SITE INVESTIGATION/ PHASE II

VAUGHN LANDFILL/ DUKE POWER SITES

CSX REAL PROPERTIES

Greenville, South Carolina

Prepared for

CSX Transportation

Jacksonville, Florida

September 1996

APPLIED ENGINEERING & SCIENCE, INC.

Atlanta, Georgia

SITE INVESTIGATION PHASE II
VAUGHN LANDFILL/DUKE POWER SITES
CSXT REAL PROPERTIES
BRAMLETTE ROAD
GREENVILLE, SOUTH CAROLINA

CSX Project Number 9415585

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EXECUTIVE SUMMARY

CSX Transportation (CSXT) currently owns several adjoining properties west of downtown Greenville, South Carolina. The properties consist of approximately 40 acres along the floodplain of the Reedy River. Past activities on the properties include coal gas production, railroad transportation, and landfilling. These activities, particularly coal gasification processes, have contributed a variety of contaminants that have impacted soil and groundwater in the area.

In 1994, at the direction of the South Carolina Department of Health and Environmental Control (DHEC), CSXT began an investigation into the types and extent of contamination on the CSXT properties. CSXT retained Applied Engineering and Science, Inc. (AES), an Atlanta, Georgia engineering and environmental consulting firm, to proceed with the investigation. This report describes AES's Phase I and Phase II field activities, historical research, interface with regulatory agencies, scientific literature review, and personal interviews.

Mr. Robert Vaughn, owner of Vaughn Construction and Demolition Company in Greenville, operated an unpermitted solid waste landfill on CSXT property from 1988 to 1992. Mr. Vaughn was advised in 1993 by DHEC that his filling activities were improper. In February 1994 the U.S. Army Corps of Engineers notified CSXT that it considered the property on which the fill was located to be wetlands and that the filling operation was a violation of section 301 of the Clean Water Act. The Corps of Engineers has deferred further action pending the environmental investigation required by DHEC.

AES completed Phase I of the investigation in February 1995 and submitted a report of findings to DHEC in March 1995. During Phase I, no materials were discovered in the landfill that could be directly connected to the contamination. Rather, Phase I confirmed that the fill consisted of dirt, brick, concrete, and other construction debris. Contamination from volatile and semi-volatile compounds (VOCs and SVOCs) was discovered in soils and groundwater below the landfill materials and in the floodplain east of the Reedy River. A substance that appeared to be coal tar was found in the floodplain soils. A subsequent investigation into the historical activities of the area indicated that the Duke Power Company operated a coal gasification plant at the corner of West Washington Street and Bramlette Road during the 1940s and 1950s. Wastewater containing coal tar was released from the west side of the plant. The wastewater flowed through a culvert under Bramlette Road and dispersed into the floodplain. The heavy coal tar settled in low

areas and eventually infiltrated the natural alluvial clays and sands, impacting local groundwater quality.

Following submittal of the Phase I report, DHEC requested additional fieldwork on the properties. Phase II consisted of the installation of eight monitoring wells to assess groundwater quality, an assessment of the extent of the coal tar in soil and groundwater, and a site characterization.

The information gathered during Phase II of the investigation indicates that the contaminants in soil and groundwater within the CSXT properties are the result of the release of coal tar and coal tar laden wastewater from the former Duke Power coal gasification plant. The VOC and SVOC compounds reported in the groundwater and soil samples are common byproducts of coal gasification processes.

Coal tar was found saturating soils within the former Duke Power Company plant site (DP Site) and in the floodplain west of the landfill. Soils saturated with coal tar on the DP Site will continue to affect groundwater quality and air quality to a lesser extent.

Impacted groundwater was identified from the coal gasification plant west to the Reedy River in a plume approximately 600 feet wide and 2,200 feet long. However, maximum contaminant levels (MCLs) were exceeded by a single contaminant (benzene) in only three of the eight wells. The groundwater plume appears to reach the Reedy River and may be discharging to the river. However, a surface water sample collected downstream of the contaminant plume contained no VOC or SVOC compounds. No downstream users of Reedy River water were identified, and a well survey found no drinking water wells within a 1/2 mile radius of the CSXT properties. No other contaminant pathways were identified for contaminants to migrate off site.

Free product coal tar was discovered in the deepest well (20 feet) lying on top of a low-permeability layer of saprolite. Because the free product coal tar in soil and groundwater will continue to release volatile and semi-volatile compounds to groundwater, it is recommended that the extent of free product in groundwater be delineated.

An underground storage tank (UST) and an industrial water supply well were reported to have been used at the coal gasification plant. The disposition of the UST should be determined. Geophysical methods may be used to determine whether the UST was removed or remains in place. The well is listed as abandoned. The location and condition of the well should be determined because it could provide a pathway for surface contamination into the subsurface.

I. INTRODUCTION

CSX Transportation, Inc. holds title to several properties west of downtown Greenville, South Carolina in the vicinity of Bramlette Road along the Reedy River. In 1994, at the direction of the South Carolina Department of Health and Environmental Control (DHEC), CSXT began an investigation into the types and extent of contamination on the properties. CSXT retained Applied Engineering and Science, Inc. (AES), an Atlanta, Georgia engineering and environmental consulting firm, to proceed with the investigation. This report describes activities relative to the site investigation on CSXT properties including Phase I and Phase II field activities, historical research, interface with regulatory agencies, scientific literature review, and personal interviews.

A. Site Description and History

Figures and tables in this report are included in **Appendix A. Figure 1 - Site Location Map** identifies the location of the property west of the City of Greenville, South Carolina. This section of Greenville (known locally as City View) includes residences, small businesses, schools, industries, and rail facilities.

Figure 2 - Site Plan is a drawing of CSXT properties north and south of Bramlette Road totalling approximately 40 acres. The properties are undeveloped except for the CSX Railroad office which is situated on the south side of Bramlette Road at the Reedy River.

The triangular property north of Bramlette Road is bordered by Bramlette Road to the south, West Washington Street to the east, and the CSX right-of-way containing the rail lines to the west. Duke Power Company, the primary electric utility provider in South Carolina, operated a coal gasification plant in the southeast corner of this property during the 1940s and 1950s. This area is referred to as the **DP Site** in this document. West of the DP Site, the property has been partially filled west to the rail lines and is overgrown with kudzu and small trees. This area contains a ditch along Bramlette Road that reportedly carried wastewater released from the coal gasification plant. This area is referred to as the **NB Site** (North Bramlette) within this document.

South of Bramlette Road, a long, narrow piece of property extends south through floodplain of the Reedy River. This property is bordered by the CSX right-of-way to the west, Greenville County School District property to the east; and Willard Street to the south. The CSX railroad office, which is used for crew transfers and scheduling activities, is located in the northwest corner of this property.

An unpermitted landfill was operated by Vaughn Demolition and Construction Company in the property south of Bramlette Road from 1988 to 1992. In 1988, Mr. Robert Vaughn attempted to purchase approximately 16 acres of the property from CSXT for the purpose of constructing a solid waste landfill. Following the payment of a deposit on the purchase, Mr. Vaughn began landfilling activities on the Site. The property transfer was never completed but unauthorized landfilling by Vaughn continued. This property is referred to as the **Vaughn Landfill Site** in this document.

The CSXT properties north and south of Bramlette Road contain the **DP Site**, the **NB Site**, and the **Vaughn Landfill Site** which were the focus of this investigation.

B. Project History

On August 24, 1994, DHEC notified CSXT by certified mail of the department's investigation of an unpermitted landfill on CSXT property in Greenville, South Carolina (Vaughn Landfill Site). DHEC, along with the US Army Corps of Engineers, had visited the site in early 1994 and noticed leachate and a black, sludge-like material at the base of the landfill. According to the letter "*The material was black with a strong petroleum odor. A similar material has been observed by Department and Corps of Engineers personnel during other site visits*". Analysis of a sample collected during the site visit

indicated that an impact to the environment had occurred. DHEC subsequently requested a work plan from CSXT to assess vertical and horizontal impact to the environment in soil and groundwater caused by the landfilling or other activities.

In October 1994, CSXT contacted AES and requested a workplan be prepared for the assessment of vertical and horizontal impact to the environment at the site.

1. Phase I - A copy of the workplan for Phase I is included in **Appendix B**. The workplan called for a series of borings to be installed in the landfill to collect soil samples from native soils beneath the fill and groundwater samples from the surficial aquifer. Sediment and surface water samples were also to be collected from the floodplain surrounding the fill. A sample of the black sludge was to be collected and analyzed. Equipment for the sample collection activities included a Strataprobe push-type sampling rig, a trackhoe for excavating impenetrable materials, and hand augers for floodplain sampling.

   Approximately seven acres of floodplain of the Reedy River have been filled with demolition debris and yard waste to a depth of up to 14 feet (the Vaughn Landfill). Excavations through the fill and borings advanced through the fill into the underlying native soils revealed the presence of a tar-like substance at the fill/soil

interface. Additional hand auger samples collected in the surrounding floodplain soils also contained tars.

Soil and groundwater samples were collected and sent to a laboratory for volatile organic compound (VOC) and semi-volatile organic compound (SVOC) analysis. Analysis of the samples indicated a band of contamination in soils trending northeast to southwest through the fill. This band extends from the floodplain northeast of the fill through the northern half of the fill material, through the southwest corner of the fill, and into the floodplain southwest of the landfill. Groundwater was encountered at or below the native soil surface. Three groundwater samples contained elevated levels of VOC and SVOC compounds. According to several chemical reference materials, many of the volatile and semi-volatile compounds reported in the samples are found in coal tars generated by coal gasification processes.

Elevated levels of lead were revealed in soil samples throughout the site. Metals levels in soil sample LF024, located in the west central section of the landfill, were especially high relative to other samples collected.

The report of Phase I findings was entitled *Site Investigation; Soil, Sediment, and Groundwater Sampling; Vaughn Landfill, CSX Real Property, AES, March 1995.* Recommendations made following the completion of Phase I included the installation of at least six monitoring wells to assess groundwater quality, excavation of sample location LF024 to investigate the cause of elevated metals concentrations in soils, and the covering of the rear uncovered portion of the landfill materials with clean soil fill.

2. Phase II - Following the review of the Phase I report, DHEC requested additional assessment of the CSXT properties including the following:

    1) Determine the extent of the tar substance.

    2) Determine the source of the tar substance.

    3) Determine the vertical and horizontal extent of groundwater contamination.

    4) Determine pathways of contaminant migration to possible receptors.

    5) Assess location LF024 for the source of heavy metals contamination.

    6) Develop a site characterization including soils, geology, hydrology, and hydrogeology.

AES prepared a workplan based on the information requested by DHEC and submitted the workplan in August, 1995. DHEC approved the workplan in

November, 1995. Copies of the DHEC correspondence are included in **Appendix C**. A copy of the Phase II workplan is included in **Appendix D**.

Three days prior to implementation of the workplan and the beginning of field activities, CSXT and AES representatives met with DHEC personnel in Greenville to discuss several issues regarding the site investigation. Those present at the meeting on March 1, 1996 were Marshall Williams, Director Environmental Real Estate Transactions, CSX/RPI; Dave Butler, Project Manager AES; Charles Bristow, Hydrogeologist, DHEC Greenville; and Tom Knight, Manager Geohydrologic Section, DHEC Columbia. Several changes and additions to the Phase II workplan resulted from this meeting that are summarized below:

1) DHEC requested that a second monitoring well screened in the upper saturated unit be placed adjacent to MW-3D. MW-3D was scheduled to be screened within the lower sand unit beneath the overlying clay. DHEC suggested that additional information could be gained by placing two wells side-by-side at separate intervals. Placement of the other wells was approved with the understanding that the location of MW-5 was dependent on the results of the coal tar delineation sampling.

2) DHEC suggested that MW-4 be advanced by hand auger in the floodplain east of the landfill to avoid disturbance of possible wetland habitat with a full size drill rig.

3) DHEC requested that the groundwater samples collected from the wells installed within the landfill be analyzed for sulfate as well as VOCs and SVOCs.

4) DHEC suggested that a biological survey be conducted within the floodplain areas affected by coal tar contamination to assess the effects of contaminants on plant species number and diversity.

5) DHEC requested that the landfill be reseeded following completion of grading activities to inhibit erosion of the landfill soils into the surrounding floodplain.

CSXT and AES agreed to the above changes but requested additional time to complete items 4 and 5 to allow for scheduling, performance and reporting. DHEC concurred with this request.

Implementation of the workplan began at the Greenville site on March 4, 1996. This report summarizes the findings of the Phase II field activities including well installations, groundwater sampling, site characterization, and a biological survey.

II. SITE CHARACTERIZATION

A. Topography

The city of Greenville lies in the piedmont province of the southeastern United States. The piedmont is characterized by rolling hills, uplands, and stream valleys which contain narrow floodplains. The general flow pattern of streams is to the southeast. Greenville county lies within the Santee River basin which includes several sub-basins such as the Reedy River basin.

The CSXT properties border the Reedy River and lie, to a large extent, within the river's floodplain. The floodplain and potential wetlands (*wetlands on the site have not been formally delineated by the Corps of Engineers*) are at an elevation of 285 feet above mean sea level (msl). Local surface flow is toward the Reedy River. Much of the local floodplain topography has been altered by human activities.

B. Geology and Hydrogeology

Bedrock west of Greenville consists of granite gneiss. Piedmont soils in the southeast commonly form from the deterioration of bedrock by chemical weathering. Saprolite is

the term given to decomposed rock which has not been transported. Rock structures are still visible in saprolite but the texture is similar to that of loose soil. The saprolite is then eroded and deposited forming the alluvial soils along river floodplains. The soils vary from fine to coarse depending on the depositional environment.

According to the *Soil Survey of Greenville County*, prepared by the Soil Conservation Service of the USDA, soils underlying the CSXT properties include Cartecay, Chewacla, and Cecil-Urban series types. Cartecay soils consist of alluvium on floodplains and are usually sandy loams. Chewacla soils are also found on floodplains and consist of the finer deposits of silty clay loams. Chewacla soils are considered hydric which is one characteristic of wetland environments. Cartecay and Chewacla soils are commonly intermixed on floodplains as stream channels migrate and floodwaters rise and recede. The floodplain soils surrounding the landfill south of Bramlette Road are a classic example of this intermixing.

The thickness of the soils and saprolite overlying bedrock in the Greenville area has been reported at an average of 58 feet. The report entitled *Groundwater Resources of Greenville County South Carolina*, published in 1968 by the South Carolina State Development Board, lists seven industrial wells within 1/4 mile of the CSXT properties. All seven of the wells were reported as destroyed or abandoned. The wells were installed

with casings varying in length from 10 feet to 41 feet below the surface. Well casings usually extend from the surface into bedrock to prohibit loose soils from entering the well, so casing length can be an indicator of the thickness of unconsolidated materials. Bedrock at the site is therefore expected to be within 40 feet of the surface. However, no borings were advanced to bedrock during either phase of the investigation. Therefore, the actual depth to bedrock is unknown.

One of the seven industrial wells was located at the Duke Power Site. The well was 298 feet deep in the fractured granite gneiss and yielded 50 gpm. The location of this well and the method of abandonment should be determined to assess whether the well presents a pathway for contaminant migration into the bedrock aquifer.

Near the Reedy River, the water table is close to or above land surface and is visible as surface water south of Bramlette Road. Borings on the CSXT properties indicate the water table to be within five feet of the natural surface. Because of the variation in soil types across the properties from fine-grained clay to coarse grained sands, permeabilities and hydraulic conductivity also vary. Wells installed during the investigation yielded flows of at least 1 gallon per minute (gpm) during development and were not stressed. Water levels were measured and compared to the surveyed top-of-casing elevations and indicate a groundwater flow direction from northeast to southwest toward the Reedy

River. Well installations and the hydrogeology of the site are discussed in more detail in Section V.

C. Surface Flow

During a day of heavy rains, AES personnel followed the paths of surface runoff over the CSXT properties from the DP Site, west along Bramlette Road, through the Vaughn Landfill Site and south through the floodplain to Willard Street and the Reedy River. **Figure 3 - Surface Flow** is a diagram of the overall surface flow patterns as well as localized surface flows and ponding in depressions. Photographs of surface flow patterns are included in **Appendix E**.

1. DP Site - The grade of the surrounding area is generally to the southwest with localized variations. Stormwater enters the DP Site from the upgradient direction along West Washington Street and to a lesser degree, from the adjacent property to the north (Suburban Propane). The two primary entry points appear to be at the east gate and north of the east gate approximately 43 feet south of the property boundary.

Runoff at the east gate flows west and collects in a depression in the north central portion of the site following heavy rainfall. Soils in this area of the site contain a high proportion of coal tar and vegetation is sparse. Strataprobe and hand auger sampling here revealed water saturated conditions in the upper 1 foot of soil. Standing water in this area is probably common during the winter and early spring.

North of the east gate, runoff flows west from West Washington Street under the fence and into a man-made ditch that carries surface flow toward the north central sector of the site. The ditch contains trash and debris brought in with the stormwaters. Where the ditch ends, the flow spreads laterally and settles in depressions or enters the larger ponded area in the unvegetated section. Because of the site topography, there appears to be no exit from these depressed areas except during exceptionally heavy rainfall at which time flow would be to the southwest. Surface water eventually infiltrates the soil or evaporates.

Precipitation falling on the southeast and south central sectors flows west\southwest and exits at the south gate onto Bramlette Road or settles in a depression near MW-7. This depression also collects surface flow from the northwest sector. Soils surrounding MW-7 contain coal tar but vegetation is present and odors are less apparent than in the northeast sector. Precipitation falling on the extreme

southwest corner of the DP Site flows west off the site and enters Ditch 1 which flows west along Bramlette Road.

2. NB Site - Ditch 1 to the west of the DP Site may be fed by a spring which discharges groundwater from the DP Site and the filled area north of the ditch. Water in the ditch flows west to a point approximately 340 feet from the DP Site fence where the water appears to enter a culvert underneath Bramlette Road. The culvert is not visible because of the overlying sediments and vegetation. Water is visible discharging south of Bramlette Road as an upwelling in the floodplain.

3. Vaughn Landfill Site - Water discharging in the floodplain south of Bramlette Road spreads south and collects behind the landfill which acts as a dam to the natural flow. Surface flow from the higher elevations to the east also enters this area. A narrow channel (Ditch 4) cut through the landfill allows the water to flow west.

Ditch 2 carries water south from the rail lines north of Bramlette Road into a culvert beneath the road. The water then enters Ditch 3 which runs between the landfill and the filled area which contains the CSX office. Flow from Ditch 3 then enters the floodplain west of the landfill joining the flow of Ditch 4.

The floodplain west of the landfill contains standing water for most of the year. Water here is prevented from entering the Reedy River by the elevated embankment which carries the north/south rail lines paralleling the river. However, Ditch 5, which appears to be a man-made canal, directs water from the floodplain south toward Willard Street. Just north of Willard Street, the ditch turns west and passes underneath the railroad trestle where it discharges into the Reedy River. *This appears to be the only discharge point for surface flow from the CSXT properties east of the Reedy River.*

D. Human Activities

Much of the floodplain along the Reedy River has been altered by human activities for many years. Aerial photographs from the 1950s reveal tilled fields for crops along the river. As time passed, industry replaced the crops. Much of the floodplain was filled in the past to accommodate the construction of rail lines, mills, and residences.

The property north of Bramlette Road has been almost completely filled above the original floodplain elevation during activities over the last 100 years. The southeast corner of this property (DP Site) was the site of the Duke Power coal gasification plant which closed in 1959. A trucking company used the lot for parking trailers during the 1970s. The DP

Site is now vacant and access is controlled by a fence topped with barbed wire. North of the coal gas plant, Texas Oil Company operated a petroleum bulking facility at the same time as the coal gas plant operated. That site now contains Suburban Propane, a propane tank storage facility. The remaining property has been filled but is otherwise undeveloped.

South of Bramlette Road, the CSXT property is largely native floodplain and has only recently received fill as the Vaughn landfill was constructed. Adjacent properties east of the landfill were filled for construction of the Greenville Sanitation Commission building and for residences along Temple Street and Walnut Street. A man-made canal (Ditch 5), that may have been dug early this century following construction of the embankment that carries the rail lines, drains the floodplain from north to south. The embankment prevented the natural flow of surface water from the floodplain into the Reedy River and the canal was apparently constructed to direct flow south to a culvert that intersects the Reedy River at Willard Street. The filling of the property has been discontinued. No other activities occur on the site except for the railroad related activities at the CSX office.

E. Biological Survey

A biological survey was requested by DHEC following approval of the original workplan for Phase II of the investigation. The purpose of the survey was to assess the effects of coal tar contaminants on the diversity and number of plant species within the seasonally flooded environment adjacent to the landfill. Soil samples previously collected by AES provided the analytical data necessary to compare plant species diversity to the concentrations of contaminants.

The survey was conducted by the Environmental Corporation of America (ECA) of Alpharetta, Georgia. Five plots were selected within the floodplain west of the Vaughn Landfill. Sample plots were chosen on the basis of soil sample data availability and the similarity of environmental characteristics (sunlight exposure, water depth, water temperature, and plant community structure) between the plots. The plots included drainage channel habitat as well as floodplain habitat. Plant species within each plot were identified and counted.

Following the collection of field data, a series of linear computer models were constructed to determine positive or negative correlations between contaminant concentrations and plant diversity. According to the ECA report, *at a confidence level of 95%, no significant*

negative correlations were found to exist between organic compounds in the soils and the prevalence of plants in the sample plots. A positive correlation, however, was found between some species and the presence of organic compounds where these plants were more abundant in plots with contaminated soils.

A copy of the complete ECA report is included in **Appendix F - Biological Survey**.

III. EXTENT OF COAL TAR

This section describes the horizontal and vertical delineation of the coal tar extent in soils within the DP Site, the NB Site, and the Vaughn Landfill Site. The effects of the coal tar on groundwater are described in Section V.

A. Sample Locations, Sampling Protocol

Sample locations for Phase II were chosen based on the results of the February 1995 Phase I site investigation and historical information related to the operations of the coal gasification plant. Efforts were made to determine the vertical and horizontal extent of the coal tar or other hydrocarbon substances in soils and groundwater.

Soil samples were collected using two methods. Push-type technology (Strataprobe) was used wherever the locations were accessible by the four-wheel drive vehicle. Hand-augers were used in less accessible overgrown areas within the DP Site or in the flooded sections of the Vaughn Landfill Site. Continuous samples were collected beginning at the surface until either coal tar was detected or saturated conditions were reached. The depths, soil characteristics, and presence or absence of detectable coal tar were noted in the field logbook. All sample locations were marked with an alpha-numeric designation

and flagged stake. Downhole sample equipment was decontaminated between each hole.

Moving outward from obvious or known contamination, samples were collected and field screened visually and by odor. If coal tar was clearly visible or coal tar odor was detected, no sample was collected for laboratory analysis. Exceptions were several samples which were analyzed to assess the concentrations of coal tar compounds within heavily affected areas. If samples exhibited no detectable signs of coal tar or other hydrocarbon, representative soils were placed in clean glass containers for shipment and laboratory analysis to confirm the absence of coal tar substances. Photographs of the soil sampling are included in **Appendix E.**

B. Duke Power Site

Delineation of the extent of coal tar began at the suspected source; the site of the former Duke Power Company coal gasification plant. **Figure 4 - Duke Power Site Plant Detail** is a diagram of the Duke Power Site based on the drawing provided by Duke Power that indicates the former locations of plant buildings. A reconnaissance of the site revealed large amounts of brick, metal, wood and other construction debris and several concrete and brick foundations. Apparently, the coal gasification plant buildings were demolished and partially buried on site following closure of the plant in 1959.

Brush, small trees, and debris were cleared from several areas to allow access of sampling equipment. The clearing revealed the presence of two heavily stained areas. **Figure 5 - Coal Tar Extent; Duke Power Site** indicates the two heavily affected areas, the sample locations, and the extent of coal tar. **Table 1** on **Figure 6** includes a summary of the laboratory analytical results of each sample collected.

The first affected area surrounds MW-7. Soils within a fifty-foot radius of the well are discolored and exhibit a moderate coal tar odor. A split-spoon sample, labeled DP1A, collected during the installation of the monitoring well, was analyzed for VOCs and SVOCs. Laboratory results of DP1A indicated several volatile and semi-volatile compounds including PAHs associated with coal tar with concentrations up to 48,000 ug/kg. According to former employees of the coal gasification plant and the detail of the plant provided by Duke Power Company, the relief holder and several tar wells were located in the vicinity of MW-7. Wastewater which contained coal tars was released into a drainage ditch west of this area.

As borings were installed by Strataprobe in an expanding radius from MW-7, soils beneath the fill materials were found to contain varying amounts of coal tars from the surface to the saturated zone. Laboratory analysis of sample DP9, collected west of the gas holder foundation, revealed several PAHs with concentrations up to 22,000 ug/kg.

Sample DP14 was collected east of the gas holder foundation and field screened. No coal tars were detected. Laboratory analysis of DP14 confirmed the absence of coal tar compounds.

Other samples collected along the east side of the property also appeared free of coal tars until the second heavily affected area was encountered beginning at the east gate. This area covers approximately one acre extending west from the east gate and was notably devoid of vegetation. The area is in a topographic depression where surface flow collects and either evaporates or infiltrates the soil. Soils were dark with coal tar and exhibited a strong coal tar odor. Two samples were collected in this area; DP17 was field screened to assess soils close to the fence; and DP29 in the center of the affected area was analyzed by the laboratory to determine the magnitude of coal tar compound concentrations. Coal tar was detected in DP17 visually and by odor to a depth of 3 feet. DP29 was collected by hand from surface soils. Laboratory analytical results of DP29 indicated several PAHs with concentrations up to 72,000 ug/kg. According to the plant detail, a purifying box and oil scrubber were located in this area. A reference on coal gasification plant operations explains that purification of the coal gas involved the removal of toxic substances such as hydrogen sulfide and cyanide. Cooling of the gases before scrubbing resulted in the condensation of coal tars. It is assumed that coal tars were released into the soils in this area during the cooling and scrubbing operations.

Several samples were collected north of the heavily affected area including DP25, DP26, DP27, and DP28. Field screening revealed no coal tar in these samples. Laboratory analysis of DP26 and DP28 indicated benzene (7 ug/kg) and naphthalene (20 ug/kg) in DP28 and trichloroethene (94 ug/kg) in DP26. Benzene and napthalene are componenents of coal tar. Because levels of compounds reported in these samples are relatively low, the northern boundary of the coal tar extent (Figure 5) has been drawn along a line extending through these sample locations.

Additional borings, field screening, and laboratory analysis of collected samples revealed coal tar extending northwest from the heavily affected area in decreasing concentrations. Samples DP23, DP21, and DP18 revealed no coal tars present and laboratory analysis confirmed the absence of VOC and SVOC compounds.

As can be seen in **Figure 5**, the coal tar extends in a broad band across the DP Site. Two heavily affected areas lie in the northeast and the southwest portions. Coal tar was found in the soils throughout this band from the surface down to groundwater which ranged from a few inches to six feet below the surface. Coal tar compounds include benzene, toluene, ethylbenzene, xylenes, naphthalene, chrysene, pyrene, anthracene, and several other PAHs.