PHASE II ENVIRONMENTAL SITE ASSESSMENT REPORT

AT

LEFLEUR'S BLUFF LANDING SITE
PHASE II SITE ASSESSMENT
FOR AREAS 2 AND 3B
658 SOUTH JEFFERSON STREET
JACKSON, MISSISSIPPI

PREPARED FOR:

MISSISSIPPI DEPARTMENT OF
ENVIRONMENTAL QUALITY
POST OFFICE BOX 10385
JACKSON, MISSISSIPPI 39289

PPM PROJECT NO. 341705-ASI

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PREPARED BY:

KEITH YARROW
GEOLOGIST/ENGINEER

REVIEWED BY:

MICHAEL D. MCCOWN, P.G.
PRINCIPAL/SR. GEOLOGIST

REVIEWED BY:

NONIE C. TAYLOR
PROGRAM DIRECTOR

PPM CONSULTANTS, INC.
104 BUSINESS PARK DRIVE, SUITE HI
RIDGELAND, MISSISSIPPI
(601) 956-8233

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1.0 EXECUTIVE SUMMARY

PPM Consultants, Inc. was retained by the Mississippi Department of Environmental Quality (MDEQ) to conduct additional assessment activities at the LeFleur's Bluff Landing property located at 658 South Jefferson Street in Jackson, Hinds County, Mississippi. The City of Jackson is proposing to redevelop the property as a festival grounds. The purpose of the additional subsurface investigation was to determine if soil and groundwater has been impacted by previous operations, which would have an adverse affect on the site for the planned development. The soil and groundwater assessment focused on the possible constituents resulting from the former operations in areas designated as Areas 2 and 3B, as identified during previous assessment activities.

The LeFleur's Bluff Landing property is located along the 600 block of Jefferson Street in Jackson, Mississippi. The property is approximately 45 acres and is bound by Jefferson Street to the west, a levee to the north, a utility right-of-way to the east, and the Pearl River to the south. The property is currently occupied by various City of Jackson facilities: The City of Jackson Street Department Engineering laboratory, which is a former cremation building; the SWAM Team/Mobile Command Unit Storage facility; the City of Jackson Mounted Patrol division; an Animal Shelter Control Center; the Downtown Jackson Landscape District Worker's Division; a vehicle storage/parking shed; and two small storage buildings. There is also the concrete foundation of the former vehicle maintenance facility on the property.

The City of Jackson retained URS Corporation (URS) through the US Army Corps of Engineers (Corps) to perform a Phase I Environmental Site Assessment in 2000. Findings from the Phase I ESA indicated the 45-acre property was used for a variety of activities including a landfill, incinerator, maintenance shop, fuel distribution, animal control, testing laboratory, asphalt plant, paint shop, and law enforcement activities. Based on the findings of URS, 70 percent of the property was used as a landfill from 1900 through 1970.

URS identified some of the former operations that may have impacted subsurface conditions of the property. These operations included the following:

- **Former landfill activities**. The City of Jackson used the facility as a municipal landfill from approximately 1900 through 1970.
- **City of Jackson refueling activities**. These activities required the operation of underground storage tanks (USTs). The site was listed on the Leaking Underground Storage Tank (LUST) database. Contamination was reported during a UST removal in which confirmation sampling was not conducted.
- **City of Jackson equipment maintenance activities at the former City Garage and current Jackson Mounted Police buildings**. Three fires occurred at the City Garage during the 1980s and impacts to the soil and groundwater may have resulted during these incidents.
- **Activities associated with the operation of the City Paint Shop, Meter Repair Facility, City Asphalt Plant, and City Refuse Burner Facility.**

Once the former operations and potential impacts were identified, the site was subdivided into four different areas with Area 3 subdivided into two specific areas. These are listed below:

Area 1:	Former City Landfill (trash piles, tar residuals, concrete, tires, and empty drums)
Area 2:	Existing City Buildings
Area 3A:	Foundation 14 in the area of the former City Paint Shop and Meter Repair Facility; Foundation 15 in the area of the former City Asphalt Plant and City Refuse Burner; concrete tank saddle; Foundation 16; and two ozone generators and open sewer
Area 3B:	Old City Garage Maintenance foundation slab
Area 4:	UST and Refueling Areas

The City of Jackson requested assistance from the MDEQ Brownfields Program to address Areas 2 and 3B. The conditions of Area 4 were addressed under the USTfields program. Site conditions within Area 1 and Area 3A were addressed under the MDEQ's Uncontrolled Sites Voluntary Evaluation Program (VEP). Based on the past operations, the potential contaminants identified in Areas 2 and 3B include:

- Volatile Organic Compounds (fuels, solvents);
- Polynuclear Aromatic Hydrocarbons
- Metals (paint pigments, engine cleaning, plating)

PPM was retained by the MDEQ to conduct the assessment, and provided a work plan, proposal, and Quality Assurance Project Plan (QAPP) for conducting an additional subsurface investigation at the site. The MDEQ and the EPA approved the workplan and proposal.

During the investigation, PPM installed soil borings and temporary wells in the vicinity of the city buildings in Areas 2 and 3B. Soil and groundwater samples were collected from the borings and wells, and site lithology and groundwater conditions were characterized. Rigid QA/QC procedures were implemented in the field and in the laboratory consistent with the approved QAPP.

Findings and conclusions were as follows:

<u>Site Geology and Hydrogeology</u>

- The majority of the site is a former landfill. Beneath surface cover in most boring locations, varying types of intermixed silt, sand, and clay are present. Beneath the initial silt, sand, and clay, each boring exhibited intermixed silts, sands, glass, trash, gravel, brick, and concrete debris that is a result of past land-filling activities. The depth and thickness of these debris layers was inconsistent throughout the subject area, and were sometimes intermixed with layers of silt, sand, and clay. In probe borings PB-2 and PB-5, a soft wet gray clay that is assumed to be native soil was present at approximately 22 to 23 feet BGS.

- Groundwater was encountered in the borings at depths ranging from 16.5 to 22 feet BGS. This water appears to be held in the landfill material by the native gray clay that was observed in PB-2 and PB-5. Groundwater elevations were recorded in all temporary wells, excluding TW-7, to determine the groundwater flow direction at the site. Temporary well TW-7 was dry; therefore, no data was collected from this well. Groundwater flow was to the south, toward the Pearl River.

Nature and Extent of Contamination

- **Soil:** No VOC constituents exceeded the Tier 1 Restricted and Unrestricted Target Remediation Goals (TRGs) for soil. PAH concentrations greater than the Tier 1 TRGs were detected in the sample collected from PB-8/7 at 12 to 16 feet BGS. The sample results for benz (a) anthracene (1.1 ppm), benzo (a) pyrene (1.1 ppm), and benzo (b) fluoranthene (1.1 ppm) exceeded the Ticr 1 TRG levels for Unrestricted sites (0.875 ppm, 0.0875 ppm, and 0.875 ppm, respectively). The benzo (a) pyrene concentration of 1.1 ppm also exceeded the Tier 1 TRG level for restricted sites (0.784 ppm). Probe boring PB-8/7 was installed to the south of the paint shop foundation. Three of the RCRA metals exceeded the Tier 1 TRGs for Unrestricted sites. Concentrations of lead exceeded the Tier 1 TRG level for unrestricted sites of 400 ppm in the samples collected from PB-2/4 (440 ppm), PB-6/1 (421 ppm), and PB-8/1 (874 ppm). The Unrestricted Tier 1 TRG level for mercury (10 ppm) was exceeded in sample PB-5/3 (16.4 ppm). Probe boring PB-2 was installed to the northeast of the vehicle maintenance foundation. Probe borings PB-6 and PB-8 were installed to the north and south of the paint shop foundation, respectively, and PB-5 was installed to the east of the air conditioning and heater repair building. Levels of arsenic exceeded the Unrestricted TRG level (0.426 ppm) in all soil samples submitted to the laboratory, and exceeded the Restricted TRG level (3.82 ppm) in all but three samples (PB-5/3, PB-6/4, and PB-8/7). Background arsenic levels in Mississippi soils have been reported to range from 0 to 26 ppm with an average of 4 to 10 ppm according to the *Solid-phase Geochemical Survey of the State of Mississippi* published by the MDEQ Office of Geology. These naturally occurring levels are above the TRGs, and may explain elevated levels of arsenic found in the soil samples analyzed during this assessment.

- **Groundwater:** Free product were not encountered in any of the piezometers. No VOC constituents exceeded the Tier 1 Restricted and Unrestricted Target Remediation Goals (TRGs) for groundwater. PAH constituents exceeding the MDEQ Tier 1 TRGs included benz (a) anthracene (0.000096 ppm) in the sample collected from PB-9/TW-9, and benzo (b) fluoranthene in the samples collected from PB-1/TW-1 (0.00027 ppm), PB-5/TW-5 (0.00014 ppm), and PB-8/TW-8 (0.00035 ppm). Only two constituents from the RCRA metals analysis exceeded the Tier 1 TRGs for groundwater. Lead concentrations detected in TW-1 (0.0597 ppm), TW-2 (0.0406 ppm), TW-5 (0.0423 ppm), TW-8 (0.0822 ppm), and TW-9 (0.0178 ppm) exceeded the Tier 1 TRG of 0.015 ppm. Barium was detected in each of the groundwater samples collected; however, the only sample that exceeded the Tier 1 TRG of 2.0 ppm was collected from TW-8 (2.39 ppm).

- **Source of Release:** The landfill material was identified as the primary source of impact during the investigation. Excluding arsenic, which exceeded the Tier 1 TRGs in all samples collected, COCs in the landfill material exceeded the Tier 1 TRGs in PB-2/4, PB-5/3, and PB-8/7. These elevated concentrations appear to be isolated occurrences that are results of the former landfilling operations at the site. Based on the knowledge that the past use of the site was an unregulated landfill, isolated areas of impact potentially exist throughout the subsurface. The soil in the vicinity of the former paint shop was identified as a secondary source of impact during the investigation. COCs in the shallow soil samples collected near the paint shop foundation include lead detected from 0 to 2 feet BGS in PB-6/1 and PB-8/1. These occurrences are likely the result of painting operations involving lead paint at the former paint shop or the sanding of metals.

- **Contaminant Fate and Transport:** The extent of soil and groundwater impact above TRGs has not been delineated. Landfill material appears to be the primary source of impact, and secondary sources included impacted soil and groundwater in the vicinity of the paint facility. Potential migration routes for the detected constituents include air, surface soil (<6 feet), subsurface soil (> 6 feet), and groundwater. Sediments and surface water were not tested as part of the approved scope of work at the site. Wind erosion and migration through air was considered to be minimal for VOC constituents and PAH constituents since the majority of impact was found in subsurface soils and groundwater. Unless the soils were disturbed through excavation, the potential for migration through air was considered negligible. Dispersion of the metals detected in the shallow soils near the paint shop foundation could occur through wind erosion.

  Migration through soil was considered negligible as well unless the soils were disturbed through excavation or other construction activities. The greatest potential for migration appears to be through groundwater. Although VOCs were not detected in downgradient wells, the potential for migration does exist due to the proximity of the site to the Pearl River. However, if the plume is stable or shrinking, this migration route may be limited as well.

  While laboratory analysis did reveal the presence of limited soil and groundwater impact, the detected constituents were scattered throughout the site in the landfill material that comprises the subsurface. The source area is not considered to be defined due to the randomness of the sampling results. Due to the nature of the landfill, COCs could be present anywhere throughout the subsurface.

- **Identified Receptors/Risk:** The sensitive receptor survey conducted revealed the presence of one potential receptor: underground utilities (water, natural gas, and sanitary sewer main). Biological receptors such as plants and animals in the site vicinity do not appear to have been impacted by the landfill or paint shop. The Pearl River floodplain lies directly adjacent to the site to the south, and the Pearl River is located approximately 50 yards from the southern boundary of the property. Five water wells were also identified within a quarter mile radius of the site: N0044, N0045, N0047, N0048, and N0056. PPM conducted field reconnaissance to verify these locations, but evidence of the wells were not found. Completion of the Baseline Site Conceptual Exposure Model (SCEM) did reveal complete pathways for soil and groundwater, if the site is developed for uses beyond industrial.

Recommendations

Due to the large area of the former landfill, and the presence of lead concentrations greater than Tier 1 TRGs that are possibly high enough to be classified as hazardous wastes, excavation of the area is not considered a viable option. Excavation of impacted surface soils near the paint shop foundation would be possible, but with the underlying landfill material impacted, this would not mitigate all COCs in this area. According to personnel with the City of Jackson, preliminary plans for re-development of the site include engineering controls to prevent exposure to the impacted subsurface. A 1-foot clay cap is planned to be installed over the entire site to prevent exposure to impacted soils and subsurface vapors. Installation of site monitoring wells has also been proposed to monitor subsurface conditions over time. Installation of this cap over the landfill, and establishment of institutional controls such as deed restrictions to limit disturbance of the impacted area and usage of the site appears to be a viable option. Installation of groundwater/landfill gas monitoring wells should be considered throughout the site, as well as along the eastern and western perimeters of the site to ensure impacted groundwater is not migrating into the Pearl River.

2.0 INTRODUCTION

PPM Consultants, Inc. was retained by the Mississippi Department of Environmental Quality (MDEQ) to conduct additional assessment activities at the LeFleur's Bluff Landing property located at 658 South Jefferson Street in Jackson, Hinds County, Mississippi. The City of Jackson is proposing to redevelop the property as a festival grounds. The purpose of the additional subsurface investigation was to determine if soil and groundwater has been impacted by previous operations, which would have an adverse affect on the site for the planned development. This report describes the scope of work completed, field and analytical methods used, and presents all findings and conclusions from the investigation.

2.1 PROPERTY BACKGROUND

Whitney's Grocery is located on the northeast corner of Middle Road and Bill Strong Road in Edwards, Mississippi. The site is geographically located at approximately Longitude 90° 37' 20.3'' West and Latitude 32° 13' 39.1" North. The area surrounding the property is used for residential purposes.

2.1.1 Property Location and Demographics

The LeFleur's Bluff Landing property is located at 658 South Jefferson Street in Jackson, Mississippi. The property is approximately 45 acres and is bound by Jefferson Street to the west, a levee to the north, a utility right-of-way to the east, and the Pearl River to the south. Based on the U.S. Geological Survey 7.5 minute Jackson, Mississippi quadrangle map, the property is located in Sections 10 and 11, Township 5 North, Range 1 East in Hinds County in the central portion of Mississippi as shown on **Figure 1** included in **Appendix A**. No residential areas are located within a half mile of the site. Across Jefferson Street is commercial and vacant properties, east of the utility right-of-way is vacant land and the Pearl River, and north of the levee is vacant property. Adjacent properties are shown on **Figure 2, (Appendix A)**.

2.1.2 Property History

The property is currently occupied by various City of Jackson facilities: The City of Jackson Street Department Engineering laboratory, which is a former cremation building; the SWAM Team/Mobile Command Unit Storage facility; the City of Jackson Mounted Patrol division; an Animal Shelter Control Center; the Downtown Jackson Landscape District Worker's Division; a vehicle storage/parking shed; and two small storage buildings. There is also the concrete foundations of a former vehicle maintenance facility and a paint shop on the property.

The City of Jackson retained URS Corporation (URS) through the US Army Corps of Engineers (Corps) to perform a Phase I Environmental Site Assessment in 2000. Findings from the Phase I ESA indicated the 45-acre property was used for a variety of activities including a landfill, incinerator, maintenance shop, fuel distribution, animal control, testing laboratory, asphalt plant, paint shop, and law enforcement activities. Based on the findings of URS, 70 percent of the property was used as a landfill from 1900 through 1970.

URS identified some of the former operations that may have impacted subsurface conditions of the property. These operations included the following:

- **Former landfill activities**. The City of Jackson used the facility as a municipal landfill from approximately 1900 through 1970.
- **City of Jackson refueling activities**. These activities required the operation of underground storage tanks (USTs). The site was listed on the Leaking Underground Storage Tank (LUST) database. Contamination was reported during a UST removal in which confirmation sampling was not conducted.
- **City of Jackson equipment maintenance activities at the former City Garage and current Jackson Mounted Police buildings**. Three fires occurred at the City Garage during the 1980s and impacts to the soil and groundwater may have resulted during these incidents.
- **Activities associated with the operation of the City Paint Shop, Meter Repair Facility, City Asphalt Plant, and City Refuse Burner Facility**.

Once the former operations and potential impacts were identified, the site was subdivided into four different areas with Area 3 subdivided into two specific areas. These are listed below:

Area 1:	Former City Landfill (trash piles, tar residuals, concrete, tires, and empty drums)
Area 2:	Existing City Buildings
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Area 3B:	Old City Garage Maintenance foundation slab
Area 4:	UST and Refueling Areas

The City of Jackson requested assistance from the MDEQ Brownfields Program to address Areas 2 and 3B. The conditions of Area 4 were addressed under the USTfields program. Site conditions within Area 1 and Area 3A were addressed under the MDEQ's Uncontrolled Sites Voluntary Evaluation Program (VEP). Based on the past operations, the potential contaminants identified in Areas 2 and 3B include:

- Volatile Organic Compounds (fuels, solvents);
- Polynuclear Aromatic Hydrocarbons
- Metals (paint pigments, engine cleaning, plating)

2.1.3 Mining/Exploration Activities

Mining/exploration activities in Hinds County primarily consist of oil and gas exploration and sand and gravel mining for construction purposes. Clay has been mined for brick and tile production, and sandstone and limestone has been mined for building stone and riprap. None of these activities were identified within a 1-mile radius of the site.

2.1.4 Previous Investigation

Available records from the MDEQ files and other sources have been reviewed to gain an overall perspective of the current site conditions and potential environmental concerns related to the subject property. These records and documents include:

- *Phase I Environmental Site Assessment (ESA)*, June 28, 2000 by URS Corporation
- *Phase II Environmental Site Assessment*; June 12, 2003 by Arcadis Geraghty and Miller, Inc.
- Recent and historical aerial photographs of the site;
- USGS topographic maps;
- USDA surface soil maps; and
- Internet resources (aerial photographs, topographic maps).

The *Phase 1 Environmental Site Assessment* conducted by URS Corporation is summarized in Section 2.1.2, Site History. The *Phase II Environmental Site Assessment*, conducted by Arcadis, Geraghty, and Miller focused on areas designated as Area 1 and Area 3A in the Phase I conducted by URS. The Phase II indicates fill material is present to approximately 24 feet BGS in Area 1, and groundwater was encountered between 21 and 24 feet BGS. Groundwater flow as determined by the Phase II generally follows the configuration of the Pearl River located south of the site. Soil samples from two of the borings advanced in Area 1 indicate low levels of arsenic and Total Petroleum Hydrocarbons-Diesel Range Organics (TPH-DRO) above the MDEQ Tier 1 Target Remediation Goals (TRGs). Groundwater samples collected from Area 1 indicated the presence of TPH-DRO, lead, and arsenic.

Arsenic and lead concentrations exceeded the Tier 1 TRGs in two soil samples collected in the area of the former asphalt plant (Area 3A). Groundwater data collected in area 3A indicated cadmium, lead, and some PAH constituents exceeded Tier 1 TRGs. Conclusions from the Phase II indicated further investigation of PAH constituents in Area 2 during any redevelopment. The conclusions also stipulated disturbance of subsurface soil deeper than 14 feet BGS should be kept to a minimum, and worker protection would be required if this soil were disturbed.

Based on these findings, the MDEQ retained PPM to further evaluate soil and groundwater conditions in these areas under our Brownfields Contract with the MDEQ.

3.0 INVESTIGATIVE METHODS

The soil and groundwater assessment focused on the possible constituents resulting from the former operations in areas designated as Areas 2 and 3B, shown on **Figure 3, (Appendix A)**. Prior to implementation, PPM reviewed the findings of the previous assessments conducted at the site to develop a scope of work for further assessing the extent of soil and groundwater impact. PPM also used industry knowledge regarding potential contaminants common to automobile maintenance, air-conditioning/heater repair, painting, and solvents. PPM used this information to develop a site-specific Quality Assurance Project Plan (QAPP) for all activities to be conducted.

Based on the environmental information associated with this property, the initial objective of the Brownfields site assessment is to assess the extent to which soil and groundwater constituents associated with former operations have impacted the site. The ultimate objective is to determine what engineering controls or remediation methods must be applied to the subject property, if any, to ensure adequate occupant and worker safety and protection of the public's health and welfare during its intended use. The scope of work for the assessment included:

- Advancement of nine soil borings using Direct Push Technology (DPT)
- Collection of soil samples from each boring at 2-foot intervals
- Field screening of soil samples with a hydrocarbon analyzer and laboratory analyses of selected soil samples
- Installation of 1 inch Inside Diameter (I.D.) piezometers (temporary wells) in each of the nine borings
- Collection of groundwater samples via temporary wells
- Laboratory analyses of 12 soil samples and eight groundwater samples for VOCs per U.S. EPA Method 8260B, Polynuclear Aromatic Hydrocarbons (PAH) per U.S. EPA Method 8310, and RCRA Metals per U.S. EPA Method 6010. An additional two soil samples were collected from shallow soil near the Paint Shop foundation and submitted to the laboratory for RCRA Metals analyses
- Preparation of an environmental assessment report

The approved scope of work from the QAPP included the installation of ten probe borings; however, during installation of PB-10 a water line was encountered at approximately 3.5 feet BGS. The boring location was hand-probed to 3 feet BGS to ensure no underground utilities were present, but the water line was located deeper than the termination depth of the hand-probe. The water line was not repaired for several hours, and the area became flooded. The MDEQ project manager was consulted, and the boring location was abandoned.

Due to the loose landfill material that comprises the subsurface, recovery in many of the 4-foot collection intervals was insufficient to collect a sample every 2 feet. The investigative methods utilized are discussed in greater detail in the following sections.

3.1 SOURCE AREA(S) CHARACTERIZATION

In the Phase II investigation conducted by Arcadis Geraghty and Miller, PAH constituents, cadmium, and lead in groundwater were detected at levels greater than the Tier 1 TRGs in Area 3B. Two soil samples also indicated arsenic and lead exceeded the Tier 1 TRGs in area 3B. Area 2 is located hydraulically downgradient from Area 3B, therefore the potential exists for migration via groundwater transport from Area 3B to Area 2.

Primary assessment activities consisted of installation of soil borings and piezometers, and collection of soil and groundwater samples. Methods used to conduct these activities are presented in the following sections.

3.1.1 Soil Sampling

Sample collection, preparation, and decontamination procedures were performed in accordance with the approved QAPP. PPM utilized DPT to collect soil and groundwater samples from the locations shown in **Figure 3 (Appendix A)**. Soil samples were collected at continuous 2-foot intervals where possible using a 1.5-inch I.D. Macro-Core Sampler. The DPT was also used to install 1-inch diameter, temporary monitoring wells. DPT was selected as the drilling technique due to its speed, effectiveness, low cost, and minimal volume of investigation-derived wastes produced.

DPT uses hollow steel rods to advance a probe or sampling tool. The sampling device consists of a 51.25-inch long stainless-steel sample tube, cutting shoe and drive head. The rods are 4-feet long and have connecting ends. As the DPT rods were "pushed" into the ground, a new section was added until the target depth was reached. Macro-core liners were used to collect the samples. Each stainless-steel sample tube was lined with 48-inch long clear disposable plastic tubes.

In general, soil samples were collected from each soil boring at continuous 2-foot intervals for field screening and potential laboratory analysis. Due to the loose landfill material that is present in the subsurface, recovery in many of the 4-foot collection intervals was insufficient to collect a sample every 2 feet. Field screening was conducted utilizing headspace analysis techniques with a Thermo Environmental Instrument, Inc. OVA Model 580B PID calibrated with 100 ppm isobutylene span gas. The PID was calibrated in accordance with the manufacturer's specifications before and during the investigation at the interval required in the QAPP. Background ambient air readings were recorded prior to each headspace reading. Meter readings were allowed to return to near previously recorded ambient air measurements.

Procedures for performing headspace analysis consisted of the following:

- Clean glass jars were half-filled with soil and quickly covered with two sheets of aluminum foil. The threaded piece of a two-piece type lid was applied tightly to seal the jar.

- The jar was shaken vigorously for approximately 15 seconds, allowed to sit for a minimum period of 15 minutes and shaken again for at least 15 more seconds.
- The probe tip of the PID was quickly inserted through the aluminum foil covering towards the center of the headspace within the jar. Care was exercised to prevent water droplets or soil particulates from entering the probe.

The highest instrument reading was recorded as the volatile organic vapor concentration. Erratic meter responses were disregarded. The field screening results were used to determine the relative distribution of VOC concentrations in soil during field activities, and to select soil samples for subsequent laboratory analysis. Soil samples were analyzed from an appropriate number of locations to define the extent of soil contamination at the site. Samples were submitted for laboratory analysis from one or more of the following intervals:

- Samples exhibiting the highest PID readings
- Samples collected from the depth at which groundwater was first encountered
- Samples collected from the depth of boring completion

Disposable nitrile gloves were worn during sample collection and changed at each sampling interval. Samples were described and recorded in a logbook according to the Unified Soil Classification System. Soil samples from each soil boring were retained for headspace and potential laboratory analyses in the appropriate sample containers and placed on ice. Each sample containerized for laboratory analyses was firmly packed into a clean, glass sample jar to the fullest extent possible to minimize headspace within the container. Each glass container was tightly sealed with a Teflon lid. Following the completion of each probe boring, the DPT equipment was cleaned thoroughly using phosphate- free detergent (Liquinox). Soil samples were analyzed for VOCs per U.S. EPA Method 8260B, Polynuclear Aromatic Hydrocarbons (PAH) per U.S. EPA Method 8310, and RCRA Metals per U.S. EPA Method 6010.

Soil cuttings and sampling tubes were containerized on site in 55-gallon drums and is scheduled to be disposed of by Walker-Hill Environmental no later than May 6, 2005, at Little Dixie Landfill located in Ridgeland, Mississippi.

3.1.2 Groundwater Sampling Techniques

Groundwater samples were collected from temporary wells (piezometers) installed in the nine probe borings advanced during the assessment. Piezometers were installed to determine groundwater flow direction and the dissolved VOC distribution in groundwater. Piezometers were constructed of 1- inch I.D. PVC Geoprobe® Prepacked Well Screens and 1- inch I.D. PVC risers. Prepacked screens consist of standard, slotted PVC well screen pipe surrounded by a stainless steel mesh. Sand is packed between the slotted PVC and the stainless steel mesh. Each well was set with 10 feet of screen set to intercept the top of the groundwater zone. The piezometers were developed using a peristaltic pump with a sufficient length of chemically inert disposable tubing to reach the middle of the screen of each well. The pump was allowed to run at a low rate so as to minimize draw down in each well. Purged water was stored on site in 55-gallon drums for subsequent disposal. Piezometer construction data is shown in **Table 1, Groundwater Elevation/Piezometer Data** included in **Appendix B, Tables**, and in the boring logs included in **Appendix C, Geologic Boring Logs**.

At least five well volumes were purged from each well prior to sampling (except TW-4) in order to obtain samples representative of subsurface conditions. Temporary well TW-4 purged dry after only 1.25 gallons of water were evacuated on the first day of sampling (March 1, 2005). PPM returned to sample this well on March 2, 2005, and only purged enough water to collect one round of stability data before filling the sample containers to prevent the well from purging dry.

In order to determine when a well was adequately purged, the pH, specific conductance, temperature, and turbidity of the ground water removed was monitored for stability. An adequate purge was achieved when the pH, specific conductance, and temperature of the groundwater stabilized and the turbidity either stabilized or was below 10 Nephelometric Turbidity Units (NTUs) (twice the Primary Drinking Water Standard of 5 NTUs). Stabilization occurred when pH measurements remained constant within 0.1 Standard Unit (SU), specific conductance varied no more that 10 percent, and the temperature was constant for at least three consecutive readings.

When stability was achieved, groundwater samples were then collected from each of the piezometers using the peristaltic pump. Disposable nitrile gloves were worn during the sample collection. Water samples for VOC analysis were stored in 40-ml septum vials with screw cap and Teflonâ-silicone disk in the cap to prevent contamination of the sample by the cap. The vials were completely filled to prevent volatilization, and extreme caution was exercised when filling the vials to avoid any turbulence, which could also produce volatilization. After capping, the bottles were turned over and tapped to check for bubbles.

Water samples for PAH analysis were stored in non-preserved 1-liter amber glass jars, and water samples for RCRA Metals analysis were placed in 500-cc Nalgene bottles preserved with nitric acid (HNO3). All samples were transferred into a laboratory-prepared container and immediately preserved on ice. Groundwater samples were analyzed for VOCs per U.S. EPA Method 8260, PAHs per EPA Method 8310, and RCRA Metals per EPA Method 6010.

Investigation derived water from well development and sampling activities was containerized on site in 55-gallon drums and is scheduled to disposed of by Walker-Hill Environmental at Little Dixie Landfill located in Ridgeland, Mississippi no later than May 6, 2005.

3.2 IMPACTED SURFACE WATERS SEDIMENTS

Surface water and sediment sampling was not conducted at the site per the approved scope of work.

3.3 PROPERTY GEOLOGY

PPM visually inspected each soil sample collected during soil boring activities to determine site-specific lithology. The continuous sampling conducted with the DPT rig enabled PPM to log a vertical profile of each boring, degree of saturation, and presence of confining layers. Soils were described per the Unified Soil Classification System (USCS) and recorded in a field book. This information was used to develop boring logs and cross sections for presentation of the data.

3.4 PROPERTY SOIL AND VADOSE ZONE CHARACTERISTICS

Physical soil properties were not determined during this investigation per the approved scope of work. Soil sampling techniques are described in detail in Section 3.1.

3.5 PROPERTY GROUNDWATER/AQUIFER CHARACTERISTICS

Due to the limited scope of this investigation and use of temporary wells to collect groundwater samples, only limited information was obtained regarding aquifer characteristics per the approved scope of work. As described in Section 3.1.2, temporary 1-inch diameter PVC piezometers were installed in nine of the boring locations to facilitate groundwater sampling. Initial saturation was recorded by visual inspection of soil cores obtained during drilling activities. The wells were purged using disposable plastic tubing and a peristaltic pump after installation of the piezometers. The wells were purged until the discharge was free of fines and clear in color.

3.6 HUMAN/TARGET POPULATION SURVEYS

PPM determined population and land use in the area by reviewing information obtained from the following sources:

- Mississippi Development Authority
- US Census Bureau
- Nationmaster.com

3.7 AREA WATER WELL SURVEYS

PPM conducted the following research to determine the location of water wells within a 1-mile radius of the site:

- US Geological Survey
- MDEQ Office of Land and Water Resources
- Field reconnaissance

3.8 ECOLOGICAL TARGET SURVEYS

PPM completed the MDEQ Brownfield Voluntary Cleanup Program Ecological Checklist using data obtained from previous environmental assessments, visual inspection of the area, review of topographic maps, and subsurface data obtained during this investigation. Findings from the checklist process are discussed in Section 4.9.

4.0 PROPERTY PHYSICAL CHARACTERISTICS

4.1 SOURCE AREA PHYSICAL CHARACTERISTICS

The source areas identified during this assessment (and corresponding location number on **Figure 3** included in **Appendix A**) were assumed to be:

- The concrete pad that was formerly the location of a vehicle maintenance facility (13);
- The janitorial supply warehouse (6);
- Air conditioning and heater repair building (3);
- The concrete pad that was formerly the location of a paint shop (17); and,
- The storage buildings/vehicle parking sheds (9 & 11).

There was no evidence of surface impact, unusual odors, stressed vegetation, soil staining, etc. identified during the assessment. Physical properties testing of soil and groundwater in these areas was not conducted as a part of the approved work scope.

4.2 IMPACTED SURFACE WATER AND SEDIMENTS

Surface water and sediments were not tested as a part of the approved scope of work.

4.3 REGIONAL GEOLOGY/HYDROGEOLOGY

Hinds County is underlain by the Midway, Wilcox, Claiborne, Jackson and the Vicksburg groups, within the Eocene series. The geology surrounding the Jackson area consists of sand, silt, clay, and lignite belonging to the Claiborne group. Formations associated with the Claiborne group include the Tallahata, Winona, Zilpha, Kosciusko, Cook Mountain, and the Cockfield.

The Tallahata formation consists of light gray to green shale and clay with beds of siltstone and silty clays. The Tallahata is approximately 75 feet thick in the vicinity of the Jackson

Dome and thickens to 250 feet in southwest Hinds County. This formation underlies the Winona and the Zilpha Formations.

The Winona formation is primarily fine to medium-grained glauconitic, calcareous sand and sandy marl. The Winona ranges from 10 to 30 feet thick. The Zilpha formation overlies the Winona mainly consisting of fossiliferous clay, with the lower Zilpha consisting of glouconite and the upper Zilpha mainly sand. This formation ranges from 250 to 400 feet thick.

Overlying the Zilpha formation is the Kosciusko (Sparta Sand) formation, which consists primarily of irregularly bedded sand, silt, clay and lignite. The Kosciusko is approximately 300 feet thick at the crest of the Jackson Dome and approximately 850 feet thick in southwest Hinds County. Sands associated with this formation range from fine- to coarse-grained. Water bearing sands range from approximately 50 feet to over 400 feet thick.

The Kosciusko formation is overlain by the Cook Mountain formation. The Cook Mountain is primarily made of micaceous, carbonaceous clay with beds of glauconitic, fossiliferous, sandy marl. The Cook Mountain is approximately 100 feet thick at the Jackson Dome and thickens to 200 feet thick in southwest Hinds County. Overlying the Cook Mountain formation is the Cockfield formation.

The Cockfield formation ranges in thickness from 250 feet to over 600 feet. The Cockfield consists primarily of irregularly bedded silty, carbonaceous, micaceous clays, silty sands, silt, and thin beds of lignite. The water bearing sands associated with this formation are fine- to medium-grained, ranging from 50 feet to 250 feet thick. The subject site sits atop the Cockfield formation.

The primary aquifers for Hinds County are the Kosciusko (Sparta Sand), Cockfield, Forest Hill and the Catahoula formations. The majority of the producing wells in the Jackson area receive groundwater from the Kosciusko and the Cockfield formations. The thickness of the Kosciusko formation is from 300 to 800 feet with individual sand beds ranging from 50 to 400 feet thick. The majority of the wells completed in the Kosciusko range from 600 to 1,500 feet below ground surface (BGS), with water yields ranging from small to intermediate. Most wells in the Kosciusko do not yield more than 500 gallons per minute (gpm). The Cockfield formation ranges from 250 to 600 feet thick, with individual sand beds ranging from 50 to 250 feet thick. Water producing wells in the Cockfield formation range from 200 to 1,400 feet BGS, with yields ranging from small to intermediate.

4.4 PROPERTY GEOLOGY

Site lithology was characterized by the visual inspection of soil samples generated during the advancement of borings. Soils were described in accordance with the USCS and geologic boring logs were developed from the visual information obtained during probe boring activities.

As mentioned in Section 2.1.2, and confirmed by the soil borings advanced during the assessment, the majority of the site is a former landfill. Beneath surface cover in most boring locations, varying types of intermixed silt, sand, and clay are present. Beneath the initial silt, sand, and clay, each boring exhibited intermixed silts, sands, glass, trash, gravel, brick, and concrete debris that is a result of past land-filling activities. The depth and thickness of these debris layers was inconsistent throughout the subject area, and were sometimes intermixed with layers of silt, sand, and clay. In probe borings PB-2 and PB-5, a soft wet gray clay that is assumed to be native soil was present at approximately 22 to 23 feet BGS.

Site lithology is depicted in the boring logs included in **Appendix C**, and in **Figure 4, Geologic Cross Section A-A'** and **Figure 5, Geologic Cross Section B-B' (Appendix A)**.

4.5 PROPERTY SOIL AND VADOSE ZONE CHARACTERISTICS

As previously discussed, soil physical property measurements were not obtained during this investigation per the approved scope of work.

4.6 PROPERTY GROUNDWATER/AQUIFER CHARACTERISTICS

Groundwater was encountered in the borings at depths ranging from 16.5 to 22 feet BGS. This water is held in the landfill material by the native gray clay that was observed in PB-2 and PB-5. Groundwater elevations were recorded in all temporary wells, excluding TW-7, to determine the groundwater flow direction at the site. Temporary well TW-7 was dry; therefore, no data was collected from this well. Groundwater flow was to the south, toward the Pearl River. **Figure 6, Potentiometric Surface Map (Appendix A)**, depicts the groundwater flow direction prior to sampling the temporary wells. Groundwater elevation data is shown in **Table 1 (Appendix B)**.

4.7 HUMAN/TARGET POPULATION SURVEYS

The City of Jackson is a large metropolitan city located in Hinds County. Residential, commercial, and industrial zones can be found throughout the city and outer lying areas. The city covers a total area of 104.9 square miles. As of the 2000 census, there are approximately 184,256 people in the city comprised of 176,841 households with 44,503 families. Population density was 105 people per square mile. The population density within the site vicinity appears to be low with no residential property in the area.

4.8 AREA WATER WELL SURVEYS

PPM reviewed information provided by the US Geological Survey, and the MDEQ Office of Land and Water Resources to determine the locations of water wells within a 1-mile radius of the site. PPM attempted to field verify wells located within a quarter mile radius of the site; however, none were located. Well data is tabulated in **Table 2, Surrounding Water Well Data (Appendix B)** and is plotted in **Figure 7, Water Well Survey (Appendix A)**.

4.9 ECOLOGICAL TARGET SURVEYS

PPM completed the MDEQ Brownfields Voluntary Cleanup Program Ecological Checklist. The checklist is included in **Appendix D, Ecological Checklist**. The Area of Impact (AOI) is greater than 1 acre in size; therefore, the site does not meet all of the criteria for exclusion for further ecological evaluation.

5.0 NATURE AND EXTENT OF CONTAMINATION

5.1 SOIL

The highest headspace reading (75 ppm) was recorded in the sample collected from PB-8/TW-8 at a depth of 0-2 feet BGS. This boring was installed to the south of the paint shop foundation. Headspace concentrations were detected in each of the subsequent samples collected from this location ranging from 1.8 to 71 ppm to a depth of 16 feet BGS. Headspace concentrations were detected in all other soil borings advanced at the site (except PB-2) ranging from 0.1 ppm to 14.8 ppm (PB-6/TW-6). Headspace concentrations are shown in the boring logs included in **Appendix C**.

In general, the vadose zone soil sample from each boring that exhibited the highest field headspace reading was selected for laboratory analyses. Other criteria for selecting soil samples included the depth at which saturated soils were first encountered, and total boring depth. Due to noticeable solvent in the first sample collected from PB-3, two samples were submitted for analysis: PB-3/1 (0 to 4 feet BGS), and PB-3/5 (12-16 feet BGS). Due to elevated PID readings in PB-6 and PB-8, two samples were submitted from each of these locations, including: PB-6/4 (6-8 feet BGS) and PB-6/8 (16-18 feet BGS), and PB-8/1 (0 to 2 feet BGS) and PB-8/7 (12-16 feet BGS). Soil samples were submitted with the appropriate chain-of-custody forms to SPL, Inc. in Scott, Louisiana for analysis. Soil samples were analyzed for VOCs per U.S. EPA Method 8260, PAHs per EPA Method 8310, and RCRA Metals per EPA Method 6010.

Because the possibility of metals from paint exists in the soil near the former paint shop, shallow soil samples were collected from PB-6/1 (0 to 2 feet BGS) and PB-7/1 (0 to 4 feet BGS) and analyzed for RCRA Metals.

Minimal concentrations of the VOC constituent methylene chloride were detected in soil in probe boring PB-1/4 (0.86 ppm) installed to the northwest of the former vehicle maintenance pad; PB-6/4 (0.48 ppm), and PB-8/1 (0.45 ppm) installed north and south of the paint shop foundation, respectively. This was the only Chemical of Concern (COC) from the VOC list detected in the soil samples collected during the investigation. Each occurrence of methylene chloride was below the MDEQ Tier 1 Target Remediation Goals for Restricted (21.9 ppm) and Unrestricted (14.3 ppm) sites. This concentration may be a relic from the extraction process used in the laboratory. Analytical results from VOC analysis of soil samples are summarized in **Table 3, Soil Analytical Summary, Volatile Organic Compounds (Appendix B)**.

Several concentrations of PAH constituents were detected in the soil samples collected during the investigation. The only soil samples that did not exhibit PAH constituents above laboratory detection limits include PB-2/4 and PB-4/4. PAH concentrations greater than the Tier 1 TRGs were detected in the sample collected from PB-8/7 at 12 to 16 feet BGS. Probe boring PB-8/7 was installed to the south of the paint shop foundation. The sample results for benz (a) anthracene (1.1 ppm), benzo (a) pyrene (1.1 ppm), and benzo (b) fluoranthene (1.1 ppm) exceeded the Tier 1 TRG levels for Unrestricted sites (0.875 ppm, 0.0875 ppm, and 0.875 ppm, respectively). The benzo (a) pyrene concentration of 1.1 ppm also exceeded the Tier 1 TRG level for Restricted sites (0.784 ppm). All other occurrences of PAH constituents were below the Tier 1 TRG levels. Analytical results from PAH analysis of soil samples are summarized in **Table 4, Soil Analytical Summary, Polynuclear Aromatic Hydrocarbons (Appendix B)**. The analytical results from PAH analysis that exceeded Tier 1 TRGs are shown on **Figure 8, PAH Concentrations in Soil Above Tier 1 TRGS (Appendix A)**.

Three of the RCRA metals constituents exceeded the Tier 1 TRGs for Unrestricted sites. Concentrations of lead exceeded the Tier 1 TRG level for unrestricted sites of 400 ppm in the samples collected from PB-2/4 (440 ppm), PB-6/1 (421 ppm), and PB-8/1 (874 ppm). The Unrestricted Tier 1 TRG level for mercury (10 ppm) was exceeded in sample PB-5/3 (16.4 ppm). Probe boring PB-2 was installed to the northeast of the vehicle maintenance foundation. Probe borings PB-6 and PB-8 were installed to the north and south of the paint shop foundation, respectively, and PB-5 was installed to the east of the air conditioning and heater repair building. Levels of arsenic exceeded the Unrestricted TRG level (0.426 ppm) in all soil samples submitted to the laboratory, and exceeded the Restricted TRG level (3.82 ppm) in all but three samples (PB-5/3, PB-6/4, and PB-8/7). Background levels of arsenic in the Jackson, Mississippi, area often exceed the Tier 1 TRGs. Analytical results from RCRA Metals analysis of soil samples are summarized in **Table 5, Soil Analytical Summary, RCRA Metals (Appendix B)**. Analytical results from RCRA Metals analysis that exceed Tier 1 TRGs are shown on **Figure 9, RCRA Metals Concentrations in Soil Above Tier 1 TRGS (Appendix A)**.

Analytical reports from soil sampling activities are included in **Appendix E, Soil Analytical Results.**

5.2 GROUNDWATER

Free product was not encountered in any of the temporary piezometers installed at the site. Groundwater samples were submitted from eight of the nine piezometer locations with the appropriate chain-of-custody forms to SPL, Inc, in Scott, Louisiana. The temporary piezometer installed in probe boring PB-7 (TW-7) was dry; therefore, no sample was collected from this location. Samples were analyzed for VOCs per U.S. EPA Method 8260, PAHs per EPA Method 8310, and RCRA Metals per EPA Method 6010.

The only VOC concentration detected in the groundwater samples was acetone (0.012 ppm) in the sample collected from TW-6, installed north of the paint shop foundation. This concentration was below the MDEQ Tier 1 TRG for acetone in groundwater (0.608 ppm). The groundwater analytical results for VOCs analysis are summarized in **Table 6, Groundwater Analytical Summary, Volatile Organic Compounds (Appendix B)**.

Several trace amounts of PAH constituents were detected in the groundwater samples submitted to the laboratory. The only constituents which exceeded the MDEQ Tier 1 TRGs were benz (a) anthracene (0.000096 ppm) in the sample collected from PB-9/TW-9, and benzo (b) fluoranthene in the samples collected from PB-1/TW-1 (0.00027 ppm), PB-5/TW-5 (0.00014 ppm), and PB-8/TW-8 (0.00035 ppm). Groundwater analytical results for PAH analysis are summarized in **Table 7, Groundwater Analytical Summary, Polynuclear Aromatic Hydrocarbons (Appendix B)**. Concentrations from constituents that exceeded the MDEQ Tier 1 TRGs are shown on **Figure 10, Elevated PAH Concentrations in Groundwater (Appendix A)**.

Only two constituents from the RCRA metals analysis exceeded Tier 1 TRGs for groundwater. Lead concentrations exceeding the Tier 1 TRG of 0.015 ppm were detected in TW-1 (0.0597 ppm), TW-2 (0.0406 ppm), TW-5 (0.0423 ppm), TW-8 (0.0822 ppm), and TW-9 (0.0178 ppm). Barium was detected in each of the groundwater samples collected; however, the only sample that exceeded the Tier 1 TRG of 2.0 ppm was collected from TW-8 (2.39 ppm). Groundwater analytical results for RCRA Metals analysis are summarized in **Table 8, Groundwater Analytical Summary, RCRA Metals (Appendix B)**. Concentrations from the three RCRA metals constituents detected are shown on **Figure 11, RCRA Metals Concentrations in Groundwater Above Tier 1 TRGS (Appendix A)**. Groundwater Analytical reports are included in **Appendix F, Groundwater Analytical Results**.

Groundwater Sampling Data Forms, used to record stability parameters collected during groundwater sampling activities are included in **Appendix G, Groundwater Sampling Data Forms**.

6.0 CONTAMINANT FATE AND TRANSPORT

6.1 POTENTIAL MIGRATION ROUTES

PPM completed the Baseline Site Conceptual Exposure Model (SCEM) as required by MDEQ. A discussion of the basis used to complete the model is provided in the following sections.

Primary Sources: The landfill material was identified as the primary source of impact during the investigation. Excluding arsenic, which exceeded the Tier 1 TRGs in all samples collected, COCs in the landfill material exceeded the Tier 1 TRGs in PB-2/4, PB-5/3, and PB-8/7. These elevated concentrations appear to be isolated occurrences that are results of the former landfilling operations at the site. Based on the knowledge that the past use of the site was an unregulated landfill, isolated areas of impact potentially exist throughout the subsurface. COCs in the shallow soil samples collected near the paint shop foundation include lead detected from 0 to 2 feet BGS in PB-6/1 and PB-8/1. These occurrences are likely the result of painting operations involving lead paint at the former paint shop or the sanding of metals.

Secondary Sources/Media: The soil in the vicinity of the former paint shop (Building number 17 on **Figure 3**) was identified as a secondary source of impact during the investigation. COCs were detected in soils within 6 feet of the surface as well as below 6 feet. Groundwater was also impacted; so, these media were selected as Secondary Sources. No data was obtained regarding impact to sediments or surface water, so these media were not considered to be Complete or Potentially Complete.

Transport Mechanisms: Complete Transport Mechanisms were determined for Wind erosion and Atmospheric Dispersion, Volatilization and Atmospheric Dispersion due to the shallow impact. Volatilization and Enclosed Space Accumulation were not considered to be complete or potentially complete due to the lack of VOC or PAH impact near the surface. Groundwater impact was documented at the site, so the Leaching and Groundwater Transport Mechanism was considered to be complete. Runoff or Surface Water Transport was considered to be Potentially Complete since surface water could come in contact with shallow impacted soils.

Exposure Pathways: Under current conditions, Incidental Ingestion and Dermal Contact with Soil and Inhalation of Vapor or Particulates were not considered to be complete in the landfill material since the impacted soils are not currently exposed. However, such exposure could occur in the future if the impacted area was disturbed through construction or other excavation activities. Ingestion of groundwater was considered complete per the MDEQ guidance since groundwater impact is present at the site.

Incidental Ingestion and Dermal Contact with Soil and Inhalation of Vapor or Particulates was considered to be complete near the paint shop foundation. Surface soils exhibited lead concentrations greater than the Tier 1 TRGs in samples collected from 0-2 feet BGS.

Potential Receptor Populations: Although the site is currently used for industrial type purposes, the site is slated for development as a festival grounds. Per MDEQ policy, potentially complete pathways should be designated as complete under both the Unrestricted and Restricted TRG scenarios. Therefore, the Potential Receptor Populations were marked complete under all media.

A completed Baseline SCEM form is included in **Appendix H, SCEM Forms**.

6.2 CONTAMINANT CHARACTERISTICS

The following provides a summary of the characteristics of the constituents detected at levels greater than the Tier 1 TRGs in soil and groundwater at the site:

PAH - a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot. PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust. However, PAHs can occur in air attached to dust particles. Some PAH particles can readily evaporate into the air from soil or surface waters. PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks. PAHs enter water through discharges from industrial and wastewater treatment plants. Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers. Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in humans. The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens. The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3).

Lead - a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. Lead can affect almost every organ and system in your body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the reproductive system. The effects are the same whether it is breathed or swallowed. At high levels, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can also damage the male reproductive system. The connection between these effects and exposure to low levels of lead is uncertain.

Arsenic - a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds. Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily on cotton plants. Exposure to higher than average levels of arsenic occurs mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic in air will settle to the ground or is washed out of the air by rain. Many arsenic compounds can dissolve in water.

Mercury - naturally occurring metal, which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas. Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make. Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposures to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems. Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

Barium - a silvery-white metal found in nature. It occurs combined with other chemicals such as sulfur or carbon and oxygen. These combinations are called compounds. Barium compounds can also be produced by industry. Barium compounds are used by the oil and gas industries to make drilling mud. Drilling mud makes it easier to drill through rock by keeping the drill bit lubricated. They are also used to make paint, bricks, tiles, glass, and rubber. A barium compound (barium sulfate) is sometimes used by doctors to perform medical tests and to take barium-rays of the stomach. Exposure to barium occurs mostly in the workplace or from drinking contaminated water. Ingesting high levels of barium can cause problems with the heart, stomach, liver, kidneys, and other organs.

6.3 CONTAMINANT MIGRATION

Potential migration routes for the detected constituents include air, surface soil (<6 feet), subsurface soil (> 6 feet), and groundwater. Sediments and surface water were not tested as part of the approved scope of work at the site. Wind erosion and migration through air was considered to be minimal for VOC constituents and PAH constituents since the majority of impact was found in subsurface soils and groundwater. Unless the soils were disturbed through excavation, the potential for migration through air was considered negligible. Dispersion of the metals detected in the shallow soils near the paint shop foundation could occur through wind erosion.

Migration through soil was considered negligible as well unless the soils were disturbed through excavation or other construction activities. The greatest potential for migration appears to be through groundwater. Although VOCs were not detected in downgradient wells, the potential for migration does exist due to the proximity of the site to the Pearl River. However, if the plume is stable or shrinking, this migration route may be limited as well.

While laboratory analysis did reveal the presence of limited soil and groundwater impact, the detected constituents were scattered throughout the site in the landfill material that comprises the subsurface. The source area is not considered to be defined due to the randomness of the sampling results. Due to the nature of the landfill, COCs could be present anywhere throughout the subsurface. Impact to the shallow soils surrounding the paint shop was not completely defined; however, it is not believed these concentrations would migrate far from the source.

7.0 IDENTIFICATION OF POTENTIAL SENSITIVE RECEPTORS

7.1 RECEPTORS AND RISK

A sensitive receptor survey was conducted within the site vicinity to identify receptors potentially sensitive to released COCs. Receptors considered potentially sensitive included: migration pathways, biological receptors, natural receptors, and underground man-made receptors.

Potential migration pathways identified at the site included underground utilities (water natural gas, sanitary sewer main). Biological receptors such as plants and animals in the site vicinity do not appear to have been impacted by the landfill or paint shop. The Pearl River floodplain lies directly adjacent to the site to the south, and the Pearl River is located approximately 50 yards from the southern boundary of the property.

Five water wells were identified within a quarter mile radius of the site: N0044, N0045, N0047, N0048, and N0056. PPM conducted field reconnaissance to verify these locations, but evidence of the wells were not found.

8.0 QUALITY ASSURANCE RESULTS

8.1 KEY PERSONNEL

Key personnel utilized on this project were identified in the approved QAPP. The specific roles, activities, and responsibilities of project participants, as well as the internal lines of authority and communication within and between organizations are summarized as follows.

The City of Jackson representative for the LeFleur's Bluff Landing property project is Ms. LaVonne McGee. Mr. Willie McKercher is the MDEQ Brownfields Project Manager. He managed the contract and interfaced directly with the primary contractor, PPM Consultants. Mr. McKercher also communicated with the U.S. EPA Brownfields Project Manager and MDEQ Brownfields Program Director.

Mr. Trey Hess is the Brownfields Program Director for the MDEQ, and coordinated the overall program decisions with regard to program funding, site and contractor assignments, contractor negotiations, and overall compliance with the applicable regulations and directives issued by the U.S. EPA. Mr. Hess is the point of contact for overall program or technical compliance issues, and provided direction to the MDEQ Project Manager in certain technical instances.

Mr. McKercher is the MDEQ Project Manager for the Brownfields assessment project, and was the day-to-day contact for technical and contractual issues. Mr. McKercher ensured the technical plans submitted for the investigation were in compliance with appropriate MDEQ and Brownfields investigation standards and protocol and that schedules were strictly adhered to in the timely execution of the project. Mr. McKercher provided regulatory oversight for the field operations executed by the contractor, and obtained samples for quality assurance/quality control (QA/QC). Mr. McKercher also provided regulatory review and approval of all plans and reports issued during the course of the assessment.

The key PPM staff responsible for implementation of the project are the Program Manager, the Project Manager, QA Officer, and Project Health and Safety Coordinator. Descriptions of duties and responsibilities for the key personnel are presented below.

The PPM Brownfields Program Manager for the project is Ms. Nonie Taylor. Ms. Taylor was fully responsible and accountable for all project assignments and activities. Ms. Taylor was responsible for developing and maintaining the QAPP throughout the project. She was also the primary contact with the MDEQ for project-specific activities, which included:

- Oversight of project-specific issues relating to contracts, technical specifications, QA, and health and safety;
- Approval and implementation of project planning documents;
- Assignment of personnel to direct specific tasks within the project and provided the necessary resources to these managers;
- Direction of procurement activities at the project level including selection of project subcontractors;
- Assessment of the overall project for compliance with federal, state, and local regulations and laws;
- Interaction with regulatory and public agencies at the request of the MDEQ; and
- Submittal of project reports, as requested, to the MDEQ.

Mr. Keith Yarrow, Project Manager, was responsible and accountable for project activities. He served as a secondary contact with the MDEQ for project-specific activities and was responsible for the sound execution of technical aspects of the project, including:

- Field team supervisor;
- Implementation of the project work plan and QAPP on-site;
- Approval and implementation of project planning documents;
- Set project schedules, assigned duties to project staff, and provided the resources necessary for staff to accomplish the project;
- Maintained, assembled, and mobilized the proper field sampling equipment and materials;
- Prepared appropriate portions of project deliverables;

- Assessed final usability of the data per results of field and data validation processes;
- Interacted with regulatory and public agencies at the request of the MDEQ;
- Approved project-specific change orders;
- Attended meetings and conferences at the request of the MDEQ; and
- Issued project reports, as requested, to the MDEQ.

The Project QA Officer is Mr. Michael D. McCown, P.G. Mr. McCown served in an independent capacity within the project organization. The QA Officer ensured all QA/QC protocol specified in the QAPP was in compliance with U.S. EPA, MDEQ and PPM policies and procedures and had the authority to stop any work or procedures that did not achieve the specified level of QA/QC required in the QAPP. The primary responsibilities of the QA Officer included:

- Review and approval of the QA/QC elements of the QAPP;
- Oversight of data validation and corrective actions processes;
- Ensured that QAPP assessment/oversight procedures were implemented;
- Ensured that all project activities were performed to meet the data quality objectives (DQOs) stipulated in the work plan;
- Identified the need for corrective actions and recommend solutions to project QC problems;
- Communicated QA issues with the Program Manager;
- Oversaw project-specific issues relating to QA/QC of the sampling and laboratory analytical data;
- Reviewed analytical data and prepared data quality reports;
- Provided QC recommendations pertaining to usability of the final data; and
- Provided QA/QC consulting as needed to project personnel and worked in cooperation with regulatory personnel.

The Project Health and Safety Coordinator was Ms. Jeri Thrasher. The primary responsibilities of the Health and Safety Coordinator included:

- Preparation of a Site Health and Safety Plan (SHSP) for proposed site investigation activities;
- Recognization of site hazards and reported health and safety incidents to the Program Manager and Project Manager;
- Ensured appropriate levels of personal protective equipment (PPE) were utilized by field team members;
- Ensured personnel had proper training and certification to perform the work and oversaw the field efforts involving health and safety concerns and procedures;
- Coordinated air monitoring efforts and hazard prevention activities on-site;
- Ensured field staff complied with procedures outlined in the SHSP; and
- Ensured a timely, safe progression of the field activities

The drilling subcontractor that provided direct-push boring and well installation activities at the property was Walker-Hill Environmental, Inc. The drilling subcontractor contact was Mr. Gary Hill (601) 736-3500. The contract laboratory selected to analyze soil and groundwater samples was SPL, Inc. The laboratory contact was Mr. John Trahan, (337) 298-7095. Mr. Trahan ensured the QA/QC protocol for samples submitted to SPL adhered to the level of data evaluation specified in this QAPP.

8.2 QUALITY ASSURANCE OBJECTIVES FOR DATA

The analytical procedures performed by the laboratory included the analysis of environmental samples for organic compounds. The quality assurance objectives provided in the QAPP were established to produce data of known accuracy, precision, representativeness, and overall comparability. Field and laboratory quality control checks were implemented during the project to verify adherence to QA/QC and to provide measurement for method, the sampler's performance as well as the laboratory's performance. Each sampling and measurement technique employed in this assessment incorporated quality control procedures either by using standard and accepted procedures or by using additional sampling techniques to confirm the quality of the data is acceptable to make project decisions and achieve the project objectives.

The following field methods were used to measure QA/QC:

- Blind duplicate samples were collected at a frequency of 10% of the total samples collected;
- Equipment blank samples were collected at a frequency of 10% of the total samples collected;
- Trip blanks were submitted with each cooler submitted to the laboratory;
- Duplicate samples were collected and analyzed at a frequency of 10% of the groundwater samples collected

The QAPP document indicated duplicate soil samples would be collected as a measure of QA/QC; however, due to the quantities of trash and debris in the subsurface, an accurate duplicate soil sample could not be collected.

The laboratory also implemented quality control checks throughout the analysis process. This was accomplished by analyzing a percentage of the samples in a "batch" (typically 20 or fewer samples) for matrix spike analysis, matrix spike duplicate samples and/or control samples as approximate for the particular analysis. These results are included with the laboratory QC analysis report, along with a narrative of the results of the internal QC checks. Results are discussed in Section 8.6.

The control limits used to measure QA/QC were as follows:

- **Precision:** The precision, or repeatability, of the groundwater data was calculated using blind field duplicates submitted to the laboratory using a sequential, but fictitious sample numbering scheme. PPM collected a duplicate groundwater sample from PB-8/TW-8 and labeled it as TW-10. The control limits set for the project dictate the range of variance between the concentrations reported in the original and duplicates samples be not more than 20 percent.

- **Representativeness:** This QC parameter was measured by analysis of equipment blanks submitted to the laboratory for analysis in the same manner by the same protocol as actual environmental samples. These samples were designed to ensure that the equipment cleaning and decontamination procedures in place were adequate to remove the contaminants from the sampling instruments prior to sampling the next location. The control limits set on this QA/QC parameter were that all equipment blank should contain more or less than 5% of the contaminants detected in the sample collected immediately before the decontamination process.

- **Laboratory QC Parameters:** Laboratory QC procedures were employed to ensure that instrument and sample integrity was acceptable and within the limits of error to be expected in the analysis of the various parameters. The laboratory QC personnel reviewed the data from the various QC parameters to determine if they fell outside the acceptable level of confidence for that parameter. The target was that no more than 20% of the sample results reported should contain flagged or estimated data to be considered viable for overall comparison to regulatory standards.

8.3 SAMPLE CONTROL AND FIELD RECORDS

8.3.1 Sample Identification

In order to properly match samples with the location collected at the site, PPM assigned each sample with a unique sample identification number. The following sample identification protocol was followed:

- **Soil Samples:** For probe borings, letters were used to identify the probe boring and consecutive numbers were used to identify the order that the boring was installed at the site. For example, the first probe boring installed at the site was labeled as PB-1. In addition to the soil boring identification, soil samples were designated by a number following the soil boring identification. The soil samples were numbered sequentially in the order they were collected. Thus, the second soil sample collected in probe boring PB-1 was identified as PB-1/2.

- **Groundwater Samples:** For groundwater sample identification, letters were used to identify the temporary wells and consecutive numbers were used to identify the order that the temporary well was installed at the site. Temporary wells were identified with the letters "TW". Thus, the second monitoring well installed at the site was labeled TW-2. The groundwater samples were labeled as the well from which it was collected.

8.3.2 Chain of Custody Procedures

The following sample handling and custody requirements were followed:

- The sample identification on the chain-of-custody form was the same as the description noted on the sample tag.
- The chain-of-custody forms were completed before samples were shipped. The person involved in relinquishing and receiving the samples signed, dated, and noted the time of sample receipt on the chain-of-custody form. The first such transfer occurred between the field sampler and the sample carrier. The next transfer occurred between the sample carrier and the laboratory sample custodian.
- A chain-of-custody record that identifies the contents of the shipment accompanied the sample shipment. Each transfer was signed, dated and the time recorded.
- Samples were shipped to arrive as soon as possible following sample collection due to short holding times for volatiles analysis.
- Samples were shipped via an overnight delivery service. The laboratory was notified before each shipment.
- The laboratory was contacted when a delivery was made to assure the samples were received in good condition.
- Sample containers were inspected upon receipt by the laboratory to verify that they were appropriate for the samples being collected. A laboratory custodian verified that the information on the chain-of-custody matched the actual contents. Any anomalies, such as broken bottles, lack of chilling (where required), or missing labels, were noted by the laboratory custodian. The laboratory has a formal system to track a sample from its receipt through analysis, to its final disposition. The laboratory forwarded to PPM all completed chain-of-custody forms with the final analytical package.

8.3.3 Field Records

The following field records were maintained during the project:

- Health and Safety Plan Approval Sign-off Form, which after the daily on-site meeting, was signed by all field personnel.
- Daily Field Activity Log, completed by the Site Supervisor and was a general, time associated description of the field activities completed on site on a daily basis.
- Boring Logs, completed by the geologist supervising drilling work. These logs detailed the lithology and well construction of each boring/well completed during the assessment. The log information was used to generate final report-quality boring logs in the office.
- Chain-of-Custody – A completed chain-of-custody form accompanied the laboratory samples collected from the time of collection through delivery to the laboratory to ensure possession of the samples is tracked and sample integrity is maintained.

- Instrument Calibration Records, used to document the calibration check procedures for a specific instrument used in the assessment of vapor concentrations, field parameter measurements, etc.
- Groundwater Sampling Data Forms, used to record stability parameters collected during groundwater sampling activities.

Copies of these logs and records were entered into the project file at the PPM office in Jackson, Mississippi.

8.4 ANALYTICAL PROCEDURES

All soil and groundwater samples were analyzed for VOCs per U.S. EPA Method 8260, PAHs per EPA Method 8310, and RCRA Metals per EPA Method 6010.

8.5 LABORATORY QA/QC

The laboratory QA/QC program encompassed the policies, methods, and procedures issued from the following:

- U.S. EPA SW-846 Test Methods for Evaluating Solid Waste, third edition and its updates
- U.S. EPA, 1994, Contract Laboratory Program National Functional Guidelines for Organic Data Review (NFG)
- U.S. EPA, 1999, 'U.S. EPA Requirements for Quality Assurance Project Plans U.S. EPA QA/R-5
- U.S. EPA/EMSL Handbook for Analytical Quality Control in Water and Wastewater Laboratories, to include statistical techniques contained therein.
- U.S. EPA, 1973, 'Methods of Chemical Analysis of Water and Wastes' current updates (MCAWW)

The analytical procedures performed by the laboratory included the analysis of environmental samples for organic compounds. The quality assurance objectives are to produce data of known accuracy, precision, representativeness, and overall comparability. The goal of the QA program is to produce defensible data that meets or exceeds the EPA program guidelines. In order to accomplish these goals, the laboratory shall have established analytical quality control requirements based upon EPA SW-846, NFG, and internally derived control limit criteria. When those criteria are developed internally, they followed EPA guidance from Chapter One of SW-846 and were in statistical agreement with criteria from the referenced method given similar analytical applications.

The laboratory SOPs were based upon recognized methods (U.S. EPA SW-846, Standard Methods, etc.). The laboratory general QA program and custody protocol were followed to ensure sound laboratory operation. Any deviations from existing analytical procedures must first be approved through both PPM and the EPA.

8.6 DATA VALIDATION AND REPORTING

8.6.1 Laboratory Validation

The laboratory used level II QA during sample analysis. This included several levels of review. Each level demands specific action to prevent the unqualified release of erroneous data and to correct any problems discovered during the review process. Analytical data were extensively checked for accuracy and completeness. The laboratory validation process consisted of data generation, data reduction, and data review. The data review process was comprised of three levels, as described below.

The analyst who generated the analytical data had the prime responsibility for the correctness and completeness of the data. Data were generated and reduced following protocols specified in laboratory SOPs. Each analyst reviewed the quality of his or her work based on an established set of guidelines. The analyst reviewed the data package to document that:

- Sample preparation information was correct and complete
- Analysis information was correct and complete
- The appropriate SOPs were followed
- Analytical results were correct and complete
- QC samples were within established control limits; and blanks were acceptable
- Special sample preparation and analytical requirements were met
- Documentation was complete (e.g., anomalies in the preparation and analysis were documented, holding times were documented, etc.).

This initial review step, performed by the analyst is designated Level I review. The analyst then passed the data package to an independent reviewer who performed a Level II review. Level II review was performed by a group leader or data review specialist whose function was to provide an independent review of the data package. This review is structured to document that:

- Calibration data are scientifically sound, appropriate to the method, and completely documented
- QC samples are within established guidelines
- Qualitative identification of sample components is correct
- Quantitative results are correct
- Documentation is complete and correct (e.g., anomalies in the preparation and analysis have been documented, out-of-control forms, if required, are complete, holding times are documented, etc.)
- The data are ready for incorporation into the final report
- The data package is complete and ready for data archive.

Level II review was structured so that calibration data and QC sample results were reviewed and analytical results from 10 percent of the samples were checked back to the bench sheet. If no issues were found with the data package, the review was considered complete. If issues were found with the data package, an additional 10 percent of the samples were to be checked to the bench sheet. The process continued until no errors were found or until the data package has been reviewed in its entirety. Level II data review was documented and the signature of the reviewer and the date of review recorded. The reviewed data were then approved for release and a final report was prepared.

Before the report was released, the laboratory project manager reviewed the report to check that the data meets the overall objectives of the project. Each step of this review process involved evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review.

If the event that out of compliance data were identified after completion of the sampling and analysis, the PPM Program Manager was prepared to evaluate whether a sufficient amount of data are in compliance to provide the necessary DQO decision inputs without the use of the out of compliance data. If the DQO decision rule can be formulated without the data, no further action will be taken. If the out of compliance data prevents DQO decision rule formulation, then corrective action would have been taken (i.e. reanalyze the samples, resample for analysis). The action to be taken will be determined by the PPM Program Manager with input from the MDEQ.

8.6.2 External Data Validation

Data generated by the laboratory was then validated by PPM personnel who were not affiliated with the laboratory. A thorough review of the analyses were conducted to confirm the analyses were performed in accordance with the project-specific requirements. Validation was performed by reviewing analytical report forms and QC summary tables without the raw data. Review consisted of sample hold times, laboratory and field QA samples (blanks), and MS/MSD and surrogate results, as well as project narratives. The validation was conducted by the project QA officer.

The results were as follows:

- **Precision:** PPM collected a duplicate groundwater sample from TW-8 and labeled it as TW-10. Both were analyzed for VOCs per U.S. EPA Method 8260. The control limits set for the project dictated the range of variance between the concentrations reported in the original and duplicates samples be not more than 20 percent. Concentrations in both samples were BDL; therefore, no variance was computed. The QAPP document indicated duplicate soil samples would be collected as a measure of QA/QC; however, due to the quantities of trash and debris in the subsurface, an accurate duplicate soil sample could not be collected.

- **Representativeness:** The control limits set on this OAC parameter were that any equipment blank shall not contain more than 5 percent of the contaminants detected in the sample collected immediately before the decontamination process. All equipment blanks (labeled as "Rinse" in the laboratory results) were BDL. Trip blanks and field blanks were also BDL.

- **Laboratory QC Parameters:** Laboratory QC procedures were employed to ensure the instruments and sample integrity were acceptable within the limits of error to be expected in the analysis of the various parameters. The laboratory QC personnel reviewed the data from the various QC parameters to determine if they fell outside the acceptable level of confidence for that parameter. The target was that no more than 20% of the sample results reported should contain flagged or estimated data to be considered viable for overall comparison to regulatory standards. This target was not exceeded. Matrix spike (MS) and matrix spike duplicate (MSD) samples were chosen and tested at random from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD provided site-specific matrix data only for those samples which are spiked by the laboratory. Since the MS and MSD were chosen at random from an analytical batch, the sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in the analytical report was determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The Laboratory Control Sample (LCS) and the Method Blank (MB) were processed with the samples and the MS/MSD to ensure method criteria were achieved throughout the entire analytical process. If insufficient sample was supplied for MS/MSD, a Laboratory Control Sample (LCS) and a Laboratory Control Sample Duplicate (LCSD) were reported with the analytical batch and serve as the batch quality control (QC). All QC parameters were met.

9.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A summary of the findings and conclusions from the investigation is presented below:

<u>Site Geology and Hydrogeology</u>

- The majority of the site is a former landfill. Beneath surface cover in most boring locations, varying types of fill material are present. Each boring exhibited intermixed silts, sands, glass, trash, gravel, brick, and concrete debris that are a result of past landfilling activities. The depth and thickness of these debris layers was inconsistent throughout the subject area, and were sometimes intermixed with layers of silt, sand, and clay. In probe borings PB-2 and PB-5, a soft wet gray clay that is assumed to be native soil was present at approximately 22 to 23 feet BGS.

- Groundwater was encountered in the borings at depths ranging from 16.5 to 22 feet BGS. This water appears to be held in the landfill material by the native gray clay that was observed in PB-2 and PB-5. Groundwater elevations were recorded in all temporary wells, excluding TW-7, to determine the groundwater flow direction at the site. Temporary well TW-7 was dry; therefore, no data was collected from this well. Groundwater flow was to the south, toward the Pearl River.

Nature and Extent of Contamination

- **Soil:** No VOC constituents exceeded the Tier 1 Restricted and Unrestricted Target Remediation Goals (TRGs) for soil. PAH concentrations greater than the Tier 1 TRGs were detected in the sample collected from PB-8/7 at 12 to 16 feet BGS. The sample results for benzo (a) anthracene (1.1 ppm), benzo (a) pyrene (1.1 ppm), and benzo (b) fluoranthene (1.1 ppm) exceeded the Tier 1 TRG levels for Unrestricted sites (0.875 ppm, 0.0875 ppm, and 0.875 ppm, respectively). The benzo (a) pyrene concentration of 1.1 ppm also exceeded the Tier 1 TRG level for Restricted sites (0.784 ppm). Probe boring PB-8/7 was installed to the south of the paint shop foundation. Three of the RCRA Metals exceeded the Tier 1 TRGs for Unrestricted sites. Concentrations of lead exceeded the Tier 1 TRG level for unrestricted sites of 400 ppm in the samples collected from PB-2/4 (440 ppm), PB-6/1 (421 ppm), and PB-8/1 (874 ppm). The Unrestricted Tier 1 TRG level for mercury (10 ppm) was exceeded in sample PB-5/3 (16.4 ppm). Probe boring PB-2 was installed to the northeast of the vehicle maintenance foundation. Probe borings PB-6 and PB-8 were installed to the north and south of the paint shop foundation, respectively, and PB-5 was installed to the east of the air conditioning and heater repair building. Levels of arsenic exceeded the unrestricted TRG level (0.426 ppm) in all soil samples submitted to the laboratory, and exceeded the Restricted TRG level (3.82 ppm) in all but three samples (PB-5/3, PB-6/4, and PB-8/7). Background arsenic levels in Mississippi soils have been reported to range from 0 to 26 ppm with an average of 4 to 10 ppm according to the *Solid-phase Geochemical Survey of the State of Mississippi* published by the MDEQ Office of Geology. These naturally occurring levels are above the TRGs, and may explain elevated levels of arsenic found in the soil samples analyzed during this assessment.

- **Groundwater:** Free product was not encountered in any of the piezometers. No VOC constituents exceeded the Tier 1 Restricted and Unrestricted Target Remediation Goals (TRGs) for groundwater. PAH constituents exceeding the MDEQ Tier 1 TRGs included benz (a) anthracene (0.000096 ppm) in the sample collected from PB-9/TW-9, and benzo (b) fluoranthene in the samples collected from PB-1/TW-1 (0.00027 ppm), PB-5/TW-5 (0.00014 ppm), and PB-8/TW-8 (0.00035 ppm). Only two constituents from the RCRA metals analysis exceeded the Tier 1 TRGs for groundwater. Lead concentrations detected in TW-1 (0.0597 ppm), TW-2 (0.0406 ppm), TW-5 (0.0423 ppm), TW-8 (0.0822 ppm), and TW-9 (0.0178 ppm) exceeded the Tier 1 TRG of 0.015 ppm. Barium was detected in each of the groundwater samples collected; however, the only sample that exceeded the Tier 1 TRG of 2.0 ppm was collected from TW-8 (2.39 ppm).

- **Source of Release:** The landfill material and former paint shop (Building number 17 on **Figure 3**) were identified as primary sources of impact during the investigation. Excluding arsenic, which exceeded the Tier 1 TRGs in all soil samples collected, COCs in the landfill material exceeded the Tier 1 TRGs in PB-

2/4, PB-5/3, and PB-8/7. These elevated concentrations appear to be isolated occurrences that are results of the former landfilling operations at the site. Based on the knowledge that the past use of the site was an unregulated landfill, isolated areas of impact potentially exist throughout the subsurface. COCs in the shallow soil samples collected near the paint shop foundation include lead detected from zero to 2 feet BGS in PB-6/1 and PB-8/1. These occurrences are likely the result of painting operations involving lead paint at the former paint shop or from metal sanding operations.

- **Contaminant Fate and Transport:** The extent of soil and groundwater impact above TRGs has not been delineated. Landfill material appears to be the primary source of impact, and secondary sources included impacted soil and groundwater in the vicinity of the paint facility. Potential migration routes for the detected constituents include air, surface soil (<6 feet), subsurface soil (> 6 feet), and groundwater. Sediments and surface water were not tested as part of the approved scope of work at the site. Wind erosion and migration through air was considered to be minimal for VOC constituents and PAH constituents since the majority of impact was found in subsurface soils and groundwater. Unless the soils were disturbed through excavation, the potential for migration through air was considered negligible. Dispersion of the metals detected in the shallow soils near the paint shop foundation could occur through wind erosion.

  Migration through soil was considered negligible as well unless the soils were disturbed through excavation or other construction activities. The greatest potential for migration appears to be through groundwater. Although VOCs were not detected in downgradient wells, the potential for migration does exist due to the proximity of the site to the Pearl River. However, if the plume is stable or shrinking, this migration route may be limited as well.

  While laboratory analysis did reveal the presence of limited soil and groundwater impact, the detected constituents were scattered throughout the site in the landfill material that comprises the subsurface. The source area is not considered to be defined due to the randomness of the sampling results. Due to the nature of the landfill, COCs could be present anywhere throughout the subsurface.

- **Identified Receptors/Risk:** The sensitive receptor survey conducted revealed the presence of one potential receptor: underground utilities (water, natural gas, and sanitary sewer main). Biological receptors such as plants and animals in the site vicinity do not appear to have been impacted by the landfill or paint shop. The Pearl River floodplain lies directly adjacent to the site to the south, and the Pearl River is located approximately 50 yards from the southern boundary of the property. Five water wells were also identified within a quarter mile radius of the site: N0044, N0045, N0047, N0048, and N0056. PPM conducted field reconnaissance to verify these locations, but evidence of the wells were not found. Completion of the Baseline Site Conceptual Exposure Model (SCEM) did reveal complete pathways for soil and groundwater, if the site is developed for uses beyond industrial.

Recommendations

Due to the large area of the former landfill, and the presence of lead concentrations greater than Tier 1 TRGs that are possibly high enough to be classified as hazardous wastes, excavation of the area is not considered a viable option. Excavation of impacted surface soils near the paint shop foundation would be possible, but with the underlying landfill material impacted, this would not mitigate all COCs in this area. According to personnel with the City of Jackson, preliminary plans for re-development of the site include engineering controls to prevent exposure to the impacted subsurface. A 1-foot clay cap is planned to be installed over the entire site to prevent exposure to impacted soils and subsurface vapors. Installation of site monitoring wells has also been proposed to monitor subsurface conditions over time. Installation of this cap over the landfill, and establishment of institutional controls such as deed restrictions to limit disturbance of the impacted area and usage of the site appears to be a viable option. Installation of groundwater/landfill gas monitoring wells should be considered throughout the site, as well as along the eastern and western perimeters of the site to ensure impacted groundwater is not migrating into the Pearl River.

Data Limitations

This investigation was not intended to represent a full characterization of environmental conditions at the site. Soil and groundwater investigations were limited to areas where impact was most likely to occur based on past operations, and as indicated in previous assessments. The data obtained was representative of the time period in which the data was collected, and may not represent future conditions.