during the Remedial Design to help design the details of the selected remedy. For example, EPA will resample the soils within the areas of contamination to better identify the soils needing remediation. Studies of this type are usually conducted at Superfund sites.

Comment #41: Merchants believes that the soil remediation goal of 700 ppm carcinogenic PAHs needs to be re-evaluated. Merchants believes that the goal was based on limited soil data (two samples), and the value used to characterize the PAHs in the soils (29 mg/kg) is low by a factor or 40. Merchants also believes that the soil remedial goal is 70 to 700 times greater than those used at other similar sites.

EPA Response: EPA agrees that the quantitative soil data for the site is scarce and that 29 mg/kg probably does not characterize the maximum PAH concentration at the site. However, the remedial goal is not based on the existing soil concentrations. It is based instead upon assumptions of frequency of exposure, the potencies of the chemicals, and an maximum incremental increase in cancer risk of 1 in 100,000 (10^{-5}). EPA required that these assumptions be consistent with those used at other Superfund sites investigations.

EPA also notes that the soil remedial goal comprises of two parts: a health-based level of 700 ppm carcinogenic PAHs and a leaching potential-based level which is determined by a soil testing method. The more stringent of the two will apply. EPA could not establish a numerical criterion for preventing leaching because the soil and waste characteristics which affect leaching can vary across the site. Therefore, EPA is requiring within the Record of Decision that the Toxicity Characteristic Leaching Potential (TCLP) test be used for this. EPA expects that the leaching potential may be the more stringent criterion because a leaching test conducted during the treatability study in the Feasibility Study showed leaching at concentrations greater than 150 ppm total PAHs.

The existing soil concentrations were used in the South Cavalcade risk assessment to estimate the risks to public health if no remediation were to occur. In risk assessments, EPA's procedures requires that only valid data be used. In this case, the soil samples containing PAHs were not valid due to laboratory interferences. EPA required that the existing risk be estimated using the available valid data, but EPA did not state that it believed this risk was correct. In fact, EPA required that the Feasibility Study report note, within the risk assessment chapter, that the actual risk at the site could be higher. For this reason, EPA stated that soil remediation may be necessary at the South Cavalcade site, and required the Koppers Company to add soil remediation alternatives to the Feasibility Study.

EPA also notes that soil remedial goals are site specific because the characteristics of each site influence the potential exposure pathways, the location of the wastes, and other factors. For South Cavalcade, EPA considered the site to be used by operating commercial enterprises such as Merchants. EPA based the assessment of public health risks on this use. The other sites quoted by Merchants are in residential areas (united Creosoting and Bayou Bonfouca), are abandoned and could be developed as residential areas (Mid-South Wood Products and Midland Products), or contain RCRA listed wastes which must be treated to a specified low level (North Cavalcade). EPA notes that the remedial goal for the Arkwood site has yet to be established.

Comment #42: Merchants requests that the Feasibility Study be clarified that remediation of the upper intermediate aquifer be required. Merchants feels that this was intended in the body of the Feasibility Study, but not clearly expressed in the executive summary of the report.

EPA Response: EPA will require, in the Record of Decision, remediation of groundwater contained in the sand lenses located 40 to 55 feet below surface. These lenses were, at one time, called the "upper intermediate aquifer". However, the lenses are not continuous, and, therefore, do not comprise an aquifer. The lenses are part of what EPA labels the "shallow" groundwater.

Comment #43: Merchants believes that the stated groundwater extraction rate may not be feasible based on model results not submitted with the comments. Merchants requests that the groundwater remedial alternatives be re-evaluated after additional pump tests are conducted. Merchants also request the specifics about well spacing, the injection rate, radius of influence, and specific yield be available for public review before completing the Record of Decision.

EPA Response: EPA agrees that the operational parameters of the groundwater collection and re-injection system may be changed after further pump tests are conducted during the Remedial Design. The parameters stated in the Feasibility Study report were not intended to be exact values for use in drawing up the design, but were rather to be used as a reasonable rate for use in costing the alternatives.

EPA does believe that the selected groundwater remedial alternative is the correct one for this site. EPA evaluated many alternatives for groundwater remediation within the Feasibility Study. The other groundwater collection alternative, trenches, is not practical because the depth of the sand lenses (40 to 55 feet) is too deep for effective use of trenches. Containment alternatives such as slurry or grout walls are not practical because they only halt horizontal migration; the vertical migration of non-aqueous phase liquids to deeper aquifers would not be controlled.

Comment #44: Merchants requests that further soil samples be collected to reassess the maximum contamination concentrations and re-evaluate the soil remedial goal. In specific, Merchants requests that some samples be collected close to the existing underground storage tanks located on the Merchants property.

EPA Response: EPA is requiring in the Record of Decision that further soil samples be collected during the Remedial Design to better define the areas needing remediation (see responses to comments #34 and #41). The soils around the buried tanks can also be sampled. EPA also reiterates that the existing soil concentration has no effect on the health-based remedial goal, but will affect the leaching potential-based goal which is an operational test (TCLP test) to be conducted during the sampling effort.

APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

APPENDIX B: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIRMENTS

Section 121(d)(2) of CERCLA as amended in 1986 by SARA requires that the selected remedy attain requirements adopted under Federal and state environmental laws. These requirements are called "ARARs" which means "applicable or relevant and appropriate requirements".

The Feasibility Study for the South Cavalcade site included a review of these laws, and identified those which could be ARARs based on the types of wastes at the site, the types of remedial actions contemplated, and the site location. This appendix lists all the laws which the Feasibility Study identified as potential ARARs for this site, and indicates whether each of the final remedial alternatives can comply with the laws. The appendix also includes the laws which the Feasibility Study did not identify as potential ARARs but which EPA now believes are ARARs.

SAFE DRINKING WATER ACT

National Primary Drinking Water Standards: Establishes health based standards for public water systems (maximum contaminant levels); an ARAR for all groundwater alternatives because the groundwater contamination can reach an aquifer used as a drinking water supply.

National Secondary Drinking Water Standards: Establishes aesthetic based standards for public water systems (secondary maximum contaminant levels); an ARAR for all groundwater alternatives because the groundwater contamination can reach an aquifer used as a drinking water supply.

Maximum Contaminant Level Goals: Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects, with an adequate margin of safety; not an ARAR but a factor to be considered for those contaminants where the Maximum Contaminant Levels have yet to be promulgated.

Underground Injection Control Regulations: Provides for protection of underground sources of drinking water; an ARAR for all groundwater alternatives because the treated groundwater will be re-injected.

CLEAN WATER ACT

Water Quality Criteria: Sets criteria for water quality based on toxicity to aquatic organisms and human health; an ARAR for disposal of those compounds for which there are no state water quality standards; applies to the discharge after mixing with Hunting Bayou water.

National Pollutant Discharge Elimination System: Requires treatment performance for the discharge of pollutants for any point source into waters of the United States; an ARAR for disposal of water into Hunting Bayou.

National Pretreatment Standards: Sets standards to control pollutants which pass through or interfere with treatment processes in public treatment works or which may contaminate sewage sludge; an ARAR because one possible disposal option from the groundwater treatment system is to a Houston sewage treatment plant.

OCCUPATIONAL SAFETY AND HEALTH ACT: Regulates worker health and safety; an ARAR for all site activities.

HAZARDOUS MATERIALS TRANSPORTATION ACT: Regulates transportation of hazardous materials; an ARAR for the offsite transport of recovered oil and creosote for burning, and offsite transport of soil in offsite landfill and incineration alternatives.

SOLID WASTE DISPOSAL ACT

Standards Applicable to Generators of Hazardous Waste: Establishes standards for generators of hazardous wastes; an ARAR for all alternatives except No Action.

Standards Applicable to Transporters of Hazardous Waste: Establishes standards which apply to transporters of hazardous waste within the U.S. if the transportation requires a manifest under 40 C.F.R. Part 262; an ARAR for the offsite transport of recovered oil and creosote generated from the groundwater treatment system, and the offsite transport of soil in offsite landfill and incineration alternatives.

Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities: Establishes minimum national standards which define the acceptable management of hazardous wastes for owners and operators of facilities which treat, store or dispose of hazardous wastes. Each subpart follows:

General Facility Standards (Subpart B): Sets siting requirements for floodplains; not an ARAR because no treatment or disposal unit will be located in a floodplain.

Releases from Solid Waste Management Units (Subpart F): Sets groundwater remediation levels; an ARAR for groundwater alternatives.

Closure and Post-Closure (Subpart G): Sets standards for maintenance of disposal sites; an ARAR only soil alternatives leaving treated soils at the site.

Use and Management of Containers (Subpart I): Sets requirements for storage of wastes in containers; not an ARAR because containers will not be used in any alternative.

Tanks (Subpart J): Sets requirements for storage of wastes in tanks; an ARAR for the groundwater treatment system.

Surface Impoundments (Subpart K): Sets requirements for disposal or treatment of wastes in surface impoundments; not an ARAR because no alternative uses surface impoundments.

Waste Piles (Subpart L): Sets requirements for storing and treating wastes in piles; an ARAR for soil alternatives which store wastes in piles prior to disposal or treatment.

Land Treatment (Subpart M): Sets requirements for treatment of wastes by placing them in land; not an ARAR because no alternative uses this method.

Landfills (Subpart N): Sets requirements for disposal of wastes in landfills; not an ARAR only because no alternative creates a new landfill.

Incinerators (Subpart O): Sets requirements for incineration of wastes; an ARAR for the soil incineration alternatives and the groundwater alternatives if the recovered creosote will be incinerated.

Land Disposal Restrictions: Establishes allowable concentration levels for burial of hazardous wastes; not an ARAR for soil alternatives because the soils to be remediated were not contaminated with a RCRA listed waste (K001 sludge or U051 creosote) and are not subject to these restrictions; an ARAR for groundwater alternatives for the incineration or recycling of the creosote collected from the groundwater.

TEXAS DEPARTMENT OF HEALTH

Allowable Limits of Metals in Drinking Water: Sets health-based standards for public water systems; these set remedial levels for groundwater alternatives.

Location of Wells used for Drinking Water Supplies: Restricts placement of drinking water wells; restricts location of solid waste disposal sites; an ARAR for groundwater alternatives because remediation requires a long time for completion.

TEXAS WATER COMMISSION

Water Quality Standards for Surface Waters: Prohibits point source discharges which cause toxicity in natural streams and sets maximum levels for selected contaminants; an ARAR for discharge of treated groundwater into Hunting Bayou; applies to the discharge after mixing with Hunting Bayou.

TEXAS AIR CONTROL BOARD

Prohibition of Air Contaminants which Adversely Effect Human Health: Health-based standards for air; only an ARAR for those alternatives which disturb the soil and may cause a release.

Control of Air Pollution from Visible Emissions and Particulate Matter: Maximum allowable levels of particulates in air; an ARAR for incinerators.

Storage of Volatile Organic Compounds: Regulates handling of tanks containing volatiles; an ARAR for the groundwater treatment system if recovered creosote is stored in a tank.

Oil/Water Separators: Controls volatile emissions from separators; an ARAR for the groundwater treatment system.

Vacuum Producing Systems: Requires incineration of emmissions from vacuum producing systems; an ARAR for the groundwater treatment system

LIST OF REMEDIAL ALTERNATIVES

Alternative #1: No Action

Alternative #2: Stabilization and Capping

Alternative #3: Offsite Landfill

Alternative #4: Onsite Soil Washing

Alternative #5: Onsite Incineration

Alternative #6: In Situ Biremediation

Alternative #7: In Situ Soil Flushing

Alternative #8: Offsite Incineration

Alternative #9: Groundwater In Situ Biological Treatment with Physical Separation

Alternative #10: Groundwater Collection; Physical Separation, Filtration, and Activated Carbon Treatment

Alternative #11: Groundwater Collection; Physical Separation, Filtration, Air Stripping, and Activated Carbon Treatment

Alternative #12: Groundwater Collection; Physical Separation, Activated Sludge Biological Treatment

NOTE: Alternatives 9 through 12 are actually the groundwater parts of alternatives 2 through 8. They are discussed separately within this appendix to help distinguish the ARARs pertaining to groundwater actions from the ARARs pertaining to soil actions.

FEDERAL ARARS

Standard, Requirement, Criteria, or Limitation	Remedial Alternative 1	2	3	4	5	6	7	8	9	10	11	12
SAFE DRINKING WATER ACT												
National Primary Drinking Water Standards (40 CFR Part 141)	A								A	A	A	A
National Secondary Drinking Water Standards (40 CFR Part 143)	A								A	A	A	A
Maximum Contaminant Level Goals	O								O	O	O	O
Underground Injection Control Regulations (40 CFR Part 144-147)									A	A	A	A
CLEAN WATER ACT												
Water Quality Criteria (40 CFR Part 131)	A								A	A	A	A
National Pollutant Discharge Elimination System (40 CFR Part 125)									A	A	A	A
National Pretreatment Standards (40 CFR Part 403)									A			
OCCUPATIONAL SAFETY AND HEALTH ACT (29 USC 651-678)		A	A	A	A	A	A	A	A	A	A	A
HAZARDOUS MATERIALS TRANSPORTATION ACT (49 CFR Part 107, 171-177)			A					A	A	A	A	A
SOLID WASTE DISPOSAL ACT												
Standards for Generators of Hazardous Waste (40 CFR Part 262)		A	A	A	A	A	A	A	A	A	A	A
Standards for Transporters of Hazardous Waste (40 CFR Part 263)			A					A	A	A	A	A

A = ARAR; O = other factor to be considered

FEDERAL ARARS continued

Standard, Requirement, Criteria, or Limitation	Remedial Alternative											
	1	2	3	4	5	6	7	8	9	10	11	12
SOLID WASTE DISPOSAL ACT												
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities:												
General Facility Standards (40 CFR Part 264 B)												
Releases from Solid Waste Management Units (40 CFR Part 264 F)	A								A	A	A	A
Closure and Post-Closure (40 CFR Part 264 G)		A		A	A	A	A					
Use of Containers (40 CFR Part 264 I)												
Tanks (40 CFR Part 264 J)									A	A	A	A
Surface Impoundments (40 CFR Part 264 K)												
Waste Piles (40 CFR Part 264 L)			A	A	A			A				
Land Treatment (40 CFR Part 264 M)												
Landfills (40 CFR Part 264 N)												
Incinerators (40 CFR Part 264 O)					A			A	A	A	A	A
Land Disposal Restrictions (40 CFR Part 268)									A	A	A	A

A = ARAR; O = other factor to be considered

STATE OF TEXAS ARARS

Promulgated Standard, Requirement, Criteria, or Limitation	Remedial Alternative											
	1	2	3	4	5	6	7	8	9	10	11	12
DEPARTMENT OF HEALTH												
Allowable Limits of Metals in Drinking Water	A								A	A	A	A
Location of Wells used for Drinking Water Supplies	A								A	A	A	A
WATER COMMISSION												
Water Quality Standards for Surface Waters									A	A	A	A
AIR CONTROL BOARD												
Prohibition of Air Contaminants that Adversely Effect Human Health			A	A	A			A	A	A	A	
Control of Air Pollution from Visible Emissions and Particulates					A			A				
Storage of Volatile Organics									A	A	A	A
Oil/Water Separators									A	A	A	A
Vacuum Producing Systems									A	A	A	A

A = ARAR; O = other factor to be considered

APPENDIX C

RISK CALCULATIONS

Potential Risks for Onsite Workers
Selected Remedy

Contaminant	Maximum Concentration (mg/kg soil)	Total Lifetime Intake (mg/kg/day)	Hazard Index	Excess Maximum Lifetime Cancer Risk
Carcinogenic PAHs	700[a]	6.66E-07		8E-06
Arsenic	8.8	2.95E-08		4E-08
Chromium	9.5	3.19E-08	6E-06	
Copper	5.0	1.68E-08	5E-07	
Lead	30.4	1.02E-07	7E-05	
Zinc	3480	1.17E-05	6E-05	
TOTALS			1E-04	8E-06

Potential Risks for Groundwater Users
Selected Remedy

Contaminant	Maximum Concentration (ug/l water)	Total Lifetime Intake (mg/kg/day)	Hazard Index	Excess Maximum Lifetime Cancer Risk
Carcinogenic PAHs	nd[b]	2.86E-06		3E-05
Benzene	5	1.43E-04		7E-06
Ethylbenzene	470[d]	1.37E-02	0.1	
Toluene	1000[d]	2.86E-02	0.1	
Xylene	440	1.26E-02	0.6	
Arsenic	50[c]	1.43E-03		*
Chromium	50[c]	1.43E-03	*	
Copper	28	8.29E-04	<0.1	
Lead	50[c]	1.43E-03	*	
Zinc	100	2.86E-03	<0.1	
TOTALS			0.9	4E-05

(a) Actual concentration may be lower based on leaching potential

(b) Not detected at normal laboratory procedures (use 0.1 ug/l)

(c) No risk because goal achieves natural background

(d) Represents existing concentration

Potential Risks for Offsite Residents (Sediments)
Selected Remedy

Contaminant	Maximum Concentration (mg/kg soil)	Total Lifetime Intake (mg/kg/day)	Hazard Index	Excess Maximum Lifetime Cancer Risk
Carcinogenic PAHs	5.8	7.18E-08		8E-07
Arsenic	34	3.83E-07		6E-07
Chromium	360	4.06E-06	8E-04	
Copper	89	1.00E-06	3E-05	
Lead	540	6.09E-06	4E-03	
Zinc	3300	3.72E-05	2E-04	
TOTALS			5E-03	1E-06

(a) Concentrations reflect present levels;
degradation reflected in intake calculations.

APPENDIX D

STATE OF TEXAS CONCURRENCE

TEXAS WATER COMMISSION

September 29, 1988

Allyn M. Davis, Ph.D., Director
Hazardous Waste Management Division
U.S. Environmental Protection Agency
Region VI
1445 Ross Avenue
Dallas, Texas 75202-2733

Re: South Cavalcade Superfund Site
Draft Record of Decision

Dear Dr. Davis:

We have reviewed the proposed Record of Decision (ROD) for the South Cavalcade Site. We have no objection to the selected remedy of in-situ soil flushing and soil washing (Alternatives 4 and 7) and groundwater treatment (Alternative 10) as described in the draft ROD of September 20, 1988.

Comments were made by Texas Water Commission staff members on the initial draft Summary of Remedial Alternative Selection document and submitted to the EPA RPM on September 14, 1988. These comments have not been incorporated into this final draft. Our comments, however, would not substantially change our concurrence with this remedial action selection.

Sincerely,

Allen P. Beinke
Executive Director

P. O. Box 13087 Capitol Station • 1700 North Congress Ave. • Austin, Texas 78711-3087 • Area Code 512/463-7830

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: South Cavalcade Street

SITE NUMBER: TXD 980810386

INDEX DATE: 08/25/88

Administrative Record Index
not included.