Comprehensive Site Investigation Report For AmerenIP Champaign, Illinois Former Manufactured Gas Plant State ID 0190100008

December 2007

Prepared for:

AMERENIP

ST. LOUIS, MISSOURI

PSC

Columbia, Illinois

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Project (62402647)

EXECUTIVE SUMMARY

Executive Summary

AmerenIP is submitting this Comprehensive Site Investigation Report (SIR) to describe the soil and groundwater impact at the former manufactured gas plant (MGP) facility in Champaign, Illinois. The Comprehensive Site Investigation has been prepared in accordance with the Illinois Environmental Protection Agency's (IEPA) Site Remediation Program (SRP) to meet the requirements of Illinois Administrative Code (IAC) Section 740.425. This site has been assigned State I.D. 0190100008.

This Comprehensive SIR is being submitted with the intent of the Remedial Applicant (RA), AmerenIP, to obtain a Comprehensive No Further Remediation (NFR) letter for the remediation site as identified in Figure ES-1. Findings of the previous investigations indicated the presence of soil and groundwater impact exceeding Tier 1 remediation objectives (ROs). Interim remedial measures (IRM) were performed in 1997 and 1998 to address subsurface impact.

The primary objective of the comprehensive site investigation was to define the extent, both vertical and horizontal, of the MGP related impacts on the AmerenIP property. Information collected and evaluated from previous site investigations indicates that some additional investigation may be required to further define the extent off-site. Based upon the data that is currently available, there is minimal potential for exposure to individuals within and outside of the remediation site for the constituents of concern. Where necessary and appropriate, AmerenIP will coordinate with potentially affected property owners to complete off-site evaluations and address impacts. Such off-site data will be incorporated into future reports.

AmerenIP initiated the investigation activities and performed the appropriate actions to address the impact related to the former uses of the property.

Site Description

The remediation site (Figure ES-1) is located at 308 North Fifth Street (formerly 502 East Hill Street), Champaign, Illinois. The site consists of a vacant flat area secured by a chain-link fence, and is owned by AmerenIP.

The site is located in a mixed residential and commercial neighborhood At this time the future uses of the surrounding properties are anticipated to remain as mixed residential and commercial.

Site History

Historical information indicates that the former Champaign and Urbana Gas Light Company and subsequently AmerenIP, operated a MGP on the remediation site from approximately 1869 through the early 1930s. The plant was placed on standby status from the early 1930's to the mid 1950's and was used for meeting peak demand up until the mid 1950's. The site remained vacant and unused from 1960 until the property was sold to American Legion Post 559 in 1979. The "Booster House" was maintained and used for periodic meetings by the

American Legion from 1979 until 1991. AmerenIP repurchased the property from the American Legion in 1991 and the site has since remained vacant.

Site Investigation Objectives

This Comprehensive SIR is being submitted with the intent of the RA, AmerenIP, to obtain a Comprehensive NFR Letter for the remediation site as identified in ES-1. Findings of the site investigation indicated the presence of soil and groundwater impact exceeding Tier 1 ROs.

Technical Approach

The technical approach for the investigations included reviewing historical data and information to identify potential recognized environmental conditions (RECs). Upon identification of the potential RECs a plan was developed to perform subsurface investigation activities to either confirm or exclude the actual presence of subsurface impact that would be associated with those potential RECs. The approach involved numerous site investigations (from 1986 to 2004) within the remediation site and its surrounding properties. Investigation results indicated the presence of subsurface soil and groundwater impact.

Recognized Environmental Conditions

Historical information representing past uses of the property identifies RECs to most likely be present on most of the remediation site. The former gas plant and associated buildings, three tar wells, two gas holders, and two oil tanks were located on the northern portion of the site. The former booster house, one gas holder, three purifiers, and seven oil tanks were located on the southern portion of the site. No other RECs were identified.

Constituents of Concern

The analytical data set was compared to the Tier 1 RO values, the provisional non-TACO ROs, and accepted background levels as an initial screening. Based on this review and comparison to the Tier1 ROs and background levels, the potential exposure pathways of concern are:

- The *soil ingestion pathway* for residential, industrial/commercial and construction worker settings;
- The soil inhalation pathway for residential, industrial/commercial and construction worker settings;
- The soil component to groundwater ingestion pathway; and
- The groundwater ingestion pathway.

Twenty-five constituents of concern (COC) were identified in soils. Fifteen constituents have been identified in groundwater at levels exceeding Tier 1 ROs. The exposure pathways and constituents of concern that exceed Tier 1 ROs or a background level are summarized in

Table ES-1. Remedial actions have been performed to address significant levels of impact. AmerenIP may incorporate the following measures in order to meet the requirements for NFR:

- remediation through excavation and proper disposal of impacted soil exceeding ROs;
- calculation of Tier 2 and/or Tier 3 ROs using site specific information and data;
- the construction and use of engineered barriers to restrict exposure;
- implementation of Highway Authority Agreements with appropriate highway jurisdictions; and/or
- implementation of institutional controls for property use as industrial/commercial purposes and for requirements of maintaining construction worker protection;

The implementation of these actions in order to meet the comprehensive NFR requirements will be discussed and presented in the Remedial Objectives Report (ROR) and the Remedial Action Completion Report (RACR).

1 INTRODUCTION

This report has been prepared for AmerenIP by Philip Environmental Services Corporation (PSC). PSC was retained by AmerenIP to provide consulting services for the investigation and closure of the former Champaign manufactured gas plant (MGP) site located in Champaign, Illinois. Site investigation activities have been performed in accordance with 35 Illinois Administrative Code (IAC) Section 740 – Site Remediation Program (SRP) and 35 IAC Section 742- Tiered Approach to Corrective Action Objectives (TACO).

Environmental investigation and remediation activities have been performed at the Champaign site since 1986. Therefore, there is a significant amount of site specific data that pre-dates the SRP and TACO guidance. Even though current methodologies were not in place at the time the data was collected, this information is very useful in understanding the current site conditions, including the degree and extent of environmental impacts. This report incorporates these earlier data to the degree practicable and both geological and chemical analytical data are included in this report.

1.1 Site Location

The site is located within the city limits of Champaign, Illinois in Champaign County in the northeast quarter of the southwest quarter of Section 7, Township 19 North, Range 9 East of the Third Principal Meridian. The site address is 308 North Fifth Street (formerly 502 East Hill Street), Champaign, Illinois. The property is currently vacant, is secured by a chain-link fence, and is owned by AmerenIP. Figure 1-1 illustrates the approximate location of the site. The general area around the site consists if both residential and commercial properties. Figure 1-2 depicts the remediation site boundaries. Figure 1-2 also identifies the extents to which AmerenIP is seeking to obtain a No Further Remediation (NFR) letter.

A railroad right-of-way (Norfolk-Southern) borders the site to the north and several residential properties are located north of the single active track within the railroad right-of-way. Vacated Sixth Street right-of-way is adjacent to the east of the site; however, Sixth Street is abandoned between the railroad right-of-way and the alley south of the site. Other property east of the vacated Sixth Street right-of-way is commercial. Residential properties to the south are separated from the site by the chain link fence and an alley. North Fifth Street borders the site to the west and separates the site from residential properties west of Fifth Street. At one time, Hill Street approximately bisected the site in the east-west direction but is now part of the site and owned by AmerenIP.

1.2 Project Objectives

The primary objective of the Comprehensive Site Investigation (CSI) was to define the extent, both vertical and horizontal, of the MGP related impacts on the AmerenIP property. Information collected and evaluated from previous site investigations indicates that some additional investigation may be required to further define the extent off-site. Based upon the data that is currently available, there appears to be a minimal potential for exposure to individuals within and outside of the remediation site for the constituents of concern. Where necessary and appropriate, AmerenIP will coordinate with potentially affected property owners to complete off-site evaluations and address impact. Such off-site data will be incorporated into future reports.

The data obtained from the CSI were utilized with the previous existing data for the evaluation of potential actions required to obtain a NFR letter for the site from the Illinois Environmental Protection Agency (IEPA).

Specific objectives of the CSI activities included the following:

- Completely characterize site geological and hydrogeological conditions;
- Assess the existence, condition, and contents of subsurface structures associated with the former MGP and not addressed during the Interim Remedial Measures (IRM) activities completed in 1997;
- Characterize the degree and extent of soil and groundwater impacts with respect to depth and site boundaries; and
- Support the development of remediation objectives for the site.

These objectives were addressed through completion of the following field activities during 2004:

- Excavation and sampling of test pits;
- Completion of surface and subsurface soil sampling using a GeoProbe™;
- Completion of a site survey;
- Redevelopment of existing groundwater monitoring wells;
- Collection of groundwater samples; and
- Completion of soil and groundwater laboratory analytical program.

1.3 Report Organization

This Comprehensive Site Investigation Report (CSIR) was prepared for submittal to the IEPA to meet the requirements of IAC Section 740.425. This report is organized into eight technical sections and fourteen appendices. Section 1 provides an introduction to the site and objectives of this report.

Section 2 presents information on the background of the site and includes details relative to site history and previous investigation activities. Since information and data from previous investigations is used in the evaluation of current site conditions, Section 2 also includes a presentation of previous data and results of earlier studies. In addition, Section 2 includes a discussion of site physical conditions, including regional and site specific geological and hydrogeological conditions. Section 3 presents a brief overview of the Comprehensive Site Investigation Work Plan and Section 4 presents a discussion of work completed for the investigation. Section 5 presents the investigation chemical analytical program and includes a discussion of the results. Section 6 presents a discussion of the endangerment assessment and includes a discussion of recognized environmental conditions at the site and the results of a comparison to Tier 1 Remediation Objectives (ROs). Section 7 is a summary of the nature and extent of impacts at the site. Section 8 presents the Illinois Licensed Professional Geologist review statement and certification.

This report includes:

- A description of the site;
- A discussion of any enforcement or response activities;
- A sampling plan developed for investigation activities;
- The discussion of site investigation field activities;
- A presentation of the data and results of the analytical testing and the evaluation of the hydrogeological conditions;
- An endangerment assessment;
- A summary and conclusions; and
- Appendices and supporting documentation.

2 SITE BACKGROUND

The following sections provide a description and characterization of the site as required under IAC Section 740.425(b)(2). The sections provide site information, a site setting, and legal description. No Phase I Environmental Site Assessment (ESA) report was prepared; however standard Phase I ESA data was collected as outlined in ASTM 1527 and was used to develop the approach for the investigation and a site investigation plan.

2.1 Site History

Historical information was used for evaluating prior property use and to identify potential recognized environmental concerns (RECs). The historical data helped AmerenIP develop a scope and plan for investigation activities and the selection of constituents for analysis. The following limited information relative to MGP history is summarized from Sanborn Fire Insurance Maps (Sanborn Maps), Brown's Directory of American Gas Companies (Brown's Directories), AmerenIP files, and other historical documents.

Historical information suggests that the original MGP at the site began operation circa 1869 and continued through approximately 1933. Figure 2-1 presents a panoramic drawing illustrating the gas plant in 1869 and was taken from a bird's eye view of the city of Champaign originally published by the Chicago Lithograph Co. Records for the site prior to 1887 are extremely limited; however, the first edition of Brown's Directory (1887) indicates that the Champaign and Urbana Gas Light Co. was producing coal gas at the site. Table 2-1 presents a summary of Brown's Directory information for the Champaign site. An 1887 Sanborn Map illustrates the facility layout and included a single gas holder, coal shed, retorts, lime house, two wells, and condensing, purifying, and meter rooms. Figure 2-2 presents a historical map obtained from AmerenIP's records showing approximate locations of MGP structures in 1910. Copies of available Sanborn Maps showing the site are presented in Appendix A.

Between 1890 and 1907, the approximate annual production grew from 6,000,000 cubic feet (c.f.) per year to approximately 30,000,000 c.f. per year. The 1907 Brown's Directory indicates that gas production was a combination of coal gas and oil gas, which continued through 1911. However, the 1902 Sanborn Map suggests that both coal gas and water gas processes were in operation by 1902. During the period 1907 to 1911, gas production increased from 30,000,000 c.f. per year to approximately 58,000,000 c.f. per year.

In the 1910 Brown's Directory, the gas holder capacity was identified as 120,000 c.f. This holder capacity is consistent with the approximate combined capacity of gas holders GH-1 and GH-2 depicted in the historical drawings (Figure 2-2). The original construction date for these two gas holders is unknown; however, Sanborn Maps for 1897 and 1902 indicate that gas holder GH-2 was constructed sometime during that five year period. The 1902 Sanborn Map indicates the capacity of GH-1 was 23,000 c.f. and the capacity of GH-2 was 49,000 c.f.

The 1909 to 1911 time frame was a period of change and expansion at the facility. A 1910 site layout drawing (Figure 2-2) illustrates the plant facilities, which included both retorts and water gas sets, indicating another change in the gas making processes. This 1910 drawing also shows three tar wells, two oil storage tanks, and an ammonia storage tank. There are two gas holders shown (consistent with GH-1 and GH-2) plus a note that a third, two-lift 340,000 c.f., gas holder (GH-3) was located to the south across Hill Street (Figure 2-2). The 1909 Sanborn Map also indicates that a second lift had been added to holder GH-2, increasing the capacity to 100,699 c.f. The 1911 Brown's Directory indicates that gas holder capacity for the plant was 500,000 c.f., confirming the note on the 1910 drawing. The 1912 Brown's Directory also confirms the installation of water gas equipment during this time period. The 1902 and 1909 Sanborn Maps also confirm the presence of water gas equipment.

Brown's Directories between 1912 and 1918 indicate little change occurred at the plant other than a steady increase in production from approximately 50,000,000 c.f. to approximately 130,800,000 c.f. In 1915 the gas produced was approximately 60% water gas and 40% coal gas. The 1915 Sanborn Map shows the facility layout approximately the same as the 1910 site map and identifies gas holder capacities as follows: GH-1 at 25,440 c.f., GH-2 at 100,700 c.f., and GH-3 at 150,000 c.f. The gas holder capacity for GH-3 conflicts with other site data and is believed to be an error by the Sanborn recorder.

Brown's Directories from 1919 through 1921 indicate total gas holder capacity was 500,000 c.f. In 1922 total capacity had decreased to 440,000 c.f. and by 1923 the capacity was 600,000 c.f. These changes are consistent with the removal of GH-1 from service as a gas holder and eventual conversion to a tar well/separator; and the addition of a third lift to holder GH-3, increasing capacity from 340,000 c.f. to 500,000 c.f. A November 2, 1922 site drawing (Figure 2-3) and the 1922 Brown's Directory confirm these changes as well as the termination of coal gas operations and complete conversion of the facility to water gas production. In addition, this 1922 site drawing (Figure 2-3) shows the relocation of purifiers from inside the building north of Hill Street to a location south of Hill Street and west of the largest gas holder (GH-3). The drawing also shows pipe sizes and location of inlets and outlets for holders GH-2 and GH-3 and distribution lines from the site. There are also seven oil and diesel fuel tanks shown along the southwestern edge of the site.

AmerenIP drawings indicate the conversion of GH-1 to a tar well/separator was completed in late 1924.

Brown's Directories from between 1918 and 1927 indicate that gas production increased during that period from approximately 130,800,000 c.f. to approximately 298,500,000 c.f. There are only two oil tanks along the southwestern edge of the site and the "Gas Experiment Station of the University of Ill." is shown at the east end of the site north of the Hill St. right-of-way. The Gas Experimental Station structures do not appear on any of the Sanborn Maps. The 1924 and 1929 Sanborn Maps (Figure 2-4) are otherwise generally consistent with both the 1926 and 1927 site maps however, the Sanborn Maps indicate that gas holder GH-3 had a capacity of 1,500,000 c.f. Although successive Sanborn Maps for 1941, 1949, 1951 and 1959 also indicate a capacity of 1,500,000 c.f., this is an obvious error, since the holder would have to be more than 200 feet tall and have eight or nine lifts. Based on both Brown's Directory and AmerenIP drawings, gas holder GH-3 had a maximum capacity of approximately 500,000 c.f. and was a three-lift, on-slab, above-grade, water-seal tank. A historical site photograph also confirms that GH-3 was an above grade three lift holder.

Brown's Directories for 1933 and 1934 indicate that production of gas on a regular basis was terminated in 1932 or 1933. The 1934 Brown's Directory indicates that natural gas was being purchased from Panhandle Illinois Pipe Line Co. of Kansas City, Mo. Based on the 1941 and 1949 Sanborn Maps, the plant was maintained in standby condition through at least 1949 and a circa 1953 photograph indicates that the plant was still standing. The photograph also shows several high-pressure gas cylinders on the eastern end of the site. These cylinders do not appear on any of the site maps or Sanborn Maps. The 1959 Sanborn Map indicates that all structures north of the Hill Street right-of way had been removed. Based on interviews with AmerenIP employees, demolition of the above ground on-site facilities, with the exception of the booster house, occurred between 1955 and 1960. The site remained vacant and unused from 1960 until the property was sold to American Legion Post 559 in 1979.

The American Legion Post renovated the interior of the "Booster House" structure and used it for periodic meetings. The structure was used and maintained by the American Legion from 1979 until 1991.

An initial site reconnaissance was conducted by AmerenIP and PSC personnel on February 9, 1990. The purpose of this visit was to confirm the location of structures and other site features, assess shallow soil conditions, and inspect the depth and nature of material remaining in GH-1. During the week of February 12, 1990, the American Legion employed a grader operator to excavate a shallow trench at the site to improve surface drainage. While excavating this trench, impacted soil and tar-like odors were encountered and AmerenIP was notified. AmerenIP and PSC personnel conducted a site inspection to assess the level of risk and to recommend site stabilization activities. A PSC representative remained on site to oversee the stabilization activities, which consisted of the following actions:

- The parking lot for the American Legion Hall was covered with a fresh layer of gravel approximately six inches thick.
- An interior fence was erected around the edge of the parking lot to discourage access to the remaining portions of the site.
- The southern two-thirds of the site were covered with approximately 18 inches of clean fill.
- Weighted 55-gallon drums were placed over the access ports of GH-1.

AmerenIP repurchased the property from the American Legion in 1991 and the site has remained vacant since that time.

In summary, MGP operations had begun by 1869 and continued through the early 1930s at which time operations were converted to storage and distribution of natural gas. During this period two below ground gas holders, one aboveground gas holder, five tar wells, a tar separator, seven oil tanks, and two diesel fuel tanks were present. All aboveground structures, except for the booster house, were demolished in the late 1950s.

2.2 Site Description

The remediation site is located within the city limits of Champaign, Illinois in Champaign County in the northeast quarter of the southwest quarter of Section 7, Township 19 North, Range 9 East of the Third Principal Meridian (Figure 1-1). The site address is 308 North Fifth Street (formerly 502 East Hill Street), Champaign, Illinois. The property is currently vacant and is owned by AmerenIP.

The cities of Champaign and Urbana have a combined population of approximately 94,000. Although the cities were once separate communities, they have merged into a single metropolitan area. The area surrounding the remediation site is generally residential and consists primarily of older homes. The remediation site is currently zoned MF2 (multi-family density 2) due to the previous site use by the American Legion. Light commercial activity is present to the southeast of the site.

Figure 2-5 illustrates the current site layout. The site is approximately 2.4 acres, is currently vacant, and is secured by a chain link fence and three (3) locked gates. The site is generally flat with grassy vegetation. The only surface structure on the site is one that remains from the MGP era (i.e. booster house) and is located near the middle of the site. This building is single story brick construction with no basement. Due to placement of fill at various times since 1990, there are no visible indications of past MGP activities other than the brick building.

A railroad right-of-way (previously Norfolk-Southern) borders the site to the north and several residential properties are located north of the single active track. The vacated Sixth Street right-of-way is adjacent to the east of the site; however, Sixth Street is abandoned between the railroad right-of-way and the alley south of the site. Other property east of the vacated Sixth Street right-of-way is zoned commercial and consists of vacant land and parking lots. Residential properties to the south are separated from the site by the chain link fence and an alley. North Fifth Street borders the site to the west and separates the site from residential properties. At one time, Hill Street approximately bisected the site in the east-west direction but is now part of the site and lies within the fenced area of the site.

2.3 Legal Description

The legal description for the Champaign remediation site is as follows:

> Part of the SW ¼, of Sec. 7 T.19N. R.9E. of the 3rd. PM., City of Champaign, Champaign County, Illinois, more particularly described as follows:
>
> Lots 7, 8, 9, 10, 11, and 12 in block 29 (except railroad right-of-way) of Seminary Addition to Urbana, now a part of the City of Champaign lying south of the railroad right-of-way;
>
> And lots 1, 2, and 3 in block 31 of Seminary Addition to Urbana, now a part of the City of Champaign;
>
> And a strip of land 66 feet in width known as vacated Hill Street lying between blocks 29 and 31;
>
> And lots 1, 2, and 3 of Assessor's Plat of subdivision of lot 8 in M.W. Busey's subdivision of south part of lot 1 of the south west quarter of Section 1, Township 19 North, Range 9 East of the third principal meridian, and lots 4, 5 and 6 in block 31 of Seminary Addition to Urbana, now a part of the City of Champaign, as per plat recorded in deed record 35 a page 66;
>
> All situated in the City Champaign, County of Champaign and the State of Illinois.

2.4 Regional Geological and Hydrological Setting

Champaign County, Illinois is situated within the Bloomington Ridge Plain in the Till Plains section of the Central Lowland Physiographic Province. The landscape is characterized by widely spaced continental glacial moraines with nearly featureless ground moraine plains. The geology beneath Champaign County has been summarized as 100 to 400 feet of Wisconsinan, Illinoian, and Kansan glacial drift deposited on Paleozoic bedrock which dips eastward and southward toward the Illinois Basin.

Six major waterways drain Champaign County. The Middle Fork of the Vermilion River, the Little Vermilion River, the Embarras River, and the Salt Fork empty into the Wabash River and drain the eastern half of the County. The Sangamon River, which discharges into the Illinois River, and the Kaskaskia River, which discharges into the Mississippi River, drains the western half of the Champaign County. Limited areas along these waterways are subjected to periodic temporary flooding.

Potential sites for development of surface water reservoirs in Champaign County have been investigated. However, because of the abundant groundwater resources available, surface water reservoirs have not yet been developed. There are no natural lakes in Champaign County, but there are about 450 acres of man-made recreational lakes.

Groundwater resources in Champaign County come from three aquifers within the Wisconsinan, Illinoian and Kansan glacial deposits. The aquifers were named the Wedron, Glasford and Banner aquifers by Kempton et al (1982), after the glacial formation in which each is encountered. Within Champaign County, however, the aquifers have been simply defined as the upper, middle and lower sand and gravel aquifer. The difference between the two definitions is that the upper aquifer in Champaign County occurs in outwash sands and gravels, whereas Kempton's Wedron Aquifer is defined as the formation's basal sand and gravel unit, the Ashmore Member. The Ashmore aquifer is encountered in scattered locations throughout east-central Illinois and is apparently not laterally continuous beneath Champaign County.

The upper sand and gravel aquifers found in the Wisconsinan Wedron Formation beneath Champaign County occur as isolated pockets or lenses of sand and gravel in the Champaign and Urbana Moraines or outwash sand and gravel near the front of the moraines. The aquifers provide water for about 29 percent of the individual farms and domestic wells in the County (Sanderson and Zewde, 1976). Throughout Champaign County, wells finished in these isolated sands and gravels vary in depth from about 25 to 100 feet BLS. Water table elevations range from 650 feet above MSL in eastern Champaign County to about 750 feet above MSL northwest of Champaign.

The middle sand and gravel aquifers found in the Illinoian Glasford Formation occur as fairly continuous layers in the Radnor and Vandalia Till Members. The middle aquifer serves as a source of water for 55 percent of the farm and domestic wells in the County. The middle aquifer also provides a backup source of water for the cities of Champaign and Urbana. The top of the middle aquifer ranges from about 125 to 175 feet BLS near Champaign/Urbana. The bottom ranges between 175 and 200 feet BLS. The water level of wells finished in the middle aquifer ranges from about 630 feet above MSL around Champaign/Urbana to about 720 feet above MSL in the northwest part of the County. The direction of flow appears to be towards the southwest (Sanderson and Zewde, 1976).

The lower sand and gravel aquifer encountered in the Kansan Banner Formation occurs as thick sand and gravel deposits of the Mahomet bedrock valley. The aquifer within the Mahomet Sand is the most significant aquifer within east-central Illinois, accounting for about 87 percent of municipal groundwater supplies for the County. The groundwater resources of the Mahomet Sand are underdeveloped, especially those overlying the main channel. The lower aquifer can be up to 150 feet thick, depending on proximity to the main channel of the Mahomet bedrock valley. The top of the Mahomet Sand is fairly consistent at 500 feet above MSL. The average width of the valley is about 12 miles in Champaign County. The deposit is composed of clean sand and gravel. However, the deposit becomes more silty towards the valley margins.

The Paleozoic bedrock beneath the glacial deposits provides only small supplies of water from sandstone and limestone beds of the Pennsylvanian formations. The groundwater in Mississippian and older bedrock is too deep and/or too mineralized to be considered a good source of water.

The Illinois American Water Company (IAWC) supplies water from water wells located in the west well field located about three miles west of the site. These wells average about 310 feet in total depth and have between 50 and 100 feet of screen. The wells in the west field produce water from the Mahomet Sand Member. IAWC also has water wells in the north well field located about 1.0 mile northeast of the site. These wells average about 210 feet deep, with screens ranging from 10 to 50 feet in length. The wells produce water from the middle sand and gravel aquifer in the Glasford Formation.

2.5 Private and Public Drinking Water Wells in Vicinity

The “EDR Illinois Water Well Report” provides a summary of known water wells within a one-half mile radius of the site. Federal, State, and Public Water supply databases were searched. Twenty-two (22) wells were identified from the State database. There are no public water supply wells within the one-half mile radius of the site. A copy of the EDR report is presented in Appendix B.

Champaign/Urbana and the University of Illinois are supplied with water from the IAWC. IAWC supplies water from water wells located in the west well field about three miles west of the MGP site. These wells average about 310 feet in total depth and have between 50 and 100 feet of screen. The wells in the west field produce water from the Mahomet Sand Member.

The IAWC also has water wells in the north well field located about 1.0 mile northeast of the MGP site. These wells average about 210 feet deep, with screens ranging from 10 to 50 feet in length. The wells produce water from the middle sand and gravel aquifer in the Glasford Formation.

2.6 Site Geology

The major geologic units present at the site; in descending order, are the surficial fill layer, the weathered till unit (Wedron), the unweathered till unit (Wedron), and the lower silty sand member of the Glasford Formation. The mappable geologic units found in the shallow subsurface at the site include (in descending order), the Surficial Fill Layer, the Weathered Till Unit (Wedron), the Unweathered Till Unit (Wedron), and a Lower Silty Sand Member of the Glasford Formation.

The geology of the site was interpreted through analysis of the Phase II geologic logs (Appendix D), CSI geologic logs (Appendix I), field notes of the site geologist, grain-size distribution curves and results of physical property testing. Physical property testing was completed during the Phase II investigation and results are summarized in Table 2-2.

2.6.1 Surficial Fill Layer

The surficial fill layer is typically three to four feet thick and covers the entire site. The fill consists of gravelly silt and sand, with cinders, bricks and debris. Much of the fill was placed on the site after demolition of the MGP facilities was completed. Some topsoil encountered may have been classified as fill material based on a dark organic appearance which resembles the known fill on site. Topsoil was also placed over portions of the site where CSI test pits were excavated. The fill is thickest in an isolated area along the northern portion of the site near the railroad tracks.

2.6.2 Weathered Till Unit

The first natural subsurface material encountered is a weathered till unit. The unit is continuous beneath the study area and is believed to be part of the Batestown Till Member of the Wisconsinan Wedron Formation. The Weathered Till Unit was contacted at various depths beneath the study area. The unit averages 10 to 15 feet thick beneath the site with maximum thickness of 18 feet encountered in borehole UTB-25 drilled near the former Booster House.

The Weathered Till Unit is comprised of brown to gray silty clay with some oxidation evident along clay fractures. MGP residual staining is present along some of these fractures. Numerous minor sand and silty sand layers were encountered; however, the sand layers are laterally discontinuous. Residual impacts are frequently associated with sandy and silty layers; however, units as thick as one foot could not be identified in adjacent borings or probeholes. The distinction between the weathered and unweathered till units was often difficult to distinguish.

2.6.3 Unweathered Till Unit

The Unweathered Till Unit is also believed to be part of the Batestown Till Member of the Wisconsinan Wedron Formation. The unit is generally differentiated from the Weathered Till Unit by the gray color and lack of weathering along fractures. The Unweathered Till was encountered at depths ranging from 9 to 20.5 feet BLS. Sand and gravel layers were also encountered within the Unweathered Till Unit; however, these layers were not laterally continuous beneath the site.

2.6.4 Lower Silty Sand Unit

Three deep boreholes drilled during the Phase II investigation encountered thick sand, silty sand, and gravel units at depths below 100 feet. These deeper deposits are believed to be the upper units of the Illinoisan Glasford Formation. The actual contact between Wedron and Glasford was not delineated due to the similarities between the units and the rotary wash drilling method used in the deeper boreholes. None of the CSI probeholes encountered this unit.

2.7 Site Hydrogeology

Groundwater hydrology activities completed during the CSI consisted only of sampling wells which had been installed during the Phase II activities.

The following sections describe the two aquifers beneath the site investigated during the Phase II investigation.

2.7.1 Shallow Groundwater System

The shallow groundwater system at the site is an unconfined water-bearing zone with the saturation depth (water table) found in the Surficial Fill Layer or the Weathered Till Unit. This groundwater system extends into the Unweathered Till Unit. Water levels have been recorded a number of times in each of the wells. In addition, water levels were recorded for several piezometers which have subsequently been abandoned. Quarterly groundwater monitoring has been performed at the site since 1996. The configuration of the shallow water table in July 2004 is shown on Figure 2-6. The configuration of the shallow water table in July 2006 is shown on Figure 2-7. Water level measurements taken at other times have been generally consistent with this July 2004 and 2006 monitoring events. Water level data from several sampling events are presented in Appendix J.

During earlier site investigation activities, some piezometers were installed as nests with monitoring intervals screened at depths of about 5-to 10-feet, 20-to 25-feet, and 30-to 35-feet BLS. In general, the deeper piezometers had deeper static water levels, indicating a downward vertical gradient. Infiltration of precipitation from the surface is the main source of recharge to the shallow groundwater system. Recharge may be variable across the site depending on surface and subsurface conditions, including remaining MGP subsurface structures.

Groundwater in the shallow system beneath most of the site generally flows in a north and northwest direction. In the south and southeast part of the site, groundwater flows to the south and southeast, respectively.

Groundwater flow gradients differ considerably between the southern and northern parts of the site. The shallow groundwater system near the southern edge of the site has a hydraulic gradient of about 0.08 foot per foot. The groundwater flow rate is about 7.5 feet/year based on an averaged observed hydraulic conductivity of 9.1×10^{-5} cm/sec from the slug tests performed in wells UMW-104 and UMW-106 (Table 2-3). Groundwater velocity could be as high as 30 feet/year using an effective porosity of 25 percent. The shallow groundwater system for the remainder of the site has a hydraulic gradient of about 0.01 foot per foot. The resulting groundwater flow rate is about 0.33 foot/year based on an average hydraulic conductivity of 3.2×10^{-5}

cm/sec from the slug tests performed in wells UMW-108 and UMW-102. Groundwater velocity could be as high as 1.3 feet/year using an effective porosity of 25 percent. Calculation methods were presented in the RI report (Burlington, 1994).

2.7.2 Deep Groundwater System

The deep sand zone groundwater system was encountered at about 115 feet BLS in the Glasford Formation and is continuous across the site. Literature references (Sanderson and Zewde, 1976) indicate that this groundwater system is a confined aquifer. This observation was confirmed at the site where water levels in the deep wells stabilized approximately thirty feet above the top of the sand unit. Configuration of the potentiometric surface of this unit in January 1993 is shown on Figure 2-7. Although the flow direction defined by the January, 1993 water levels was to the southeast, other measurements taken between December 1990 and November 1992 have also indicated flow to the northeast, southwest, and northwest. The regional gradient in the Glasford aquifer is to the west-southwest (Sanderson & Zewde, 1976); however, local flow directions in the site vicinity are not well defined and may be influenced by use of the backup well field located about 4000 feet northeast of the site.

The three deep wells installed during the Phase II site investigation were plugged and abandoned in 1999. During the period between 1992 and 1998 when these wells were being monitored, no impacts were detected. Since there is a downward gradient from the shallow groundwater unit to the deeper aquifer, these wells were plugged to prevent them from acting as a potential conduit from shallow impacted soils to the deeper aquifer.

2.8 Geological Summary

In order to facilitate interpretation of site investigation findings, a series of "fence diagrams" (referred to as cross sections) were developed which illustrate some of the site features and characteristics. A total of six sections have been constructed. Figure 2-9 is a site plan which shows locations of these six cross sections. Figures 2-10 through 2-12 are west to east cross sections and Figures 2-13 through 2-15 are south to north sections through the site.

The three west to east cross sections show a fairly uniform distribution of the surficial fill layer, weathered till and the unweathered till units. The lower sand unit was only encountered in the northwestern portion of the site. The surficial fill layer is slightly thicker in the northern portion of the site with thicknesses of approximately 3.5 to 3.9 feet. The weathered till unit averages from 6.25 to 6.5 feet thick. The unweathered till unit averages approximately 19.5 to 20.25 feet thick.

2.9 Preliminary Assessment

Elements of a Phase I ESA have been completed throughout the duration of project activities dating back to 1990. In July 2002 PSC completed Phase I ESA activities through an Environmental Data Resources, Inc. (EDR) data search. The Preliminary Assessment (PA) elements provided by EDR included the following:

- Search of Illinois Water Well Report,
- Search of available environmental records, and
- Search of Sanborn Fire Insurance maps.

Sanborn Fire Insurance Maps covering the site area were examined for the years 1887, 1892, 1897, 1902, 1909, 1915, 1924, and 1951. Observations from examination of these maps were presented previously in Section 2.1. Copies of the maps showing the general site area are presented in Appendix A.

EDR completed a search of available environmental records and produced a report entitled "The EDR Radius Map With GeoCheck". A copy of the complete EDR report is presented in Appendix B. The EDR search revealed the following:

- Search of the RCRIS-SQG list revealed that there are four RCRIS-SQG sites within approximately 0.25 miles of the site.
- Leaking Underground Storage Tank (LUST) incident Reports revealed that there are seven LUST sites within approximately 0.5 miles for the site.
- The Underground Storage Tank (UST) database of registered USTs revealed that there are seven UST sites within approximately 0.25 miles of the site.
- Search of the Illinois Site Remediation Program (SRP) list revealed that there are three SRP site within approximately one mile of the site.

2.10 Previous Investigations

Several phases of investigation have been completed at the site and are summarized briefly below. It is noted that a significant portion of the work completed at the site pre-dates the initiation of the SRP and TACO. It is also noted that field technologies and methodologies have changed and that analytical laboratory procedures have improved considerably during that period. These investigations began in 1986 and have included both on-site and off-site activities. An interim removal action was also completed in 1997 and 1998 and groundwater sampling activities have been carried out on a quarterly basis from 1997 through 2004. Due to the changes noted above, rationale and objectives have varied considerably during the course of these activities. Beginning in 1990, AmerenIP communicated information through a variety of channels about the various phases of the investigation to the surrounding neighborhood and local, state and federal officials.

The following phases of investigation are discussed in subsequent sections:

- *Phase IA/IB Investigation* – completed by Warzyn Engineering, Inc. (Warzyn) in 1986
- *Phase IC/ID RECON™ Investigation* – completed by John Mathes & Associates, Inc. (Mathes) in 1990
- Phase II Site Investigation – completed by Burlington Environmental, Inc. (Burlington) in 1990
- Supplemental Site Investigation – completed by Philip Services Corporation in 1997
- Interim Remedial Measures – completed by Philip Services Corporation in 1998
- Quarterly Groundwater Monitoring – currently being performed by Kelron Environmental

2.10.1 Phase IA/IB Investigation

Warzyn conducted two phases of investigation during 1986. The objectives of the Phase IA/IB Investigations were to determine the presence or absence of MGP residual products and to identify buried structures associated with the MGP operation. Phase IA consisted of a detailed site inspection and interviews, and was completed October 22 and 23, 1986. Phase IB was conducted November 17 and 18, 1986 and included soil gas sampling and geophysical exploration.

Evidence of both buried structures and MGP residuals was observed on the site. Several circular slabs and numerous foundation walls were visible at grade throughout the site and their locations generally coincided with historical drawings. In addition, soil gas anomalies were noted in areas consistent with the location of historical MGP structures. Site activities subsequent to the Phase IA/IB investigation have resulted in either the removal or covering of historical structures visible at that time.

2.10.2 Phase IC/ID RECON® Investigation

Mathes completed the Phase IC/ID RECON Investigation activities, on-site and off-site, between March 5, 1990 and May 25, 1990. The principal objective of the Phase IC/ID RECON Investigation was to evaluate the nature and extent of impacts of MGP residuals in both shallow soils and groundwater. Results of the Phase IC/ID activities indicated that there were widespread MGP impacts both on-site and off-site. These results were presented in detail in the Phase IC and Phase ID Investigation Reports.

The Phase IC (on-site) and Phase ID (off-site) RECON investigations were performed to obtain subsurface data for AmerenIP to use in a preliminary assessment of the nature and extent of impact to soil and groundwater at the site, and to assess possible off-site movement of MGP residuals. Site activities included using a GeoProbe for collection of both soil and groundwater samples at 34 locations on-site (Phase IC) and 37 locations off-site (Phase ID). Figure 2-16 shows the approximate location of Phase IC/ID probeholes.

During the Phase IC investigation, 34 locations were probed to collect groundwater and soil samples for on-site chemical analysis of headspace vapors.

Headspace analysis of soil and water samples was performed because the formation materials encountered were too impermeable for an appreciable volume of soil-gas to enter the probes. At three locations, probe refusal was encountered at a depth of less than three feet into the surface fill material; therefore, no sampling was performed at these points. At the remaining locations, 20 groundwater or fluid samples and 17 soil samples were collected for headspace analysis. The headspace vapors of these samples were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) constituents and relative total petroleum hydrocarbon (TPH) concentrations using an on-site gas chromatograph (GC).

During the Phase ID investigation, groundwater and soil samples were collected at 37 off-site locations. A total of 34 soil samples and nine groundwater samples were collected for headspace analysis. The samples were analyzed for BTEX and TPH.

The combined results of the on-site and off-site surveys indicated subsurface impacts from MGP related residuals over much of the site and also off-site primarily to the northeast, north and west. Based on BTEX values, off-site migration of MGP residuals appeared to have occurred along the northern and northwestern boundaries of the site. Along the northern boundary, residual impact appeared to have migrated north of the active rail line at depths of more than 28 feet below ground surface (bgs). Along the northwestern boundary, residual impact appeared to have migrated across North Fifth Street west of the former gas-plant building.

Two areas identified with BTEX impacts may be due to releases of fuel oil/diesel fuel rather than MGP constituents. One area (former above ground oil tanks) is located in the southern part of the site and appears to extend beneath the alley adjacent to the southern site boundary. The other area is located immediately west of the northwest portion of the property. Historical data indicates that an oil storage facility and gasoline station were once located in that area. No off-site laboratory analysis was performed on samples collected during the Phase IC/ID activities. While notes of subsurface conditions were recorded, no borehole logs were generated for the Phase IC/ID activities. For preparation of the sampling plan, the information obtained from the Phase IC/ID investigations was used for qualitative purposes to aid in selecting boreholes and monitoring well locations. The results of soil and groundwater headspace data were not used for comparisons to Tier 1 ROs, nor will it be used for justification for no further remediation. Table 2-4 summarizes soil-gas results for the Phase 1C/1D investigations.

2.10.3 Phase II Site Investigation

The objective of the Phase II Site Investigation (SI) activities was to assess the horizontal and vertical extent of impact from MGP constituents in the soil and groundwater. In addition, the levels of impacts of these constituents on subsurface soils and the shallow groundwater were evaluated. The investigative methods used to accomplish these objectives were described in the Phase II Work Plan submitted to and approved by the IEPA in 1990. The Work Plan contained sampling, health and safety, quality assurance, and community relations plans.

Phase II SI activities began in November 1990, continued throughout 1991, and were completed in January 1992. Phase II SI activities, both on-site and off-site, included completion of soil borings, installation of piezometers and monitoring wells, excavation of test pits, chemical analysis of soil and groundwater samples, aquifer characteristic tests, and ambient air monitoring. Soil boring locations are illustrated on Figure 2-17 and approximate piezometer and well locations are illustrated on Figure 2-18. Thirty-four soil samples (Table 2-5) were collected for analysis from 28 boring locations (Table 2-6). Three deep borings were drilled with total depths ranging from 170.0 feet to 175.0 feet bgs. The remaining 25 borings were drilled to depths ranging from 8 feet to 35 feet bgs. A groundwater monitoring program was begun during the Phase II SI activities and has been continued to the present, however, some of the wells and all of the piezometers have been abandoned and, therefore, are no longer included in a monitoring program.

Phase II SI activities also included collection and analysis of five (5) surface soil samples, excavation and sampling of test pits, sampling and analysis of storm sewers, and residential air sampling and analysis (Figure 2-19). In general the results of the Phase II SI confirmed the results of the Phase I studies; however, it did not fully define the degree and extent of MGP impacts. Impacts from MGP constituents were identified both on-site and off-site. In addition, non-aqueous phase liquid (NAPL), potentially related to MGP activities, was identified in two off-site wells; one north of the site and one east of the site. Data developed during the Phase II SI will be used to evaluate remedial objectives to the extent that the data satisfy TACO quality criteria. In addition, Phase II SI information will be used to further refine the site conceptual model. A discussion of the results of the Phase II Investigation is incorporated into Section 7 of this report.

A summary of the techniques used during the Phase II SI is as follows:

- geologic test drilling using hollow-stem augers;
- soil sampling using 1.25- or 2.5- inch inside diameter split-spoon samplers, continuous-tube-system samplers, and three-inch-diameter Shelby Tube samples;
- excavation and sampling of exploratory test pits;
- installation of one-inch-diameter, PVC piezometers;
- installation of two-inch-diameter, stainless steel or PVC groundwater monitoring wells;
- well development using bailers, surge blocks, rod pumps, centrifugal lift pumps, and bladder pumps;
- collection of water or sediment samples from selected underground utilities such as sewers;
- chemical analysis of soil, NAPL, groundwater, surface water, and sewer samples; and,
- physical testing of selected soil samples.

2.10.3.1 Borehole Drilling and Soil Sampling

Boreholes drilled and sampled during the Phase II SI activities were numbered sequentially from UTB-01 through UTB-28 (Figure 2-16). Three deep boreholes were drilled to depths of 170 to 175 feet bgs for the installation of deep monitoring wells. All other sampled boreholes were drilled to depths of 14 to 35 feet bgs. Drilling was performed utilizing 4.25-inch-interior-diameter (I.D.) hollow-stem augers. Samples were collected continuously in all boreholes (with the exception of the three deep boreholes) to the termination depth of the borehole. The three deep boreholes were sampled continuously to a depth of 30 feet. Cuttings were logged for the remainder of the deep boreholes. Soil samples were obtained with either a continuous-tube sampler or a split-spoon sampler. Thirty-four soil samples were collected for chemical analysis. Table 2-5 presents a summary of the Phase II SI laboratory analytical program. Phase II analytical results for soil samples are presented in Appendix C and have been used subsequently in the Tier 1 evaluation to the extent that the data are applicable. The analytical results are discussed and summarized in Section 5.

Some soil sample collection was performed with three-inch-diameter, Shelby-Tube samplers. This type of sampler was used to collect relatively undisturbed samples of fine-grained materials for laboratory geophysical soil testing. Logs for the Phase II SI borings are presented in Appendix D.

2.10.3.2 Test Pit Excavation And Sampling

Test pits were excavated at several locations on-site. Figure 2-19 illustrates the approximate location of test pits. Test pits were excavated in the area of the former purifiers to evaluate potential impacts from inorganic residuals. Test pits were also excavated in the areas of former facility structures to determine if any MGP residuals remained in these underground structures. No analytical samples were collected.

2.10.3.3 Surface Soil Sampling

Five surface (0-6 inch) soil samples were collected from both on-site and off-site locations during the Phase II SI. Figure 2-19 shows the approximate location of surface soil samples. Three samples were collected on-site and two samples were collected off-site. These samples were collected to provide information on potential exposure levels and also to provide background information.

2.10.3.4 Storm Sewer Sampling

Five samples of both liquid and sediment were collected through manholes of storm sewers adjacent to the site (Figure 2-19). Sampling methods included removing the manhole covers and collecting a fluid sample by lowering a bailer through the manhole to obtain the sample. Sediment samples were collected by taping a stainless steel spoon to a wooden handle extension, lowering the spoon through the manhole and scooping up a sample of the sediment at the base of the sewer. The objective of sampling of storm sewers was to determine the potential for these utilities to act as conduits for transport of MGP impact.

2.10.3.5 Residential Air Sampling

Results of Phase IC and ID investigations indicated the potential for off-site impact of volatile compounds. As a result, air samples were obtained from the basements of target residences adjacent to the site in December 1990, March 1991, and December 1991. Samples were also obtained from the basements of homes in the general area of the site but not adjacent to the site. Ambient air samples were obtained from the site and a city park located about 10 blocks north of the site during the March and December 1991 sampling events. All air samples were analyzed for BTEX constituents

Analytical results indicated that the concentrations of BTEX vapors detected in the target houses were comparable to the concentrations detected in the control homes. The concentrations detected in both the target and control houses are somewhat lower than those reported in the literature as typical concentrations of these compounds in the indoor air in most U.S. homes.

Concentrations of toluene, ethylbenzene, and xylenes detected on-site were slightly higher than those detected at the park; however, the concentration of benzene was lower on site. These differences are believed to be a result of variability in atmospheric conditions and sampling and analytical variability. The outdoor concentrations of benzene and toluene observed at Champaign were fairly comparable to concentrations typically observed in remote or rural areas.

2.10.3.6 Groundwater Monitoring and Sampling

Monitoring well locations were selected to evaluate groundwater quality up-gradient and down-gradient of the site and to define the horizontal and vertical extent of MGP-related impact. Piezometer locations were selected to monitor groundwater levels, intersect potential NAPL, and provide groundwater quality data in the potential source areas. Figure 2-18 illustrates approximate locations of piezometers and monitoring wells. Table 2-6 presents well and piezometer construction information, including depth and screened interval, for the 35 wells and piezometers.

Monitoring Well Installation

Initial monitoring wells were constructed with PVC materials; however, based on directions from AmerenIP on December 6, 1990, monitoring wells installed after that date were constructed with two-inch-diameter No. 304 stainless steel screens and risers. Monitoring well UMW-403 was of hybrid construction, with a stainless steel screen and riser from 170 feet bgs to approximately 50 feet bgs and a PVC riser from that point to the ground surface.

Well screens were 0.010-inch slot size, either machine-cut PVC or wire-wrapped stainless steel. Screen lengths were 30 feet for the deep wells (400-series) and 10 feet for all shallow monitoring wells with the exception of UMW-102, which has 15 feet of screen. Rationale for shallow wells was to screen across the water table at an average depth of 10 to 20 feet. The deep wells were screened from approximately 130 to 170 feet bgs. Rationale for deep wells was to screen the deeper confined water bearing unit below 115-feet bgs.

Most monitoring wells were completed with flush-mount well protectors, with the exception of the wells within the property boundary (UMW-113, UMW-114, and UMW-115), which were completed with three-foot stickup well protectors. A WB-40 sand pack was placed around the well screens and brought up to an elevation of approximately two feet above the top of the well screen. A two-foot thick bentonite grout seal was placed above the sand pack. The remainder of the borehole was sealed to the ground surface with a cement-bentonite mixture. Well construction logs and details are presented in Appendix E.

Upon completion, wells were developed to restore the natural hydraulic conductivity of the monitored formation, and remove all drilling-induced sediment to provide turbidity-free groundwater samples. Well development was completed by surging water through the screens using a PVC bailer to loosen the fine-grained material in the sand packs and by pumping the wells with a two-inch-diameter submersible pump. The wells were developed until the discharge was clear and the water quality parameters of pH, temperature, and specific conductance had stabilized.

Piezometer Installation

Piezometers installed during the Phase II SI were constructed using one-inch-diameter Schedule-40 PVC. Screen sections were 0.010-inch machine-cut slot size and were three or five feet in length for all piezometers except for UPZ-108, which had 10 feet of screen. Piezometers were completed with flush-mount well protectors, except those installed within the site boundary which were completed with three-foot stickup well protectors. Some piezometers were installed as clustered nests (Table 2-6). Shallow piezometers are identified as the 100-series and were typically installed with screened intervals between 4 and 10 feet. Intermediate piezometers were the 200-series and are installed with screened interval between 12 and 20 feet, and deep piezometers were the 300-series and are installed with screened intervals of 20 to 30 feet.

Piezometer locations were selected based on assumed potential MGP source areas; therefore, the possibility of fluid NAPL accumulating at the bottom of the piezometers existed at the time of their installation. During normal development procedures, any NAPL present in the piezometer could be contacted with the bailer and then smeared over the screen and riser sections and would make subsequent collection of representative groundwater samples of no value. Therefore, piezometers were not developed, and samples were collected carefully from only the upper portion of the water column.

Groundwater Sampling

Groundwater samples were collected during the Phase II SI from the 16 shallow (UMW-101 through UMW-116) and three deep monitoring wells (UMW-401 through UMW-403). Water samples were also collected from selected on-site and off-site piezometers. Prior to sample collection, each well was purged by removing a minimum of three casing volumes of water. Removal rates during purging did not exceed well development rates. Water quality parameters were monitored during purging to ensure stabilization and removal of stagnant water. Teflon bailers were used to collect groundwater samples during the earlier sample rounds and low flow purge pumps or peristaltic pumps were used to sample during later events.

Aquifer Testing

In situ permeability tests were performed on four select wells screened in differing soil types as determined during drilling and sampling. The test data were analyzed according to the Bouwer-Rice solution (1976). The test method used in two of the four wells involved the insertion and removal of a solid stainless steel slug, with water level measurements taken with an electronic water level indicator and a stop watch. The other two wells were tested based on Ferris and Knowles studies (1963) by removing a known volume of water and checking water level measurements during recovery with an electronic water level indicator and watch. Table 2-3 presents aquifer test results.

Groundwater Flow Conditions

Phase II study results indicate that flow velocities, based on the apparent gradients, single well permeability tests and an estimated effective porosity of 25 percent are approximately 30 feet/year to the south and 1.3 feet/year to the northwest. Shallow groundwater flow directions and velocities are complicated by localized areas of enhanced permeabilities, e.g., sand lenses and backfill around gas and sewer lines. Groundwater traveling through the granular backfill in sewer trenches may also infiltrate the sewer lines where the vitrified clay pipes have cracked. An inspection with a television camera of the first 100 feet of the storm sewer running south from the corner of N. Fifth Street and Washington Street revealed the line to be in poor condition with cracks and leaks. Migration in the sewer backfill may have facilitated the flow of groundwater towards wells UMW-107 and UMW-103, causing the elevated benzene and cyanide concentrations in these wells.

Groundwater flow is also influenced by observed sand horizons in the till which are not laterally continuous, but appear to provide local pathways of higher permeability for groundwater flow. A higher groundwater velocity is present in the vicinity of well UMW-105. The groundwater velocity is higher than other portions of the site. MGP constituents have not migrated noticeably greater distances to the south, suggesting the area of higher groundwater velocity is very restricted.

2.10.3.7 Site Surveying

During the Phase II activities a grid coordinate system for the site was established by AmerenIP surveyors. A site-specific datum for horizontal coordinates was established in the southeast corner of the site and was assigned the coordinates of 5,000.0N and 3,000.0E (in feet). The elevation for the site was established from a City of Champaign record of a sewer manhole at the north end of the site. The locations of pertinent site features and a surface topographic map were surveyed with reference to these site data. Survey accuracies were on the order of ± 1.0 foot horizontally and ± 0.01 foot vertically. It is noted that during the CSI activities completed in 2004, a site survey was completed by an Illinois registered surveyor and previous data were corrected. The site survey currently ties the site into the Illinois state co-ordinate system.

2.10.3.8 Chemical Analysis

Chemical analyses were performed by Heritage (EMS) Laboratories of Indianapolis, Indiana on soil, groundwater, and sediment samples obtained during the Phase II SI activities. Groundwater samples obtained subsequent to 1993 were analyzed by TekLab Inc. (TekLab) of Collinsville, Illinois. Analytical parameters included volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCS), cyanide, and various metals and other indicator parameters. Table 2-5 is a summary of chemical analyses and methods completed for the subsurface soil samples. Table 2-7 is a summary of chemical analyses and methods of the Phase II SI groundwater analytical program. Laboratory analytical data sheets for soil are presented in Appendix C and groundwater data sheets are presented in Appendix F.

Soil samples representative of different lithological units encountered during the Phase II SI were selectively tested for physical properties. These tests included:

- vertical permeability (four samples, ASTM D 5084);
- natural moisture content (nineteen samples, ASTM D 2216);

- dry unit weight (four samples);
- grain-size distribution (seven samples, ASTM D 422 and D 2240); and
- liquid and plastic limits (seven samples, ASTM D 4318).

Physical testing results are presented on Table 2-2 and laboratory data are presented in Appendix G.

2.10.3.9 Phase II SI Summary

Results of the Phase II SI showed that significant impacts to both surface and subsurface soil and groundwater existed both on-site and off-site. Soil impacts are greater and appear to extend to greater depth on the northern portion of the site and also extend off-site to an area north of the railroad right-of-way. Off-site impacts also extend to the east into the vacated Sixth Street right-of-way. Groundwater impacts also extend off-site. The Phase II SI activities did not completely define the degree and extent of MGP residual impacts.

2.10.4 Supplemental Site Investigation

Based on the results of the Phase I and Phase II investigations, AmerenIP determined that an Interim Removal Action (IRA) was warranted and that additional site information would facilitate completion of Interim Remedial Measures (IRM) at the site. PSC prepared a Supplemental Site Investigation (SSI) work plan to complete this additional site investigation work.

The SSI was completed in March 1997 to further assess extent and impacts of off-site residuals east of the site and to characterize materials within the below grade gas holder (GH-1) with respect to planned source removal. The SSI was also undertaken in response to the observation of increasing impacts from monitoring well UMW-103 located in the vacated Sixth Street right-of-way immediately east of the site. This well showed a trend of decreasing BTEX and naphthalene concentrations from 1990 through the first quarter of 1996; however, dense non-aqueous phase liquid (DNAPL) was discovered in the well in August of 1996.

SSI activities included GeoProbe soil sampling within the vacated Sixth Street right-of-way east of the site, test pit excavations near gas holder GH-1 and on-site immediately west of Sixth Street, and sampling of liquids from within gas holder GH-1. Figure 2-20 illustrates the approximate locations of the SSI test pit excavations and probeholes. Ten probeholes were completed to depths ranging from six to eighteen feet bgs. Six soil samples from the probeholes were collected and analyzed for BTEX and naphthalene. Four test pits were excavated during the SSI; however, no analytical samples were collected from the test pits. Boring and test pit logs are presented in Appendix H.

Impacts from MGP residuals were observed at several locations within the vacated Sixth Street right-of-way; however, neither a source nor a pathway for these residuals was identified. No obvious NAPL migration pathways were discovered during the SSI activities. The backfill of the east-west sewer line through the site did not appear to be more permeable or more impacted than the adjacent native till materials. However, as a cautionary measure, capping of the sewer was recommended as part of the IRM.

2.10.5 Interim Remedial Measures

As noted in Section 2.10.4, AmerenIP determined that proceeding with IRM activities was warranted based on previous investigations at the remediation site. PSC prepared an IRM Work Plan during mid year 1997 and performed the IRM activities between October 10, 1997 and May 14, 1998.

The primary objective of IRM activities was to remove MGP potential source materials from the belowground gas holder (GH-1), tar wells, a tar separator, and an area of purifier waste. Fluid NAPL and MGP impacted materials from the belowground structures were blended on-site to render the material suitable for off-site thermal treatment. Purifier media was blended with the material from gas holder GH-1. Concrete, wood, metal, and other materials not accepted at the treatment facility were segregated and staged in a covered roll-off box for disposal at an AmerenIP-approved landfill. These objectives were accomplished in general accordance with the Work Plan. Figure 2-21 illustrates the approximate areas of IRM activity.

The three suspected tar wells (TW1, TW2, and TW3) northwest of gas holder GH-1 were located and excavated. All three tar wells were larger than anticipated based on historical maps of the site. Another potential tar well, TW4, northeast of gas holder GH-1, was identified as a concrete foundation pad, possibly from an oil tank. However, the entire area northeast of GH-1 was excavated to insure that no belowground structures were missed. The tar separator located south and southwest of gas holder GH-1 was excavated along with an adjacent valve pit located to the east containing impacted materials. A test pit was also excavated in the northwest corner of the site at the location of a shallow brick manhole. No MGP residual impacts were observed at this location.

MGP residual material was treated as necessary to meet TCLP benzene limits and to make the material acceptable for shipment and for thermal treatment. The material was blended on site either within the gas holder tank or in two mixing boxes. This "MGP special waste" was shipped off site for treatment at Illinova Resource Recovery's Baldwin Thermal Treatment Facility (BTT) in Baldwin, Illinois. Approximately 8,467 tons of blended material was transported to BTT in 339 truckloads. Concrete debris and steel from gas holder GH-1, the tar wells, tar separator, purifier pads, and miscellaneous excavated foundations were segregated, the concrete was broken with a hydraulic hammer, and either disposed of as construction debris or utilized as backfill at the base of gas holder GH-1.

Approximately 487.5 tons of soil containing purifier media was excavated from an area on the southwest corner of the site, west of the Booster House. Depth of the excavation was 3 feet bgs. The excavated soil and purifier material, which was non-hazardous, was stockpiled east of gas holder GH-1. The stockpiled material was later placed directly into the gas holder GH-1 below grade tank along with clay, coal, and quicklime and blended with other tar-like materials. The purifier area excavation was then backfilled with clean fill.

Approximately 526 tons of heavily MGP impacted material was excavated from gas holder GH-1 from the depth of 7 to 16.5 feet bgs. About 100 cubic yards (CY) of concrete and steel from the cover of GH-1 were separated during the excavation process, stockpiled, broken up with a hammer hoe, and sent off site for disposal. In addition, 85,000 gallons of heavily impacted water and rainwater were pumped from gas holder GH-1 prior to and during excavation. Water was pumped from gas holder GH-1 into storage tanks, treated to meet disposal requirements, and discharged to the sanitary sewer system.

The potential source materials in gas holder GH-1, from 7 feet bgs to 16.5 feet bgs, required on-site treatment as necessary to meet TCLP benzene limits prior to disposal. TCLP benzene analytical results for the blended material were below BTT's acceptance criteria and RCRA characteristic hazardous waste levels. The blended material from gas holder GH-1 was stockpiled for subsequent shipment to BTT.

Approximately 482 tons of source material, demolition debris and impacted soils were excavated from tar wells TW1, TW2 and TW3, the tar separator and adjacent valve pit, and at CHTP-203. Test pit

CHTP-203, northeast of gas holder GH-1, was in the area of a potential fourth tar well, which was determined to be a concrete foundation. The outer walls of TW1 and TW2 were excavated and the bottoms were left intact. The walls and bottoms of TW3, the tar separator, and the valve pit were left intact. All three tar wells and the tar separator contained liquids with debris such as bricks and concrete. Heavily impacted soil, concrete and steel associated with former building foundations and walls were removed during the process of locating and excavating the tar wells. With the exception of concrete and steel debris, the impacted materials from TW1, TW2, TW3, and CHTP-203 were excavated and placed into gas holder GH-1 for treatment. The concrete and steel debris were separated during the excavation process and stockpiled prior to off-site disposal.

The source material and heavily impacted soils placed into gas holder GH-1 from the tar wells, tar separator/valve pit, and CHTP-203 required treatment to render the material acceptable for shipment and treatment at BTT.

Exploratory test trenches CHTP-201 and CHTP-202 were excavated in accordance with the Work Plan, although both trench locations were moved further east. Additional exploratory trenches were also excavated northeast of gas holder GH-1 (CHTP-203) and in the northeastern portion of the site (CHTP-204). The materials excavated from exploratory trenches CHTP-202 and CHTP-203 were heavily impacted with MGP residuals. These impacted materials were placed into gas holder GH-1 for blending and the excavations were backfilled with clean soil.

Other objectives accomplished as part of the IRM included capping the abandoned storm sewer traversing the site at the west and east terminal, and removal for off-site disposal of approximately 105 clean empty drums, two dozen wooden pallets, miscellaneous surface debris, hoses, fencing, trees, and brush.

Following site cleanup, site restoration was completed. Site restoration was conducted in accordance with the Work Plan. Approximately 780 CY of topsoil was spread over the site, final graded, seeded, and covered with straw to restore the site to grass cover.

2.10.6 Groundwater Monitoring

As noted in Section 2.10.3.6, piezometers and groundwater monitoring wells were initially installed during the Phase II Site Investigation activities. Nineteen wells were installed both on-site and off-site, including three deep wells. Wells have been sampled for chemical analysis numerous times since initial installation in 1990 and have been sampled on a quarterly basis since 1996.

Groundwater samples were initially collected from the off-site wells UMW-101 through UMW-112 (with the exception of UMW-109 which had not yet been installed); UMW-401 through UMW-403; and piezometers UPZ-101, UPZ-301 and UPZ-303 in December 1990 (refer to Figure 2-18 for approximate well locations). A second round of groundwater samples was collected in January 1992 after the on-site wells had been installed and included all wells (UMW-101 through UMW-116) with the exception of UMW-104, which could not be located at that time. A third round of groundwater samples was collected from all wells in January 1993 with the exceptions of UMW-101 (DNAPL accumulation in the well) and UMW-107, which was obstructed at the time by a housing construction project. Piezometers UPZ-104, UPZ-105 and UPZ-106 were also sampled at this time.

Quarterly groundwater sampling at the site commenced in the first quarter of 1996. Samples were collected from selected wells (UMW-102, UMW-107, UMW-108, UMW-109, UMW-111, UMW-112, UMW-114, UMW-115 and UMW-116) and analyzed for BTEX and naphthalene. Samples from wells UMW-107 and UMW-114 were also analyzed for PAHs. Well UMW-103 was sampled until the third quarter of 1996 when DNAPL was identified in the well and sampling was discontinued. This well and wells UMW-101, UMW-401, UMW-402, and UMW-403 were subsequently abandoned in accordance with Illinois Department of Public Health guidelines. During sampling events from 1990 to 1999 no impacts were identified in the deep wells (UMW-401, UMW-402, and UMW-403) and subsequent to identification of DNAPL in wells UMW-101 and UMW-103 all five wells were sealed to prevent any potential hydraulic connection to the deeper aquifer. These five wells were sealed in August of 1999. Well UMW-111 was located in Washington Street and was subject to traffic damage. This well was also abandoned and a replacement well UMW-111R was installed nearby. During site maintenance activities and the IRM, all of the piezometers on the northern half of the site were destroyed.

Table 2-8 presents a summary of groundwater results (BTEX, PAHs, and Metals) for those wells monitored through 1999. The shallow groundwater system at the site has been impacted by MGP residuals over much of the site. The VOCs present in the impacted groundwater include benzene, ethylbenzene, toluene and xylenes. Throughout the duration of sampling activities various SVOCs have been detected in 14 of the 18 shallow monitoring wells and piezometers. Table 2-9 presents a summary of groundwater results (BTEX, PAHs) for wells monitored from 2004 through 2006.

Although the flow direction defined by the January, 1993 water levels was to the southeast, other measurements taken between December 1990 and November 1992 have also indicated flow to the northeast, southwest, and northwest. December 2006 water levels indicated flow to the north.

2.11 Enforcement Actions

No enforcement actions have been taken at the site. AmerenIP entered this site into the IEPA voluntary program known as the Site Remediation Program (formerly the Pre-Notice Program) in 1989. The site identification number is LPC # 0190100008. Since the site was entered into the SRP, plans and reports related to site activities have been reviewed and approved by the IEPA. No enforcement notices from the IEPA or other federal, state, or local agency have been received by AmerenIP.

3 COMPREHENSIVE SITE INVESTIGATION WORK PLAN

This section presents the proposed activities described in the Site Investigation Work Plan (SIWP, August 6, 2002). The investigation activities include the collection of subsurface data necessary to complete the delineation of impact to soil and groundwater and to fully characterize the site. It also includes the development of remedial objectives and the preparation of the Remedial Objectives Report (ROR). It is noted that the Champaign MGP site has had no commercial or industrial use other than the MGP since at least 1869, with the exception of the twelve year period from 1979 through 1991 when the property was used by the American Legion. During this twelve year period the American Legion used the remaining MGP structure for meetings. Based on this fact, and the fact that the surrounding area has been primarily residential over the same period, as permitted in IAC Section 740.420(b)(1) the CSI analytical program can be limited to specific MGP chemicals of concern and satisfy the requirements for a Comprehensive Site Investigation.

The sequence of activities described in the SIWP was developed to insure a dynamic investigation which could be refined throughout the duration of field activities to consider and address field observations. For example observations made during test pit activities resulted in relocating and adding additional test pits as well as adding and relocating borings. The historical information about the remediation site and the data from previous activities was used to help identify features and areas that required further data or delineation. The planned CSI activities included the following:

- Site preparation and mobilization,
- On-site excavation and sampling of test pits,
- On-site soil boring and soil sampling,
- Off-site soil boring and soil sampling,
- Re-development of existing monitoring wells,
- Groundwater sampling,
- Soil and groundwater laboratory analytical program,
- Site survey, and
- Management of investigation derived wastes.

Field activities were managed and completed by PSC and its subcontractors. Kelron Environmental of Champaign, Illinois provided on-site geological oversight for all field work including test pit excavation, GeoProbe borings, survey services, and groundwater sampling. Transhield Underground Services, Inc. of West Chicago, Illinois provided GeoProbe equipment and services. Vegrzyn, Sarver and Associates of Champaign, Illinois provided survey services and Teklab, Inc. of Collinsville, Illinois provided analytical laboratory services.

The site was entered in the SRP in January 1989 by AmerenIP and assigned the site number 0190100008. In the CSI Work Plan, activities within the railroad and street right-of-way are referred to as off-site activities. Figure 3-1 illustrates the SRP boundary and bordering property parcels.

3.1 CSI Objectives

Based on a detailed review of previous investigation results, observations made during the IRM activities, and understanding the time frame within which previous work was completed (i.e. 1986 through 1998), it was concluded that additional site specific data were necessary to fully delineate environmental impacts at the site and to provide the quantity and quality of data necessary to complete a CSIR and ROR under the SRP and TACO. The primary objective of the CSI work was to collect additional data to more completely characterize the site, including off-site areas, (i.e. delineate the degree and extent of site impacts) and to provide data which is complete and of the desired quality to allow subsequent completion of the ROR. Therefore, the primary purpose of the CSIR is to provide the IEPA with an evaluation of the horizontal and vertical extent of environmental impacts on the site.

The components of a Site Investigation (SI) and CSI are set forth in IAC Section 740.415 and Section 740.420 respectively. The CSI work plan did not include all elements set forth in these sections because many of these elements had been satisfied through the previous investigations. For example, since monitoring wells were installed in 1990 and groundwater has been monitored since that time it was not necessary to include the installation of additional wells during the CSI.

3.2 Test Pit Excavation

The objectives of the test pit portion of the CSI were two fold; one objective was to investigate potential MGP below grade structures which were not addressed during the IRM, and the second objective was to identify potential off-site migration pathways to the north and east of the site. Test pit excavation and sampling was the initial activity planned for the CSI field work. Test pits were planned to be excavated with the primary objective to identify specific MGP subsurface structures and the presence or absence of MGP residual impacts. Table 3-1 presents the general rationale for test pit excavation. Test pit activities were planned as the first element of the CSI to be completed so that observations could be considered in refining the GeoProbe program if warranted.

Test pit activities planned to use a track hoe with a minimum reach of fifteen feet. Based on previous investigation activity and current understanding of groundwater conditions, it was anticipated that the desired test pit depths in some areas of the site might not be achievable. MGP structures of interest are primarily the gas holder foundations and intake and outlet structures. Based on observations during the IRM and other historical data, questions remained relative to the date and type of construction for gas holder GH-2. It was believed that this gas holder may have had a below grade water tank, which could contain source material or heavily impacted material and may be twenty-five feet or more deep.

Although an effort was made during the supplemental SI to identify the pathway for residuals east of the site, it was not conclusive that the east-west sewer was the only pathway for off-site migration of residuals into the vacated Sixth Street right-of-way. A test pit was planned to be excavated inside the fence and along the fence in an attempt to identify other potential migration pathways. A similar excavation was to be completed along the inside of the north fence in the general area north of gas holders GH-1 and GH-2, in an attempt to locate the pathway for the NAPL observed in monitoring well UMW-101 (now abandoned) north of the railroad right-of-way.

Any test pits excavated within structures were to be excavated to the base of the structure, if possible, and terminated. At no time would the bottom of a former MGP structure be penetrated. Test pits were to be terminated prior to reaching the target depth in the event that any of the following occurred: excessive readings from air monitoring equipment; excessive odors that could adversely impact off-site properties; buried utilities encountered in the excavation; gross infiltration of groundwater or MGP residuals; significant sidewall failure; or degradation of the integrity of the structure that is being examined. At least one soil sample representative of the excavated material was to be collected for laboratory analysis from each test pit. In addition, if impacted material was encountered, an attempt was to be made to collect a sample of the most heavily impacted material.

Test pit samples were to be analyzed for VOCs or BTEX constituents, and SVOCs or polynuclear aromatic hydrocarbon compounds (PAHs). In addition some select samples would also be analyzed for cyanide (CN), metals, and TPH.

3.3 On-Site Soil Boring and Sampling

Soil borings were to be completed on-site (i.e. the AmerenIP parcel) during the CSI. Table 3-2 presents the general rationale for each location. In general soil borings were to be advanced to a depth of approximately 25 feet bgs using a truck-mounted drilling rig with hollow stem augers. The final boring depth at each location was to be determined in the field based on observations by the site engineer/geologist. The following criteria were to be used to determine final depth:

- Auger refusal indicating a buried structure. If refusal was encountered within five feet of the ground surface, the boring location was to be shifted a few feet and re-drilled.
- Terminate in the un-weathered till after five feet with no apparent MGP impacts.
- If un-weathered till was impacted, terminate five feet below the visually impacted interval.

All borings were to be continuously sampled using split spoon or other comparable methods.

In general, a minimum of three soil samples were to be collected from each boring for laboratory analyses. A surface soil sample was to be collected from the interval from ground surface to three feet bgs at each location based on PID readings. A second sample was to be collected from the three to ten foot bgs interval, also based on PID readings, and a third from the bottom two foot interval at each boring location. In addition, if MGP impacts were observed, at least one sample from the most heavily impacted interval was to be collected. The impacted sample was to be based on PID readings and odor and visual observations. If the observed most heavily impacted interval is not consistent with the highest PID reading, two samples would be collected, one representing each interval. The goal of this sampling rationale was to define the degree and extent of MGP impacts in both horizontal and vertical directions.

3.4 Off-Site Soil Boring And Sampling

Proposed soil borings were to be completed off-site (i.e. within the railroad and Sixth Street rights-of-way). The primary objective of these borings was to define the pathway for MGP residuals identified in off-site wells during previous investigation activities and to define the lateral and horizontal extent of these residuals. Based on previous observations, these borings were to be at least 25-30 feet bgs and were to be drilled using the same methodology as described for the on-site borings in the previous section (Section 3.3). Criteria for depth of termination were to be the same as for the on-site borings.

Borings were to be drilled north of the north property fence in the railroad right-of-way in the N. Sixth Street right-of-way east of the property fence. Exact locations for these borings were to be established in the field after completion of the on-site test pits and borings. Additional off-site borings were anticipated and would be located based on observations of the initial borings.

3.5 Groundwater Sampling

Quarterly groundwater monitoring at the site has been underway since 1997 and has included nine wells on and around the site. Also, groundwater level data has been collected from those nine wells and five additional wells. Existing well locations are illustrated on Figure 2-18.

Fourteen monitoring wells were sampled for chemical analysis. Water level measurements were to be obtained from all wells using an electronic water level indicator and recorded on field logging forms. Depth to the bottom of each well would also be measured and recorded, and presence of NAPL will be noted.

Groundwater sampling activities were initiated approximately two weeks after well installation and development had been completed. After collection of water level data and prior to sampling, each of the fifteen wells would be purged of a minimum of three well casing volumes of water. During purging, field measurements of pH, specific conductivity, temperature, and dissolved oxygen would be measured until these parameters had stabilized to within ten percent of the previous reading. Wells would be slow purged and groundwater samples collected using a peristaltic pump with dedicated disposable tubing.

3.6 Site Survey

As a result of inconsistent survey data from previous investigations, it was determined that a complete site survey and development of a new site base map was warranted. An Illinois licensed surveyor would determine the horizontal location, ground surface elevation, and top of casing elevation for all monitoring wells. The location and ground surface elevation for each test pit and boring would be determined. Elevation data would be referenced to a National Geodetic Vertical Datum (NGVD), or local permanent datum, based on availability. Horizontal coordinates would be referenced to the Illinois State Plane Coordinate system or to a local permanent reference point. In addition, other points of reference identified by the site engineer/geologist, such as fence corners, buildings, sewer manholes, etc. would be surveyed for elevation and coordinates. The data collected by the surveyor would be used to prepare a site base map to be used for the CSI Report.

3.7 Analytical Program

Both soil and water samples were to be collected during CSI activities for chemical analysis at an off-site laboratory. During sample collection, samples were to be placed in laboratory provided containers and labeled according to matrix, sample location, date, and analytical method. Quality control (QC) samples, which include trip blanks, field blanks, duplicates, and matrix spikes were collected to assess the quality of the data resulting from the field sampling program.

Soil samples were to be collected from test pits, and on-site and off-site soil borings. It was anticipated that in excess of eighty-five soil samples would be sent to the laboratory for analysis. Since analytical data were available from the Phase II investigation and a relatively large number of additional samples were to be collected, complete analyses of all samples for all parameters would not be necessary. The analytical rationale would be to complete a full VOC and SVOC analysis on approximately every fifth sample; the remaining four samples were to be analyzed for only BTEX and PAH constituents.

Soil samples were to include a minimum of one sample from each test pit and three samples from each boring. Surface soil samples were also to be analyzed for RCRA metals and cyanide. Select samples were to be analyzed for TPH constituents based on PID readings and visual observations. In addition, at least one QA/QC sample was to be collected for every ten soil samples.

The analytical methods to have been used for soil samples included the following:

- SW-846; Method 8260 (BTEX & VOC parameters)
- SW-846; Method 8270 SIM (PAH & SVOC parameters)
- SW-846; Method 8015 (TPH constituents)
- SW-846; Method 9010 (total Cyanide)
- SW-846; Methods 6000 & 7000 series (RCRA metals)
- SW-846; Method 9045C (pH)

Soil samples submitted for BTEX and VOC analysis were to be collected in accordance with Method 5035. One of every five soil samples was to be analyzed for the entire IAC Section 740 Appendix A list of VOCs (Table A) and the remaining samples would only report for BTEX parameters. One out of every five soil samples collected for SVOC analysis would be reported for all parameters identified in IAC Section 740 Appendix A (Table B). Arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver were to be the parameters reported for soil samples analyzed for metals.

Groundwater samples would be collected from fourteen pre-existing monitoring wells. In addition, three duplicate samples would be collected for QA/QC purposes. The analytical methods were to include the following:

- SW-846; Method 8260 (BTEX)
- SW-846; Method 8310 (PAHs)

4 COMPREHENSIVE SITE INVESTIGATION FIELD INVESTIGATION

As required in IAC Section 740.425(b)(4), the following sections provide documentation of the field activities that were performed to characterize the site. Investigation activities as defined in IAC Section 740 were performed during June through August 2004. In addition certain activities defined in IAC Section 740 were performed during earlier investigations completed in 1986, 1990, 1997, and 1998. Only those activities completed during 2004 are discussed in this section. Elements applicable to completion of this CSIR that were completed previously are presented in earlier sections of this report. The principal CSI activities completed during 2004 included excavation and sampling of test pits, logging and sampling of probeholes, and groundwater sampling. The following sections address the CSI activities in detail:

- Test pit excavation and sampling;
- GeoProbe completion and sampling;
- Well redevelopment and groundwater sampling;
- Site survey and base map development;
- Investigation waste management and disposal;
- Quality assurance / quality control activities; and
- Deviations from site sampling plan.

4.1 Test Pit Excavation and Sampling

During the week of July 5, 2004 nine (9) test pits (identified as TP-501 through TP-510) were excavated as part of the CSI field activities. The proposed location and rationale for these test excavations is presented in Section 3.2 of this CSIR. The objective of these excavations was to investigate below grade MGP structures and to evaluate potential off-site migration pathways. Figure 4-1 illustrates the actual locations where test -pits were excavated. Each test pit was supervised by the site engineer/geologist, who made a field determination relative to the nature of the material being excavated. Any material deemed to be moderately or heavily impacted, was placed into a roll-off container for subsequent off-site. Soils were classified in accordance with ASTM Standard D 2488-90. Data recorded included field observations, including PID readings, characterization of soils, and indications of impacts such as stained soils or odors. MGP structures were described and photographs taken. The subsequent paragraphs provide brief descriptions of observations made at each test pit location.

Test Pit TP-501: Test Pit TP-501 was excavated on July 8, 2004 and oriented approximately north-south inside the site fence and approximately parallel to the vacated Sixth Street right-of-way. The objective of this excavation was to identify preferential pathways for MGP impact. Test Pit TP-501 was approximately 52 feet long, 5 feet wide, and 5 to 7.5 feet deep. The following four soil horizons (from ground surface down) were observed in the walls of the excavation:

- Horizon A – medium brown moist fill (1 to 1.5 feet thick), primarily clay with sand, gravel, brick (PID=2.5 ppm)
- Horizon B – black silty clay to clay (2.5 to 3 feet thick) with brick, tile, and cinders, and a tar-like odor (PID=5.7 ppm)
- Horizon C – dark gray to black silty clay (1 foot thick) with tar-like odor
- Horizon D – gray to olive gray clay to silty clay (greater than 2.5 feet thick), soft and wet, water seeps below 5 foot depth, impacted (PID=289 ppm) with immiscible hydrocarbon oil-like fluid, tar-like odor, some yellow to yellow-orange staining

In addition, a layer of broken brick was observed at a depth of about 3 feet bgs. This may be the remnant of the original surface of Hill Street, which bisected the site between Fifth and Sixth Streets. A 24-inch diameter cast iron gas main was encountered at 6 to 7.5 feet of depth perpendicular to the trench (i.e. parallel to Hill Street) and about 15 feet from the southern end of the test pit. A hydrocarbon-like liquid was observed seeping out of the sidewall of the trench along the contact between Horizon C and Horizon D. A soil sample [TP501(7)] was collected from the 6 to 7 foot depth interval for chemical analysis.

Test Pit TP-503: Test Pit TP-503 was excavated on July 8, 2004 outside and parallel to the north property fence along the railroad right-of-way. This trench was a composite of proposed test pits TP-502 and TP-503 excavated to evaluate potential migration pathways from the site toward former monitoring well UMW-101. Test Pit TP-503 was approximately 97 feet long, 5 feet wide and 4 to 5 feet deep. The upper 4 feet of material was generally a loose black fill composed of ash, cinders, slag, clinker, and gravel. Water seeps with a hydrocarbon sheen were observed at approximately 2.5 feet bgs. Tar-like odors were also observed and PID readings from the 2 to 4 foot depth ranged from 12 ppm to 34.8 ppm. along the entire length of the trench. A gray silty clay was observed below the 4 foot depth. The clay had a tar-like odor and a PID reading of 18 ppm near the west end of the excavation.

There were variations observed along the length of the trench with respect to the rate of water inflow, hydrocarbon-like sheen, tar-like odors and possible NAPL material. However, the inflow rate was sufficient to limit the depth of excavation to 5 feet or less. Two soil samples [P-503(3) and TP-503A(3.5)] were collected from TP-503 for chemical analysis.

Test Pit TP-504: Test Pit TP-504 was excavated on July 8, 2004 along the outside west edge of gas holder tank GH-1 to investigate the inlet/outlet sump and/or valve pit for that gas holder. The contents of GH-1 were excavated and disposed of during the IRM activities in 1997. Test Pit TP-504 was approximately 29 feet in length, 10 to 16 feet wide and 4 to 6 feet deep. The top of gas holder GH-1 wall was encountered at 2 feet bgs. Clean brown sand was encountered inside the gas holder GH-1 tank and the following three soil horizons were identified outside of the tank wall:

- Horizon A – one foot of clean sand fill with light brown clay topsoil at the ground surface
- Horizon B – fill composed of cinders, clay, ash-like material, brick, and piping all heavily stained with strong tar-like odor (1 to 4 ft. bgs)
- Horizon C – gray to olive gray clay with staining and tar-like odor (4 to 6 ft. bgs)

Four pipes were encountered during excavation. Two metal pipes (4 inch-diameter and 1 inch-diameter) were observed above the gas holder wall and parallel to the wall. A 4 inch-diameter clay pipe was observed approximately 3 feet bgs and a 3 inch-diameter metal pipe containing tar-like material was observed at a depth of about 2.5 feet bgs. Both the clay pipe and 3 inch metal pipe were oriented approximately north-south and approximately 4 to 5 feet east of the gas holder wall. Soil sample TP-504(3) was collected for chemical analysis.

Test Pit TP-505: Test Pit TP-505 was excavated on July 6, 2004 along the northwest edge of gas holder GH-3 to investigate the valve vault/pit and outlet piping. The primary objective of the excavation was to locate outlet piping shown on a 1922 site plan and determine the presence or absence of MGP residual impacts. Test pit TP-505 was approximately 39 feet long, 7.5 to 8 feet wide, and 5 to 7 feet deep. The following three soil horizons were observed in the excavation:

- Horizon A – dry light brown clay and gravel fill (0.5 to 1 foot thick) with some sand, no odor noted (PID=2.9 ppm)
- Horizon B – medium brown moist silty clay (1.5 to 2 feet thick), no odor noted (PID=37 ppm at 2 ft. bgs)
- Horizon C – silty clay to clay, black with residual staining of tar-like material, wet below 4 ft., strong tar-like odor (PID=137 ppm)

The brick holder foundation was encountered from 1 foot to 6.5 feet in the southeast wall of the excavation. The concrete top of valve vault/pit was encounter at about 2 feet bgs. The valve pit is approximately 8 by 8 feet, constructed of concrete, and is tied into the holder foundation. The vault/pit bottom is about 7.5 feet bgs and contained water and 3 to 3.5 feet of tar-like material. Strong tar-like odors were noted when the cover was removed from the valve vault/pit. No sample of the liquid was collected.

Test Pit TP-506: Test Pit TP-506 was excavated on July 6 and 7, 2004 adjacent to the GH-3 gas holder foundation to investigate the holder inlet piping. The excavation was 'L' shaped with one leg excavated to expose the tank holder slab and the second leg approximately parallel to the foundation wall. The leg outside of the slab was oriented east-west and was approximately 18 feet long, 5 feet wide and 8 feet deep. The leg on the holder slab exposed an area approximately 15 feet long and 10 feet wide. The holder slab is approximately 3 feet bgs. The inlet pipe vault/pit was located inside the holder foundation; however, no vault was found outside the foundation. The vault/pit is approximately 8 feet long, 2 feet wide and 5.5 feet deep below the bottom of the slab (i.e. about 8.5 feet bgs). The vault/pit has a concrete cover and approximately 3 feet of water and tar-like material was observed in the bottom of the vault/pit. The following soil horizons were observed in the trench outside of the holder foundation:

- Horizon A – light brown clay fill (0 to 1 ft.) with coarse gravel (PID = 4ppm)
- Horizon B – black clay with staining, strong tar-like odor

Test Pit TP-507: Test Pit TP-507 was excavated on July 7, 2004 adjacent to the southwest edge of gas holder GH-2. The purpose of this trench was to locate the outlet piping vault/pit and assess potential impacts of residuals. The trench excavation was in excess of 35 feet long approximately perpendicular to the GH-2 holder wall and 15 to 20 along the wall. Several pipes were identified both inside and outside of the wall. The gas holder GH-2 wall is 1 to 1.5 feet wide, constructed of concrete or possibly brick with a concrete veneer and the top is about 1 foot bgs. The concrete wall was impacted with tar-like material and was exposed to a depth of 8.5 feet. Material within the holder consists of fill with brick, clay and wood to a depth of about 2 feet. Below 2 feet the material is primarily clay impacted with tar-like residuals.

In addition, a two-compartment vault was observed inside the wall. The entire vault was not exposed; however, it is about 10 feet long and constructed of brick. The cover is constructed of wood and concrete and was encountered about 2.5 feet bgs. The compartment nearest the wall is filled with viscous tar-like material and the other compartment is filled with what appeared to be water. A soil sample, TP-507(3.5), was collected from north of the vault for chemical analysis.

Test Pit TP-508: Test Pit TP-508 was excavated on July 8, 2004 in the area northwest of gas holder GH-2 and south of the fence. This excavation was oriented approximately northeast southwest and was about 35 feet in length.

The objective of TP-508 was to locate the inlet pipe and valve pit for the 20 inch gas main shown on the 1922 site plan. In addition the excavation was located in the general area where a curved brick wall (assumed to be gas holder GH-2 wall) was observed during the IRM activities. Neither the brick wall nor the pipe and valve pit were encountered. The western portion of the excavation encountered the clean sand backfill from the IRM and the eastern portion encountered moderately to heavily impacted material at 1 foot bgs. The impacted side of the test pit was excavated to depths of 6 to 8 feet. A soil sample, TP-508(4), was collected from a heavily impacted area of the excavation.

Test Pit TP-509: Test Pit TP-509 was excavated on July 7, 2004 to locate the east wall of the holder tank for GH-2. The excavation was oriented approximately east west and was about 30 feet long and 5 to 10 feet wide. The depth was between 3.5 and 4 feet and was limited due to the inflow of water. The material encountered from the surface to about 2 feet was composed of cinders, ash, brick, pipe and concrete and exhibited low levels of MGP residual impacts. Material below 2 feet was similar but was more heavily impacted with tar-like material. The gas holder wall for GH-2 was not encountered. No soil samples were collected from TP-509.

Test Pit TP-510: Test Pit TP-510 was excavated on July 7, 2004 to locate the gas holder wall for GH-2. The excavation was approximately 28 feet long, 5 feet wide, 4.5 feet deep and oriented northwest to southeast. The inflow of perched groundwater limited the depth. The top of a wall, possibly GH-2, was encountered about 1.5 feet bgs and is constructed of brick and approximately 2 feet wide. Tar-like impacts were noted on both the inside and outside of the wall and water seeping into the excavation was heavily impacted with both tar-like and petroleum-like materials. Three 2-inch pipes were encountered and contained tar-like material. The following three soil horizons were encountered:

- Horizon A – Fill containing clay, rock and soil from ground surface to about one foot bgs
- Horizon B – Clay with brick and cinder fill (1-2.5 ft. bgs), slightly impacted
- Horizon C – Dark gray to black clay, highly impacted with tar-like material

Summary: Nine test pits were excavated at the locations identified in Figure 4-1. Test pit depths were less than anticipated due to presence of groundwater, although depth to water and inflow rates varied considerably over relatively short lateral distances. Evidence of impacts from MGP residuals was observed in all test pits and six soil samples were collected for chemical analysis. The objective of locating below grade structures was generally successful; however, the exact location of GH-2 holder wall was not defined. The encountering of fill within the area of GH-2 and not encountering a slab, indicates that GH-2 was likely a below grade holder instead of a former aboveground structure. Although heavily impacted material and NAPL were identified in both TP-501 and TP-503, due to the relatively shallow depths they are not likely the pathways contributing to DNAPL in the two abandoned off-site wells.

4.2 Soil Boring And Sampling

As noted previously, several phases of soil sampling have been completed at the site since initial investigation activities were initiated by AmerenIP in 1986. Summary details relative to these previous activities were presented in Section 2. This section presents details relative to CSI field activities completed during July 2004. Fourteen onsite and eleven offsite soil boring locations were originally proposed in the Comprehensive Site Investigation Work Plan (CSIWP). Based on data obtained during test trenching and while advancing probeholes, twenty-seven probeholes were completed (Figure 4-2).

A modification was made to the CSIWP and soil sampling was completed using a GeoProbe system instead of with a drill rig. The site engineer/geologist logged each sample and recorded information on field logging forms. Soil type, recovery, observations relative to odors and impacts were to be recorded. Soil samples were classified in accordance with ASTM Standard D2488-90 (Standard Practice for Description and Identification of soils (Visual-Manual Procedure)). Each sample was field screened for organic vapor concentrations using a PID and the results recorded in the field logs. A 4-foot long, 1 ½-inch diameter MacroCore™ sampler was advanced using direct-push methods. All probe locations were continuously sampled and samples were recovered in disposable acetate liners. Based on observations made during previous site activities, probeholes were driven to a depth of at least 24 feet with the final termination depth determined in the field by the site geologist. Rationale for termination was based on lack of visual or olfactory impacted material. The maximum depth sampled was 32 feet.

Upon retrieval of the sample the acetate liner was opened and all recovered sample material was scanned for the presence of VOCs using a PID. Representative material was collected from each one-foot interval for determination of volatiles using head-space analysis. These data were logged on the geologic drilling logs and were used in the field to aid in selection of intervals to be sampled for laboratory chemical analysis.

Recovered soil samples were described and logged by the site geologist immediately upon opening the acetate liner. Descriptions included sample recovery; sample interval; stratum thickness; depth of lithology change; color; approximate grain size; indications of contamination; macro-features and physical characteristics; and soil classification according to the Unified Soil Classification System (ASTM D 2487 and D 2488). "Record Of Subsurface Exploration" logs were completed for each probe location and are presented in Appendix I.

Soil sampling rationale was to collect a minimum of three samples from each probehole location; one sample from ground surface to three-foot of depth, one sample between three feet and ten feet of depth, and one sample below ten feet. Additional samples were to be collected based on head-space PID results and visual observations by the field geologist. In general, at least four samples were collected from each location and five or six samples were collected from several locations. Details relative to the analytical program are presented in a subsequent section of this chapter. Table 4-1 presents a summary of soil properties based on observations and soil sampling and Figure 4-2 shows probehole locations with respect to historic MGP structures. Table 4-2 presents a summary of soil parameters analyzed. The following paragraphs provide brief descriptions of observations made for each sample location.

B-501: Probehole B-501 was completed on July 13, 2004 to a total depth of 24 feet bgs at a location on the west side of the property adjacent to the Hill Street gate. Four soil samples were collected for chemical analysis. Two impacted zones were observed; one between 8 and 10 feet bgs, and a second between 14 and 15 feet bgs. Analytical samples were collected from both impacted zones. Based on field measurements, the interval with the highest PID level was 14 to 15 feet bgs. Soils below 16 feet bgs did not appear to be impacted.

B-502: Probehole B-502 was completed on July 13, 2004 to a total depth of 24 feet bgs at a location approximately 75 feet north of B-501. Four soil samples were collected for chemical analysis. Impacts were observed from a depth of 5 to 12 feet bgs and two analytical samples were collected from that zone. Based on field measurements, the interval with the highest PID level was 11 to 12 feet bgs. Soils below 13 feet bgs did not appear to be impacted.

B-503: Probehole B-503 was completed on July 13, 2004 to a total depth of 28 feet bgs at a location near the north fence line west of 5th Street and approximately 20 to 25 feet from the former tar wells that were excavated during the IRM activities. Five soil samples, including one duplicate, were collected for chemical analysis. Two general zones of impacts were observed; one between 6 and 10 feet bgs, and a second between 12 and 15 feet bgs. Based on field measurements, the interval with the highest PID level was 10 to 11 feet bgs. Soils below 15 feet bgs did not appear to be impacted.

B-504: Probehole B-504 was completed on July 13, 2004 to a total depth of 28 feet bgs at a location north of gas holder GH-2 near the north fence line. This location is between holder tank GH-1 and UMW-101 where tar-like

DNAPL was identified in 1997. Six soil samples, including a duplicate, were collected for chemical analysis. Impacts were observed from about one foot bgs to a depth greater than 20 feet bgs. Based on field measurements, the interval with the highest PID level was 20 to 21 feet bgs. Soils below 24 feet bgs did not appear to be impacted.

B-505: Probehole B-505 was completed on July 14, 2004 to a total depth of 28 feet bgs at a location within the footprint of gas holder GH-2. Five soil samples were collected for chemical analysis. Impacts were generally observed from 3 feet bgs to through 21 feet bgs. Based on field measurements, the interval with the highest PID level was 5 to 6 feet bgs. Soils below 21 feet bgs did not appear to be impacted. No solid bottom was encountered for gas holder GH-2.

B-506: Probehole B-506 was completed on July 22, 2004 to a total depth of 28 feet bgs at a location near the central area of the site in the vacated Hill Street right-of-way. Four soil samples were collected for chemical analysis. Several zones of impacts were observed from 3 feet bgs to 17 feet bgs. Based on field measurements, the interval with the highest PID level was 16 to 17 feet bgs. Soils below 18 feet bgs did not appear to be impacted.

B-507: Probehole B-507 was completed on July 21, 2004 to a total depth of 28 feet bgs at a location approximately 50 feet northeast of B-506. Four soil samples were collected for chemical analysis. Although impacts were observed from 3 feet bgs to 17 feet bgs, two significant zones of impact were noted; one between 5 feet bgs and 8 feet bgs, and a second from 12 feet bgs to 18 feet bgs. Based on field measurements, the interval with the highest PID level was 12 to 18 feet bgs. Soils below 18 feet bgs did not appear to be impacted.

B-508: Probehole B-508 was completed on July 19, 2004 to a total depth of 28 feet bgs at a location near the northeast corner of the site. Four soil samples were collected for chemical analysis. Slight to moderate impacts were noted from 4 feet bgs through 5 feet bgs and heavier impacts were observed at the 11 to 12 foot depth. Based on field measurements, the interval with the highest PID level was 10 to 11 feet bgs. Soils below 12 feet bgs did not appear to be impacted.

B-509: Probehole B-509 was completed on July 21, 2004 to a total depth of 28 feet bgs at a location within the Hill Street right-of-way approximately 65 feet east of the Sixth Street gate. Five soil samples, including one duplicate, were collected for chemical analysis. Impacts were noted at 7 and 9 feet bgs. Based on field measurements, the interval with the highest PID level was 17 to 18 feet bgs. Light staining was observed at that depth, although PID readings below 10 feet bgs were minor.

B-510: Probehole B-510 was completed on July 12, 2004 to a total depth of 28 feet bgs at a location approximately 60 feet from the southeast corner of the site. Four soil samples were collected for chemical analysis. No visible evidence of impacts was observed at this sampling location. All PID readings from this location were minor with the highest reading recorded at 1 to 2 feet bgs.

B-511: Probehole B-511 was completed on July 12, 2004 to a total depth of approximately 3 feet bgs at a location near the center of gas holder GH-3. This probehole confirmed the depth from ground surface to the foundation slab for gas holder GH-3. No soil samples were collected.

B-512: Probehole B-512 was completed on July 12, 2004 to a total depth of 24 feet bgs at a location near the south fence line east of the former fuel tanks. Four soil samples were collected for chemical analysis. Impacts were noted near the surface and in the 6 to 8 foot bgs interval. Based on field measurements, the interval with the highest PID level was 7 to 8 feet bgs. Soils below 9 feet bgs did not appear to be impacted.

B-513: Probehole B-513 was completed on July 12, 2004 to a total depth of 24 feet bgs at a location near the southwest corner of the site. Five soil samples, including one duplicate, were collected for chemical analysis. Hydrocarbon impacts were observed in the 6 to 9 foot bgs interval. Based on field measurements, the interval with the highest PID level was 7 to 8 feet bgs. Soils below 10 feet bgs did not appear to be impacted.

B-514: Probehole B-514 was completed on July 22, 2004 to a total depth of 28 feet bgs within the Hill Street right-of-way approximately 15 feet north of the Booster House. Five soil samples, including one duplicate, were collected for chemical analysis. Several impacted zones were observed between depths of 3 and 16 feet. Heavily impacted zones were noted between depths of 10 and 16 feet. Based on field measurements, the interval with the highest PID level was 16 to 17 feet bgs. Soils below 20 feet bgs did not appear to be impacted.

B-515: Probehole B-515 was completed on July 16, 2004 to a total depth of 32 feet bgs at a location within the footprint of gas holder GH-2. Four soil samples were collected for chemical analysis. Impacts were noted throughout most of the probehole. Based on field measurements, the interval with the highest PID level was 18 to 19 feet bgs. Soil below 24 feet bgs did not appear to be impacted.

B-516: Probehole B-516 was completed on July 22, 2004 to a total depth of 24 feet bgs at a location approximately 75 feet south of B-506. Five soil samples, including one duplicate, were collected for chemical analysis. Impacts were observed at several depths from 3 to 14 feet bgs. Based on field measurements, the interval with the highest PID level was 5 to 6 feet bgs. Soils below 14 feet did not appear to be impacted.

B-550: Probehole B-550 was completed on July 20, 2004 to a total depth of 28 feet bgs at a location approximately 60 feet north of B-503 in the right-of-way north of the site. Five soil samples were collected for chemical analysis. Impacts were observed at several zones between 2 feet and 17 feet bgs. Based on field measurements, the interval with the highest PID level was 11 to 12 feet bgs. Soils below 18 feet did not appear to be impacted.

B-551: Probehole B-551 was completed on July 15, 2004 to a total depth of 28 feet bgs at a location in the north right-of-way approximately 50 feet east of B-550. Four soil samples were collected for chemical analysis. Impacts were observed between 8 and 12 feet bgs. Based on field measurements, the interval with the highest PID level was 11 to 12 feet bgs. Soils below 12 feet bgs did not appear to be impacted.

B-553: Probehole B-553 was completed on July 14, 2004 to a total depth of 32 feet bgs at a location in the north right-of-way approximately 65 to 70 feet north of gas holder GH-2. Six soil samples, including one duplicate, were collected for chemical analysis. Impacts were noted from between 2 feet and 28 feet bgs. Based on field measurements, the interval with the highest PID level was 23 to 24 feet bgs. Soils below 28 feet bgs did not appear to be impacted.

B-554: Probehole B-554 was completed on July 15, 2004 to a total depth of 32 feet bgs at a location in the north right-of-way approximately 60 feet east of B-553. Five soil samples, including one duplicate, were collected for chemical analysis. Three zones of impacted soils were observed from between 3 feet to 26 feet bgs. Based on field measurements, the interval with the highest PID level was 17 to 18 feet bgs. Soils below 26 feet bgs did not appear to be impacted.

B-556: Probehole B-556 was completed on July 20, 2004 to a total depth of 28 feet bgs at a location along the north edge of the AmerenIP property boundary, approximately 50 feet southeast of B-554. Five soil samples, including one duplicate, were collected for chemical analysis. Several zones of impacts were observed from between 3 feet and 20 feet bgs. Based on field measurements, the interval with the highest PID level was 19 to 20 feet bgs. Soils below 20 feet bgs did not appear to be impacted.

B-557: Probehole B-557 was completed on July 20, 2004 to a total depth of 24 feet bgs at a location in the north right-of-way near the northeast corner of the site. Four soil samples were collected for chemical analysis. Minor impacts were observed from between 6 feet and 13 feet bgs. Based on field measurements, the interval with the highest PID level was 11 to 12 feet bgs. Soils below 13 feet bgs did not appear to be impacted.

B-558: Probehole B-558 was completed on July 19, 2004 to a total depth of 28 feet bgs at a location in the vacated Sixth Street right-of-way approximately 50 feet east of the northeast corner of the site. Five soil samples were collected for chemical analysis. Minor impacts were observed from between 5 feet and 18 feet bgs. Based on field measurements, there were significantly elevated PID levels at this location. Soils below 18 feet bgs did not appear to be impacted.

B-559: Probehole B-559 was completed on July 19, 2004 to a total depth of 28 feet bgs at a location near the south end of the vacated Sixth Street right-of-way. Five soil samples, including one duplicate, were collected for chemical analysis. No impacts were observed at this location and no elevated PID levels were recorded.

B-560: Probehole B-560 was completed on July 15, 2004 to a total depth of 28 feet bgs at a location approximately 50 feet north of B-559 in the vacated Sixth Street right-of-way. Six soil samples, including one duplicate, were collected for chemical analysis. Some residual impacts were observed within a sand unit in the 11 to 13 foot bgs interval. Based on field measurements, the interval with the highest PID level was 12 to 13 feet bgs. Soils below 13 feet bgs did not appear to be impacted.

B-561: Probehole B-561 was completed on July 15, 2004 to a total depth of 32 feet bgs north of the site at a location within the railroad right-of-way. Six soil samples, including one duplicate, were collected for chemical analysis. This probehole location is adjacent to the former location of monitoring well UMW-101 (screened between 14 and 26.5 feet) where tar-like DNAPL was observed in 1997. Residual impacts were observed from depths of 7 to 16 feet bgs. Based on field measurements, the interval with the highest PID level was 12 to 13 feet bgs. Soils below 16 feet bgs did not appear to be impacted.

B-562: Probehole B-562 was completed on July 15, 2004 to a total depth of 32 feet bgs at a location in the railroad right-of-way north of the tracks approximately 35 feet east and south of B-561. Four soil samples were collected for chemical analysis. Residual impacts were observed from 8 to 16 feet bgs, although recovery of soil material from this interval was poor. Based on field measurements, the interval with the highest PID level was 13 to 14 feet bgs. Soils below 16 feet bgs did not appear to be impacted.

Summary: Twenty-seven probeholes were completed (Figure 4-2) to depths ranging from twenty four to thirty two feet. One probehole (B-511) was completed to a depth of only three feet to verify the presence of GH-3 holder foundation slab. Three probeholes (B-558 through B-560) were completed within the vacated Sixth Street right-of-way and seven probeholes (B-550 through B-557 and B-561 & B-562) were completed within the railroad right-of-way. The remaining seventeen probeholes (B-501 through B-516, and B-556) were completed on the AmerenIP owned parcel. At least four soil samples were collected from each probehole with the exception of B-511. No samples were collected at that location. Evidence of environmental impacts was noted at all probehole locations with the exception of B-510 and B-559. Observed impacts tended to be both greater and deeper in the northern portion of the site, including the railroad right-of-way north of the site.

4.3 Groundwater Sampling

As discussed in Section 2.10.3.6, groundwater monitoring wells were installed during site investigation activities completed in 1990 and 1991. Section 3.5 presents a summary of groundwater activities planned for the CSI, which was completed in 2004. The following paragraphs provide a brief summary of groundwater related activities completed at the site. Since 1990, a total of 19 wells have been installed on and adjacent to the site. During the intervening period, five of those wells have been abandoned. Figure 4-3 shows the location of the sixteen wells currently included in the groundwater monitoring program.

The first groundwater samples were collected during the Phase IIA and IIB investigations (1990 and 1991). These samples were collected from the 16 shallow (UMW-101 through UMW-116) and three deep monitoring wells (UMW-401 through UMW-403). Subsequent rounds or partial rounds of groundwater sampling were performed in January 1993, during 1996 and 1999.

Based on groundwater analytical results and site observations, five of the original 19 wells were abandoned in August 1999. Two wells (UMW-101 and UMW-103) were abandoned as a result of DNAPL accumulations within the wells. It was believed that representative samples of groundwater could not be obtained from these wells. The three deep wells (UMW-401, UMW-402, and UMW-403) were abandoned to eliminate potential pathways for contamination from the shallow soil horizons. Analytical results for samples from these wells prior to August 1999 indicated no impacts from MGP residuals. Abandonment of these five wells was approved by IEPA.

Since 1999, monitoring wells have been sampled on a quarterly basis and analyzed for select MGP constituents (primarily BTEX constituents and naphthalene). Table 2-10 presents a summary of groundwater sample results from all monitoring events.

4.4 CSI Laboratory Analytical Program

The proposed CSI analytical program has been presented in Section 3.7 along with sample handling procedures and sampling rationale. Analytical methods are also presented in Section 3.7 and all analyses were consistent with the work plan. One hundred eleven soil samples and eleven duplicate samples were collected for laboratory chemical analysis from the CSI probeholes advanced in 2004. Six soil samples were collected for laboratory analysis from CSI test pit excavations. Table 4-2 presents a summary of analyses completed for these samples. Fourteen groundwater samples were collected from both on-site and off-site monitoring wells. Figure 4-4 presents a composite of all CSI sampling locations. In addition samples of investigation derived waste material, both liquid and solid, were collected and analyzed for disposal characteristics. All laboratory analyses were completed by TekLab. Results of laboratory analyses are discussed in detail in Section 5 of this report.

Samples were protected from breakage and shipped in coolers. Coolers were transported and delivered to the lab by PSC field staff. Ice was used to maintain a temperature of 4 degrees C. All soil and water samples were delivered to Teklab. The laboratory provided a data quality objective (DQO) level III data package upon completion of analysis.

4.5 Management of Investigation Waste

All equipment and materials used in drilling, sampling, and monitoring well construction were decontaminated prior to use at the site. In addition, all sampling equipment was decontaminated between samples and all drilling and geoprobe equipment decontaminated between boreholes.

All equipment and material coming into contact with potentially impacted material or the sample medium was decontaminated before, between, and after usage or properly discarded after becoming contaminated. Equipment was washed using a laboratory- grade detergent followed by clean-water and distilled-water rinses.

The following materials generated during CSI activities were containerized and stored on site:

- Test pits – impacted soils that could not be replaced into test trenches were deposited in roll-off boxes;
- Geoprobe – soils materials not used for analytical samples were placed in roll-off boxes;
- Well development – water generated from re-development of monitoring wells was contained in 55-gallon drums;
- Well purging – purge water from groundwater sampling was contained in 55-gallon drums;
- Decontamination fluids – water and other fluids from equipment decontamination was contained in 55-gallon drums; and

- Disposable protective clothing and equipment – was contained in roll-off boxes.

The drilling- and sampling-generated soil, spoils, fluids, and groundwater were separated as liquid or solids. All containers were clearly marked with indelible marker or paint. Each container was labeled with the type of waste contained, the location generated (when applicable), and the date sealed. Upon completion of CSI field activities all containers, liquids and solids were sampled and analyzed for disposal parameters. Materials were subsequently disposed of at approved off-site facilities.

4.6 CSI Quality Assurance Activities

During CSI field activities certain records were maintained in logbooks and/or on field forms for sampling events and daily activities during the investigations. The following sections describe the major documentation and record keeping activities.

Each sample collected for chemical analysis was assigned a specific identifier based upon the sample location designation. The specific designation for groundwater and soil samples was based upon the monitoring well, test trench, or borehole number.

Each sample submitted for chemical analysis was properly sealed immediately after collection. All sample containers were labeled to prevent misidentification of samples. The label included at a minimum the following information:

- name of collector;
- date and time of collection;
- location;
- sample number; and
- requested analyses.

All groundwater characterization samples were placed on ice immediately following field collection. The intent was to lower the fluid temperature near to (but above) freezing as soon as possible to decrease the rate and minimize the amount of physicochemical change of the sample before submittal to the analytical laboratory. All containers in a groundwater sample set were additionally identified to indicate each as a part of a specific set.

All information pertinent to a field survey or sampling event was recorded in a field logbook (or series of logbooks). The field logbook is a bound book with consecutively numbered pages. Field logbooks were completed in a thorough manner so that later modifications or additions were not necessary. These logbooks became a part of the permanent file for the investigation.

Entries in the field logbooks detailed three basic categories of information:

- site activities log – site visits, site reconnaissance (specific purpose), daily activities, documentation of procedures, and environmental monitoring data;
- photo and survey data log – photo descriptions and survey data (well locations and elevations); and
- sampling data log – pre-sampling well development/evacuation data (applies to sampling monitoring wells) and sampling data.

Site activity entries were completed on a daily basis to record all relevant site investigation information. The photo/survey log and sampling log were completed on an "as performed" basis.

The field logbook was kept throughout the field sampling operations to document relevant information concerning sample generation, preparation, and field data. All well development/flushing data, sampling activities, and measurement data, were recorded on specified forms (provided weather conditions were dry) and filed in a three-ring binder. When rainy conditions occurred, information was recorded in the field logbook and then transferred at a later time. Specific forms and documentation requirements were contained in the QAPP.

5 CHEMICAL ANALYTICAL RESULTS

Chemical analyses were performed on soil and groundwater samples obtained during CSI activities completed during 2004. Samples were delivered to and analyzed by TekLab. Analytical parameters included VOCs, SVOCs, BTEX, PAHs, cyanide, RCRA metals, and TPH. Analyses specific to each sample are discussed in subsequent sections. Samples of both liquid and solid investigation derived wastes were also collected and analyzed for disposal characteristics. In addition, soil and groundwater samples and samples of other media (i.e. sediment, air, etc.) have been sampled and analyzed during earlier investigation phases completed since 1990.

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record was filled out and accompanied every sample. Copies of all chain-of-custody records are included in Appendix K. The chain-of-custody contains at a minimum the following information:

- sample number(s);
- signature of sampler(s);
- date and time of collection;
- sample location;
- analyses to be performed;
- preservative;
- signatures of persons involved in the chain of possession;
- inclusive dates of possession; and
- shipping destination, carrier, and shipping bill number.

All samples were transported to the laboratory for chemical analysis and were accompanied by the chain-of-custody record and by sample analysis request sheets. All samples were delivered to the person in the laboratory authorized to receive samples (often referred to as the sample custodian).

The sample containers were placed on sufficient ice inside plastic ice chests with the intent to maintain temperature of the samples equal to or less than 4°C upon receipt by the laboratory. The remaining volume inside the ice chest was filled with packing material of sufficient quantity to absorb all sample material that might leak. The ice chests were taped closed using a chain-of-custody seal. The temperature of the samples was checked by the laboratory upon arrival.

5.1 Analytical Program Summary

The CSI analytical program was developed with several objectives in mind. The primary objective was to provide sufficient analytical data to delineate environmental impacts and to facilitate comparison with Tier 1 ROs. Tier 1 ROs are presented in Tables 5-1 through 5-4. Since the site was known to be significantly impacted by MGP residuals, a secondary objective to the comparison to Tier 1 ROs was to provide sufficient data to allow subsequent development of remedial objectives possibly proceeding through completion of Tier 3 evaluations. A second objective was to analyze a sufficient number of samples for IAC Section 740 Appendix A (Table A (VOC) and Table B (SVOC)) constituents to allow a Comprehensive evaluation of environmental impacts.

Table 4-2 presents a summary of the CSI soil analytical program. The following is a summary of analyses completed for soil samples during the CSI:

- BTEX (SW 846, Method 8260) – 100 analyses
- PAHs (SW 846, Method 8270) – 99 analyses
- VOCs (SW 846, Method 8260) – 29 analyses
- SVOCs (SW 846, Method 8270) – 29 analyses
- TPH (SW 846, Method 8015) – 33 analyses
- Cyanide (SW 846, Method 9012) – 29 analyses
- RCRA Metals (SW 846, 6000 & 7000 Series) – 51 analyses

Due to the significant quantity of data collected from the site since 1990, and based on the subsequent objective of evaluation in accordance with TACO guidance, the CSI soil sample analytical data are divided into three general groups. These groups include surface soils (0 to 3 ft. bgs), shallow subsurface (3 to 10 ft. bgs), and deep subsurface (greater than 10 ft. bgs). The following subsections present a discussion of analytical results based on these depth intervals.

5.2 Surface Soil Results

Surface soil samples are defined as soils collected from the ground surface to a depth of three feet bgs. Twenty-eight samples, not including three duplicates, were collected from twenty-six (26) probeholes and two test pits. Twenty samples were analyzed for BTEX, PAHs, RCRA metals and cyanide. Five (5) samples were analyzed for VOCs, SVOCs, RCRA metals and cyanide. Samples from two test pits were analyzed for BTEX, PAHs and TPH. In addition, two probehole samples were analyzed for TPH.

5.2.1 BTEX And PAH Results

Table 5-5 presents a summary of BTEX and PAH results for all surface soil samples collected during CSI activities, including samples analyzed for VOC and SVOC constituents. Laboratory analytical data sheets for all soil samples are presented in Appendix L.

Some BTEX parameters were reported above detection limits in all 28 surface soil samples, including six samples analyzed for VOCs. Benzene was reported in all samples and ranged from 0.7 ug/kg (B-559-3) to 14,500 ug/kg (TP-503). Ethylbenzene was reported above detection limits for twenty-five samples and ranged from 1.1 ug/kg (B-507-1) to 45,600 ug/kg (TP-503). Toluene was reported in twenty-six samples ranging from 3.0 ug/kg (B-515-2) to 6,280 ug/kg (B-503-3). Total xylene was reported in twenty-seven samples ranging from 1.8 ug/kg (B-513-2) to 91,700 ug/kg (TP-504).

PAHs were reported above detection limits for all twenty-eight surface soil samples (Table 5-5), including six samples analyzed for SVOCs. All sixteen PAHs were reported above detection limits for sixteen of the twenty-eight surface soil samples and four samples had fifteen PAHs reported above detection limits. Many of the samples for which PAHs were below detection limits were the result of laboratory dilution. It is noted that for many of the PAH constituents that are reported below detection limits that the detection limits are significantly above the IEPA established background levels. In general PAH levels were reported from the 100 ug/kg range up to 100,000 ug/kg.

5.2.2 VOC And SVOC Results

Full VOC and SVOC analyses were completed for six surface soil samples. In addition, duplicates were analyzed for two of these samples. These results are presented in Table 5-6 (VOCs) and Table 5-7 (SVOCs). BTEX and PAH constituents are discussed in Section 5.2.1 and are not included in these tables. Laboratory analytical data sheets are presented in Appendix L.

Five VOC constituents were reported above detection limits for five of the six surface soil samples analyzed. These five constituents include Acetone (4 samples), Carbon disulfide (2 samples), Methyl ethyl ketone (2 samples), Methylene chloride (2 samples), and Styrene (1 sample). Except for PAHs, SVOC constituents were not reported above detection limits for any of the six samples analyzed.

5.2.3 Metals and Cyanide Results

Table 5-8 presents results for metals and cyanide analyses for surface soil samples. All twenty-six surface soil samples were analyzed for both RCRA metals and cyanide. Laboratory analytical data sheets are presented in Appendix L.

Seven constituents were reported above detection limits for all the surface soil samples analyzed. These seven constituents include arsenic (25 samples), barium (26 samples), cadmium (25 samples), chromium (26 samples), cyanide (26 samples), lead (26 samples), and mercury (26 samples).

5.3 Shallow Subsurface Soil Results

Shallow subsurface soil samples are defined as soils collected from three feet bgs to a depth of ten feet bgs. Thirty samples, not including four duplicates, were collected from twenty-six probeholes and four test pits. Twenty-four samples were analyzed for BTEX and PAH constituents. Six samples were analyzed for all VOC and SVOC constituents. Four test pit samples were analyzed for TPH parameters in addition to BTEX and PAH constituents. Six samples were analyzed for RCRA metals. In addition to four test pit samples, five probehole samples were also analyzed for TPH parameters.

5.3.1 BTEX And PAH Results

Table 5-9 presents a summary of BTEX and PAH results for all shallow subsurface soil samples collected during CSI activities. Laboratory analytical data sheets for all shallow subsurface soil samples are presented in Appendix L.

Some BTEX parameters were reported above detection limits in twenty-nine of the thirty shallow subsurface soil samples, including those samples analyzed for VOCs. Benzene was reported above detection limits in twenty-seven samples and ranged from 4.3 ug/kg (B-510-5) to 20,800 ug/kg (B-504-7). Ethylbenzene was reported above detection limits for twenty-seven samples and ranged from 1.9 ug/kg (B-560-5) to 145,000 ug/kg (B-504-7). Toluene was reported in twenty-four samples ranging from 1.4 ug/kg (B-509-8) to 10,900 ug/kg (B-504-7). Total xylene was reported in twenty-nine samples ranging from 1.3 ug/kg (B-510-5) to 140,000 ug/kg (B-504-7).

PAHs were reported above detection limits for twenty-nine of thirty shallow subsurface soil samples (Table 5-9), including those samples analyzed for SVOCs. All sixteen (16) PAHs were reported above detection limits for eighteen of the thirty samples and six samples had fifteen PAHs reported above detection limits. In general PAH levels for individual constituents were reported from the 100+ ug/kg range to greater than 100,000+ ug/kg.

5.3.2 VOC And SVOC Results

Full VOC and SVOC analyses were completed for five shallow subsurface soil samples. In addition, duplicates were analyzed for three of these samples. These results are presented in Table 5-10 (VOCs) and Table 5-11 (SVOCs). BTEX and PAH constituents for shallow subsurface samples are discussed in Section 5.3.1 and are not included in these tables. Laboratory analytical data sheets are presented in Appendix L.

Three VOC constituents were reported above detection limits (Table 5-10). Acetone was reported in three of the five samples and methyl ethyl ketone and methylene chloride were reported in one sample each. Detection limits are relatively high for some of the samples, indicating several dilutions of the samples were required by the laboratory.

Three SVOC constituents were reported above detection limits (Table 5-11). Dibenzofuran was reported in four samples, 2-methylnaphthalene was reported in three samples, and bis(2-ethylhexyl)phthalate was reported in one sample. As noted above, detection limits for some samples indicate laboratory dilutions were required.

5.3.3 Metals Results

Table 5-12 presents results of analyses for metals for shallow subsurface soil samples. Five (5) shallow subsurface soil samples were analyzed for RCRA metals. Laboratory analytical data sheets are presented in Appendix L.

Six constituents were reported above the detection limits for all the shallow subsurface soil samples. These six constituents include arsenic (four samples), barium (five samples), cadmium (four samples), chromium (five samples), lead (five samples), and mercury (five samples).

5.4 Deep Subsurface Soil Results

Deep subsurface soil samples are defined as soils collected from a depth of greater than ten feet bgs. Fifty-nine deep subsurface soil samples, not including four duplicates, were collected from twenty-six probeholes. Forty-nine samples were analyzed for BTEX and PAH constituents. Ten samples, plus two duplicates were analyzed for VOC and SVOC constituents. Eleven samples, plus two duplicates were analyzed for RCRA metals. Eighteen probehole samples were analyzed for TPH parameters.

5.4.1 BTEX And PAH Results

Table 5-13 presents a summary of BTEX and PAH results for all deep subsurface soil samples collected during CSI activities. Table 5-13 includes BTEX and PAH constituents for those CSI soil samples analyzed for VOC and SVOC constituents in addition to samples analyzed only for BTEX and PAHs. Laboratory analytical data sheets for all soil samples are presented in Appendix L.

Some BTEX parameters were reported above detection limits in all fifty-nine of the deep subsurface soil samples, including those samples analyzed for full VOCs. Benzene was reported above detection limits for all fifty-nine samples and ranged from 0.7 ug/kg (B-509-28 and B-516-24) to 659,000 ug/kg (B-507-19). Ethylbenzene was reported above detection limits for forty-five samples and ranged from 0.8 ug/kg (B-559-19) to 797,000 ug/kg (B-514-17). Toluene was reported in fifty-eight samples ranging from 1.0 ug/kg (B-513-24) to 1,540,000 ug/kg (B-507-19). Total xylene was reported in fifty-seven samples ranging from 1.0 ug/kg (B-510-12 and B-513-24) to 1,300,000 ug/kg (B-507-19).

PAHs were reported above detection limits for forty-seven of the fifty-eight deep subsurface soil samples (Table 5-13), including those samples analyzed for SVOCs. All sixteen PAHs were reported above detection limits for fifteen of the fifty-eight samples and an additional seven samples had fifteen PAHs reported above detection limits. Some of the samples for which PAHs were not reported above detection limits were the result laboratory dilution.

5.4.2 VOC and SVOC Results

Full VOC and SVOC analyses were completed for ten deep subsurface soil samples. In addition, duplicates were analyzed for two of these samples. These results are presented in Table 5-14 (VOCs) and Table 5-15 (SVOCs). BTEX and PAH constituents for deep subsurface samples are discussed in Section 5.4.1 and are not included in these tables. Laboratory analytical data sheets are presented in Appendix L.

Three VOC constituents were reported above detection limits (Table 5-14). Acetone was reported in eight of the ten samples. Methylene chloride were reported in five samples and styrene was reported in one sample. Detection limits are high for three of the samples, indicating several laboratory dilutions were required.

Three SVOC constituents were reported above detection limits (Table 5-15). Dibenzofuran, 2-methylnaphthalene, and bis(2-ethylhexyl)phthalate were reported in three samples. As noted above, detection limits for some samples indicate laboratory dilutions were required.

5.4.3 Metals Results

Table 5-16 presents results of analyses for metals for deep subsurface soil samples. Eleven (11) deep subsurface soil samples were analyzed for RCRA metals. Laboratory analytical datasheets are presented in Appendix L.

Six constituents were reported above detection limits. These constituents include arsenic (nine samples), barium (11 samples), cadmium (four samples), chromium (11 samples), lead (11 samples), and mercury (ten samples).

5.5 Total Petroleum Hydrocarbons

Thirty-two soil samples collected from twenty-six probeholes and six test pits were analyzed for TPH. Four analyses were completed for surface soil samples and ten were completed for shallow subsoil samples. Eighteen deep subsurface soil samples were analyzed. Table 5-17 presents the TPH results and laboratory analytical data sheets are included in Appendix L.

5.5.1 Surface Soil Results

Surface soil samples are defined as soils collected from the ground surface to a depth of three feet bgs. The TPH parameters diesel fuel and motor oil were identified above detection limits in all four of the surface soil samples. Diesel range parameters ranged from 50.9 mg/kg (B-510-2) to 21,300 mg/kg (TP-503-3) and motor oil parameters ranged from 97.9 mg/kg (B-510-2) to 13,200 mg/kg (B-504-3). Kerosene and mineral spirit parameters were below detection limits for all four surface soil samples. The total TPH values for surface soil samples ranged from 148.8, g/kg (B-510-2) to 24,730 mg/kg (TP-503-3).

5.5.2 Shallow Subsurface Soil Results

Shallow subsurface soils are defined as soils collected from three feet bgs to a depth of ten feet bgs. The TPH parameters diesel fuel and motor oil were identified above detection limits in all ten of the shallow subsurface soil samples. Diesel range parameters were identified above detection limits in all ten samples and ranged from 699 mg/kg (B-551-10) to 25,600 mg/kg (B-505-6). Motor oil parameters were identified above detection limits in seven samples and ranged from 75.0 mg/kg (B-512-8) to 5,510 mg/kg (B-505-6). Kerosene and mineral spirit parameters were below detection limits for all ten shallow subsurface soil samples. The total TPH values for shallow subsurface soil samples ranged from 838 mg/kg (B-551-10) to 31,110 mg/kg (B-505-6).

5.5.3 Deep Subsurface Soil Results

Deep subsurface soil samples are defined as soils collected from a depth of greater than ten feet bgs. The TPH parameters diesel fuel, kerosene, and motor oil were identified above detection limits in seventeen of the eighteen deep subsurface soil samples. Diesel range parameters were identified in sixteen samples and ranged from 222mg/kg (B-503-11) to 45,900 mg/kg (B-514-17). Kerosene range parameters were identified above detection limits for one sample (8.58 mg/kg at B-509-18). Mineral spirit range parameters were not identified above detection limits for any samples. Motor oil parameters were identified above detection limits in eight samples and ranged from 87 mg/kg (B-503-11) to 14,800 mg/kg (B-514-17). The total TPH values for the deep subsurface soil samples ranged from 8.58 mg/kg (B-509-18) to 60,700 mg/kg (B-514-17).

5.6 Groundwater Results

Fourteen groundwater monitoring wells were sampled on July 26, 2004. Samples were analyzed for BTEX constituents in accordance with SW-846 Method 8260B and for PAH constituents in accordance with SW-846 Method 8310. Analytical results are presented in Table 2-8, 2-9, and 2-10. Laboratory analytical data sheets are presented in Appendix M.

BTEX constituents were identified above detection limits in five samples. Benzene was detected in five samples, ranging from 5.7 ug/L (UMW-113) to

760 ug/L (UMW-107). Toluene was identified above detection limits in only two samples; 2.3 ug/L (UMW-110) and 120 ug/L (UMW-114). Ethylbenzene was identified above detection limits in four samples ranging from 1.0 ug/L (UMW-113) to 868 ug/L (UMW-114). Total Xylenes were identified above detection limits in four samples and range from 4.8 ug/L (UMW-113) to 425 ug/L (UMW-114).

PAH constituents were identified above detection limits in five samples. Only two samples had more than three constituents identified above detection limits. Acenaphthene was identified in four samples and ranged from 13.5 ug/L (UMW-115) to 214 ug/L (UMW-114). Acenaphthylene was also identified in four samples and ranged from 26.4 ug/L (UMW-115) to 552 ug/L (UMW-114). Anthracene was identified above detection limits in two samples; 1.04 ug/L (UMW-114) and 15.1 ug/L (UMW-110).

Benzo(a)anthracene was identified in only one sample; 0.33 ug/L (UMW-110). Fluoranthene was identified in two samples; 0.99 ug/L (UMW-114) and 12.2 ug/L (UMW-110). Fluorene was identified above detection limits in four samples, ranging from 2.36 ug/L (UMW-113) to 20.6 ug/L (UMW-114). Naphthalene was identified above detection limits in three samples; ranging from 24.7 ug/L (UMW-110) to 3,650 ug/L (UMW-114). Phenanthrene was identified above detection limits in two samples; 7.48 ug/L (UMW-114) and 26.7 ug/L (UMW-110). Pyrene was also identified above detection limits in two samples; 0.64 ug/L (UMW-114) and 5.25 ug/L (UMW-110).

Quarterly groundwater monitoring has also continued on eight of the fourteen groundwater monitoring wells since the July 2004 sampling event. Quarterly groundwater samples were analyzed for BTEX constituents and naphthalene in accordance with SW-846 Method 8260B and for PAH constituents in selected samples in accordance with SW-846 Method 8310. Analytical results for the quarterly results from 1990 through 2007 are also presented in Table 2-8 and 2-9, and laboratory analytical data sheets are presented in Appendix M.

BTEX constituents were identified during the 2004, 2005, and 2006 quarterly groundwater monitoring events above detection limits in five monitoring wells. Benzene and ethylbenzene were detected in two monitoring wells (UMW-107 and UMW-114) during 2004 through 2007. Xylene was detected in two of the monitoring wells (UMW-107 and UMW-114) in 2005. Xylene was detected in three of the monitoring wells (UMW-107, UMW-114, and UMW-115) in 2006.

The highest benzene concentration identified was at UMW-107 during the September 2006 sampling event with a concentration of 1280 ug/L. Benzene was also identified at UMW-114 during the September 2007 sampling event at a concentration of 1150 ug/L. The highest ethylbenzene concentration was identified during the September 2005 sampling event at UMW-114 at a concentration of 1370 ug/L.

The general trend of BTEX constituents in UMW-107 and UMW-114 shows concentrations have remained the same with a slight increase in concentrations in the past year.

5.7 QA/QC Analytical Summary

Duplicate samples were collected for both soil and groundwater samples. Complete laboratory results for all duplicate soil samples are included in Appendix L. It is noted that due to the lack of homogeneity of soil materials, duplication of analytical results is virtually impossible. Laboratory QA/QC reports for all soil analyses are presented in Appendix N.

Table 5-18 presents results for duplicate soil samples analyzed for BTEX and PAH constituents. Duplicate samples were analyzed for five soil samples representing all depth ranges. In general, correlation between the primary sample results and duplicate sample results is good. The BTEX and PAH constituents identified in most samples and the levels identified in the duplicate are consistent with levels identified in the primary sample.

Table 5-19 presents results for duplicate soil samples analyzed for VOCs. Duplicate samples were collected and analyzed for seven soil samples representing all depth ranges. Analytical results for duplicate samples are generally consistent with results for the corresponding primary samples. Six VOCs were identified in duplicate samples, including acetone, carbon disulfide, methyl ethyl ketone, methylene chloride, styrene, and trichloroethene. All of these constituents, with the exception of trichloroethene, were identified above detection limits for other primary samples analyzed for VOC constituents (Tables 5-6, 5-10, & 5-14). Trichloroethene was identified in only one sample (B-509-8D) at a level slightly above the detection limit.

Table 5-20 presents results for duplicate soil samples analyzed for SVOC constituents. Duplicate samples were collected and analyzed for seven soil samples representing all depth ranges. Analytical results for duplicate samples are consistent with results for the corresponding primary samples. Three SVOC constituents were identified above detection limits in duplicate samples, including 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, and dibenzofuran. These same constituents were identified in other primary samples analyzed for SVOC constituents (Tables 5-11 and 5-15).

Table 5-21 presents results for duplicate soil samples analyzed for RCRA metals and cyanide. Duplicate samples were analyzed for eight soil samples representing all depth ranges. Analytical results for the duplicate samples are generally consistent with primary sample results.

6 ENDANGERMENT ASSESSMENT

This section presents the results of the CSI activities in addition to applicable data from all previous investigation activities as required in IAC Section 740.425(b)(5). Results are presented within the context of the site conceptual model to provide an understanding of the extent of impacts identified at the site. Potential exposure routes are discussed, taking into consideration site conditions and features affecting chemical constituent movement within the environment (i.e. chemical transport). Table 6-1 presents the MGP constituents of concern (COC) that have been identified for the site. Analytical results are compared to the Tier 1 ROs for all potential exposure pathways.

6.1 Recognized Environmental Conditions

Historical information relative to the site indicates that gas was manufactured on the site as early as 1869 and continued through 1933 (i.e. at least 64 years). Initially production was limited to the northwest portion of the site; however, by 1915 the operation had expanded to the southern portion of the site. Gas was produced by coal carbonization, oil gasification, and carbureted water gas methods during various periods of operation. Throughout the operating period modifications and expansion resulted in various forms of MGP activity occurring over the entire site area. These historical activities resulted in construction of a significant number of below grade structures in addition to underground piping; however, the majority of the below grade structures were located on the northern portion of the site. After operations ceased in 1932 or 1933, the plant was maintained for stand-by production purposes until about 1955. Plant facilities were demolished, with the exception of the booster house, between 1955 and 1960. Although the property remained vacant, AmerenIP maintained ownership of the property until 1979 when it was sold to the American Legion. AmerenIP repurchased the property from the American Legion in 1991 after preliminary environmental investigations indicated the presence of MGP related impacts at the site.

Environmental site investigations in the early 1990s resulted in identification of some of the below grade structures and the presence of "source material" within those structures. These structures were generally located in the northwest corner of the site. In addition soil and groundwater impacts were identified both on-site and off-site and subsequently DNAPL was identified in off-site wells north and east of the site. Groundwater impacts have been monitored on a quarterly basis since 1997 and impacts have not changed significantly during that eight year period.

The IRM activities were completed during 1997 and 1998 with the primary objective of removing "source material" from identified below grade structures. The MGP residuals were removed from seven below grade structures located on the northeast portion of the site and disposed of off-site. These structures included gas holder tank GH-1, tar wells, and tar separator and valve pit. Some MGP impacted soil outside of structures was also removed and disposed of. In addition, shallow soils impacted by purifier residuals were removed from the southern portion of the site and the abandoned sewer along the Hill Street right-of-way was also plugged. In addition approximately one foot of topsoil was placed over the site to mitigate exposures at the site.

Based on observations during IRM activities and the presence of DNAPL at two locations not on the AmerenIP property, additional recognized environmental conditions were identified and the CSI activities were completed to define those conditions. Figure 6-1 illustrates approximate locations of historical MGP structures on the site and CSI results indicate that the following environmental conditions exist at the site relative to some of these structures.

6.1.1 Former Tar Wells

Three tar wells (TW1, TW2, and TW3) have been identified at the site. TW1 and TW2 had diameters of approximately 10.7 feet. The tops of both tar wells were located approximately 2 feet bgs and their bottoms were 10 feet bgs. The walls and floors were constructed of brick and mortar. TW1 was covered with a brick and concrete lid approximately 8-inches thick that was supported by rails. Above the lid was a concrete foundation 12-inches thick with metal rebar.

Tar well TW3 had a diameter of 19.3 feet wide and depth of 10 feet bgs. The walls were constructed of brick and mortar and the bottom was constructed of 6-inches of concrete. The environmental impacts from these tar wells would have been from releases through the sides and bottom. The material from these tar wells has been removed therefore these structures no longer serve as a source for continued releases.

6.1.2 Former Tar Separator

One tar separator was identified at the site. The dimensions of the separator were approximately 10 feet in diameter with separate chamber that ranged in depth of 6 to 10.5 feet bgs. The walls and base were concrete with interior wooden baffles. The upper two feet contained clean fill material with the remainder of the backfill saturated with fluid tar. The valve box was located east of the separator and was approximately 9 feet wide on each side with brick walls extending to 5 feet bgs. The separator did not have a floor other than native clay till. The valve box contained two 10-inch diameter iron pipes with 5-foot invert depths that ran east-west at the north and south ends. The valve box was covered with a concrete lid and contained clay and brick fill. The walls and floor of the separator and the wall of the valve box were left intact. Environmental impacts related to this structure could have been from releases of source material through the base of the separator, the valve box, or from piping. The contents of the separator were removed in 1997 therefore this structure no longer serves as a source for further releases.

6.1.3 Former Purifiers

Three concrete purifier pads were identified at the site. The purifier pads range in diameters from 20 to 30 feet. The purifier waste consisted mainly of wood shavings, coal, and cinders. The contents and pad structures have been removed. Releases from purifiers would primarily have been cyanide and other inorganic constituents. This would typically have occurred when the purifying material was removed from the purifiers and spread on the ground to regenerate.

6.1.4 Former Gas Holder Tank GH-1

Gas holder tank GH-1 was constructed prior to 1869 and was converted to a tar well in 1924. This below ground structure contained a significant quantity of source material and was the primary focus of the IRM removal actions in 1997. The IRM activities did not address the inlet/outlet valve pit(s) located on the west side of the holder tank. A valve structure was not located during the CSI test pit activities; however, MGP related impacts were observed. The prior release of MGP related material could have occurred through the base or sidewalls of the structure. Additionally, releases could have occurred from piping going into the structure. The contents of this structure were removed in 1997, thus mitigating further releases to the subsurface.

6.1.5 Former Gas Holder Tank GH-2

Gas holder tank GH-2 was constructed prior to 1902 and was the focus of CSI test pit and boring activity. Based on the site history and the period of operation, this gas holder tank may have been used as a relief holder during part of the operation. Evidence from the 2004 CSI appears to indicate that this former gas holder was a belowground structure. A circular brick wall believed to be the outside of this gas holder tank was observed during IRM activities. CSI activities confirmed the presence of structures, including walls, valve pit, and piping; however, a solid bottom was not encountered. It is possible that the GH-2 gas holder tank was constructed without a brick or concrete bottom due to the relatively impermeable un-weathered till below the structure and the relatively shallow static water table. CSI soil sample analytical results indicate significant levels of MGP impacts within the GH-2 gas holder tank. Environmental impacts related to this structure could be from the bottom, from valve pits, or from piping.

6.1.6 Former Gas Holder Tank GH-3

Gas holder tank GH-3 was constructed between 1909 and 1915 and historical photographs indicate that the water tank was above grade and constructed on a concrete slab. CSI activities focused on identifying the depth to the slab and locating the piping valve pits. The foundation slab and both inlet and outlet valve pits were located. The bottom of the valve pits is about 8.5 feet bgs and both pits contained some tar-like liquid. Environmental impacts related to this structure could be from the valve pits, from piping, or from surface releases.

6.1.7 Former Oil And Diesel Storage Tanks

Seven above ground oil and diesel storage tanks were located along the southwest property line from the early 1920s until plant demolition in the 1950s. In addition, other oil storage tanks on the northern portion of the property were used at various times during the operation of the MGP. Environmental impacts from these structures could be related to piping and accidental spillage and would most likely have been either surface or shallow subsurface releases. The decommissioning and removal of these structures in the late 1950s has served to eliminate any continued releases from the former aboveground tanks. The CSI analytical results confirmed the presence of some minor impacts near the southwest property fence-line.

6.1.8 North Property Line

The north AmerenIP property line from the northeast corner to the east central area of the site is identified as a recognized environmental condition due to the DNAPL identified in monitoring well UMW-101 north of the railroad right-of-way. The DNAPL location is within the boundary of what is currently defined as the remediation site. No MGP activities occurred north of the railroad tracks; however, impact appears to have migrated to that area. CSI test pit and boring activities focused on locating an environmental pathway from the site MGP operations to UMW-101. While impacts were identified in both test pits and borings, a preferential pathway was not identified.

6.1.9 East Property Line and Former Gas Experiment Station

The east property line along the vacated Hill Street right-of-way is identified as a recognized environmental condition due to the DNAPL identified in monitoring well UMW-103 located in the vacated Sixth Street right-of-way on the current eastern boundary of the AmerenIP property. Historical MGP activities did not occur in this area; however, the "Gas Experiment Station of the University of Illinois" was located near the northeast corner of the AmerenIP property and MGP impact appears to have migrated into the vacated Sixth Street right-of-way. In addition, a sixteen inch diameter gas main is known to exist within the vacated Sixth Street right-of-way. Observations made during early site investigation activities and during IRM activities concluded that the Hill Street sewer was not the migration pathway. CSI activities did not identify a preferential pathway from the AmerenIP property to the right-of way portion of the site.

6.1.10 Vacated Hill Street Right-Of-Way

Although no actual MGP operating activities occurred in the Hill Street right-of-way, gas mains were located within the right-of-way and piping between various operations was buried under the street. Due to significant impacts identified during CSI activities in borings and test pits located within the right-of-way, Hill Street is identified as a recognized environmental condition that will need to be addressed. Impacts observed within the right-of-way could be from piping, incidental spillage, or migration from other MGP structures and operations.

6.2 Nature and Extent Of Impact

This section provides a discussion of the nature and extent of environmental impacts to the site media. IAC Section 740(b)(5)(C) requires definition of the degree and extent of impact as well as evaluation of potential fate and transport. Soil analytical results have been compared to Tier 1 ROs for all pathways and property uses. Groundwater analytical results have been compared to Class I groundwater ROs.

Impacts exceeding the Tier 1 ROs exist at the site for both soil and groundwater. The following subsections describe the degree and extent of the impacts with respect to depth. The first subsection discusses surface soil (i.e.

ground surface to a depth of three feet). The second subsection discusses shallow subsurface soil (i.e. soil from three ft. to ten ft. depth), and the third subsection discusses deep subsurface soil (i.e. soil greater that ten ft. depth). The fourth subsection presents an evaluation of potential source material and the fifth subsection addresses groundwater.

6.2.1 Surface Soil Impact Assessment

Analytical results for BTEX and PAH constituents for surface soil samples are presented in Table 5-5. In addition to samples collected during the CSI field activities, this table also includes surface soil samples collected in 1990. Constituents that exceed the Tier 1 ROs for inhalation, ingestion, and/or the soil to groundwater pathway for all property scenarios are identified. Results for thirty-three samples are presented in Table 5-5 and there is an exceedance for at least one BTEX or PAH constituent in thirty-one of the samples. Twenty-one samples have one or more exceedances for at least two pathways. One sample with no exceedances has high detection limits for PAH constituents and the other sample was collected in 1990 to provide off-site background data. Three figures were developed to illustrate the aerial extent of these Tier 1 RO impacts with respect to BTEX and PAH constituents.

Soil Ingestion

Figure 6-2 shows the location of surface soil samples that exceed the RO for the soil ingestion pathway and identifies the specific constituents and analytical result for each. The general extent of impact is the entire remediation site, including areas along the railroad and Sixth Street rights-of-way. All exceedances are for PAH constituents with the exception of benzene at sample locations B-503 and TP-503; both are located near the AmerenIP north property line. The ROs are exceeded for four or more PAH constituents at twenty-one locations covering all areas of the site. Higher levels of impact, including five or six PAH constituents per location exceeding a Tier 1 RO, occur on the northern portion of the site, along the north fence line and the railroad right-of-way.

Soil Inhalation

Figure 6-3 shows the location of surface soil samples that exceed the RO for the soil inhalation pathway and presents the analytical result. The inhalation RO is exceeded at eleven sample locations. The RO is exceeded at two locations for benzene, naphthalene, and xylene. TP-

504, which is located adjacent to GH-1, exceeds Tier 1 ROs for benzene, ethylbenzene, naphthalene, and xylene. The RO is exceeded at two locations for benzene and naphthalene only. One exceedance is near the AmerenIP north property line, the second is at B-506 near the center of the site. In addition, six locations exceeded the RO for naphthalene only.

Soil Component to Groundwater Ingestion

Figure 6-4 shows the location of surface soil samples that exceed the RO for the soil to groundwater pathway. Specific constituents and analytical results are also shown. The RO are exceeded at twenty-two of thirty-three locations. Benzene and ethylbenzene are the only BTEX parameters that exceed the ROs. Benzene exceeds the RO at twelve locations and ethylbenzene exceeds the RO at two locations (TP-503 and TP-504). Several PAH constituents exceed the RO at twelve different locations. The more highly impacted samples tend to be confined to the northern portion of the site; however, there are also exceedances for samples located near the southern property line and along Hill Street through the middle of the site.

Inorganics

Table 5-8 presents analytical results for metals and cyanide for surface soil samples. In addition to samples collected during CSI activities this table includes samples collected and analyzed in 1990 and 1991 during the Phase II SI activities. Sample dates are included in the table. Tier 1 ROs for the soil to groundwater pathway for some metals were exceeded for twenty-two of the thirty-seven samples analyzed. Most of these samples exceeded the ROs for arsenic, cyanide, chromium, and lead. Twelve samples exceeded the RO for the ingestion pathway for arsenic. Three of these samples also exceeded the RO for the soil to groundwater pathway. The Tier 1 RO for cyanide was exceeded for the soil to groundwater pathway in five samples. Two of these samples also exceeded the RO for the ingestion pathway. Four samples exceeded the RO for the ingestion pathway for lead. In addition, two samples exceeded the RO for chromium for the soil to groundwater pathway.

6.2.2 Shallow Subsurface Soil Assessment

Analytical results for BTEX and PAH constituents for shallow subsurface soil samples are presented in Table 5-9. In addition to samples collected during the CSI field activities, this table also includes shallow subsurface soil samples collected during the 1990 and 1991 Phase II SI activities. Constituents that exceed the Tier 1

ROs for inhalation, ingestion, and/or the soil to groundwater pathway for all property uses are identified. Results for forty-six samples are presented in Table 5-9 and there is an exceedance for at least one pathway for at least one BTEX or PAH constituent in forty of the samples. Three samples analyzed in 1990 have no exceedance; however, the detection limits exceed some of the RO and indicate laboratory dilutions. Three figures were developed to illustrate the extent of these Tier 1 RO impacts on shallow subsurface soil.

Soil Ingestion

Figure 6-5 shows the location of shallow subsurface soil samples that exceed the RO for the soil ingestion pathway and identifies the specific constituents and analytical result for each. Benzene is the only BTEX parameter that exceeds the RO and is present at six locations above the RO. All benzene RO exceedances are located in the north central part of the AmerenIP property in the general location of gas holder tanks GH-1 and GH-2. The only sample locations with no RO exceedances for BTEX or PAH constituents are either off-site or near the southeast corner of the AmerenIP property (UTB-22 and B-512). Samples with higher analytical results and multiple exceedances tend to be located through the central area of the AmerenIP property (i.e. along Hill Street) and north into the railroad right-of-way portion of the site.

Soil Inhalation

Figure 6-6 shows the location of shallow subsurface soil samples that exceed the RO for the soil inhalation pathway and identifies specific constituents and analytical result. The RO is exceeded at twenty-one locations for xylene across the site. The RO is exceeded at twenty locations for benzene and thirty-two locations for naphthalene. The highest exceedances are located at UTB-23, TP-507, B-504, and B-505 near the former gas holder tanks GH-1 and GH-2. RO exceedances generally occur at locations on the northern portion of the site; however, there are exceedances for naphthalene across the site.

Soil Component to Groundwater Ingestion

Figure 6-7 shows the location of shallow subsurface soil samples that exceed the RO for the soil to groundwater pathway. Specific constituents and analytical results are also shown. The RO is exceeded at thirty-six of forty-six locations. The RO for BTEX parameters are exceeded at thirty-one locations, with the benzene RO exceeded at thirty locations. Four or more PAH ROs are exceeded at nineteen locations. RO exceedances generally occur throughout the AmerenIP property as well as the north and east rights-of-way portions of the remediation site.

Inorganics

Table 5-12 presents analytical results for metals and cyanide for shallow subsurface soil samples. In addition to samples collected during CSI activities this table includes samples collected and analyzed during the Phase II SI activities in 1990 and 1991. Sample dates are included on the table. Tier 1 ROs for the ingestion pathway for arsenic were exceeded for two CSI samples. No other metals were detected in these samples above Tier 1 ROs.

Metals Tier 1 ROs were exceeded at one location where ROs for BTEX and PAH constituents were not exceeded. The ingestion pathway RO for arsenic was exceeded at sample location B-559. The BTEX and PAH detection limits indicate some laboratory dilution; however, detection limits are not greater than the ingestion pathway RO.

6.2.3 Deep Subsurface Soil Assessment

Analytical results for BTEX and PAH constituents for deep subsurface soil samples (greater than ten feet) are presented in Table 5-13. In addition to samples collected during the CSI field activities, this table also includes deep subsurface soil samples collected during the Phase II SI activities in 1990 and 1991. Constituents that exceed the Tier 1 RO for inhalation, ingestion, and/or the soil to groundwater pathway for all property use scenarios are identified. Results for seventy-seven samples are presented in Table 5-13 and there is an exceedance for at least one pathway for at least one BTEX or PAH constituent for thirty-four of the sample locations. Three figures were developed to illustrate the extent of these Tier 1 RO impacts on deep subsurface soil at the site.

Soil Ingestion

Figure 6-8 shows the location of deep subsurface soil samples that exceed the RO for the soil ingestion pathway and identifies the specific constituents and analytical result for each exceedance. BTEX or PAH RO are exceeded at twenty-eight sample locations and three of those locations have ROs exceeded at multiple depths. Benzene is the only BTEX constituent that exceeds the RO. The PAH ROs are exceeded for more than three PAH constituents at twenty-one sample depths representing nineteen different locations.

Soil Inhalation

Figure 6-9 shows the location of deep subsurface soil samples that exceed the RO for the soil inhalation pathway and identifies specific constituents and analytical result. The RO is exceeded for three or more constituents at sixteen sample locations. The RO is exceeded at twenty-one locations for benzene and twenty-three locations for naphthalene. In addition the RO is exceeded for toluene, ethylbenzene, and xylenes at three locations (B-507, B-506, and B-514) and for ethylbenzene at one location (B-562). RO exceedances generally occur at locations on the northern portion of the AmerenIP property and railroad right-of-way portion of the remediation site; however, there are two exceedances for naphthalene on the vacated Sixth Street right-of-way (B-558 and B-560).

Soil Component to Groundwater Ingestion

Figure 6-10 shows the location of deep subsurface soil samples that exceed the RO for the soil to groundwater pathway. Specific constituents and analytical results are also shown. The RO is exceeded for thirty samples at twenty-five locations. The ROs for BTEX parameters are exceeded for thirty samples, with the benzene RO exceeded at all thirty locations. Other BTEX constituents exceed the RO for twelve sample locations. Four or more PAH ROs are exceeded for sixteen samples at fourteen locations. RO exceedances generally occur on the northern portion of the AmerenIP property and the railroad right-of-way portion of the site.

Inorganics

Table 5-16 presents analytical results for metals and cyanide for deep subsurface soil samples. In addition to samples collected during CSI activities this table includes samples collected and analyzed during the Phase II SI activities completed in 1990 and 1991. Sample dates are included on the table. Tier 1 ROs for metals were not exceeded for any CSI samples.

6.2.4 Potential Source Determination

IAC Section 740.420(b)(2) requires characterization of source and potential sources of recognized environmental conditions. This section presents an evaluation of CSI analytical data with respect to IAC Section 742.305 for contaminant source and free product determination.

IAC Section 742.215 requires determination of soil attenuation capacity by evaluation of natural organic carbon fraction data, TPH data and/or total organic carbon concentration (OCC). During 1996 twelve soil samples were collected from four probeholes completed at the site. Probeholes were located near the four corners of the AmerenIP property. Three samples were collected from each location; one sample from the surface soil, one from the three foot to ten foot interval, and one from below ten feet. All samples were analyzed for total organic carbon using Method 415.1. Table 6-2 presents analytical results for total organic carbon (TOC).

Table 6-2 also presents information on soil type for the various depth intervals. All samples collected from the one foot interval were described as fill material containing coal, cinders, etc.; therefore the default value of 6,000 mg/kg was used to evaluate potential source materials from the surface soil interval (i.e. 0-3'). Sample groups for the three to ten foot and greater than ten foot interval each included one sample with TOC result considerably higher than the remaining samples. The conservative assumption to exclude these samples was made. The TOC average for the three to ten foot interval is 2,370 mg/kg, compared to the default value of 2,000 mg/kg. The TOC average for greater than ten foot interval is 4,293 mg/kg, compared to the default value of 2,000 mg/kg.

TPH results and total organic carbon concentration for CSI samples were compared to these TOC values. Table 6-3 presents a summary of those samples and includes location, depth, and TPH results. Based on the results presented in Table 6-3, potential source materials are present on the site at depths ranging from two feet to twenty-four feet bgs. These samples tend to represent the central and north central area of the AmerenIP property and the area of the railroad right-of-way where DNAPL was present in UMW-101. Three samples from one location (B-504) represent potential source material at depths of three feet, seven feet, and twenty-one feet. Samples from B-553 represent depths of five to six feet and twenty-four feet.

IAC Section 742.305(b) also requires evaluation of source and free product determination by comparison of analytical results to soil saturation limits. This comparison resulted in no additional sample locations being identified as potential source material.

6.2.5 Groundwater Assessment

<u>*July 2004 Data*</u>

Groundwater impact has been identified in three of the on-site monitoring wells and two of the off-site monitoring wells. Six constituents have been identified that exceed the Tier 1 ROs or the Groundwater Quality Standards for Class I Groundwater. Analytical results for the most recent CSI groundwater sampling event are presented in Table 6-4. As noted previously, groundwater samples were analyzed only for BTEX and PAH constituents. These results were compared to the Class I groundwater standards and exceedances are highlighted on Table 6-4. Historical groundwater samples were also analyzed for metals and are also presented in Table 6-4. A groundwater concentration map showing the constituents that exceeded a Tier 1 RO is presented in Figure 6-11.

Benzene was detected in five wells (UMW-107, UMW-110, UMW-113, UMW-114, and UMW-115) at concentrations that exceed the Class I RO: Three wells on the south portion of the AmerenIP property, one well in the vacated Sixth Street right-of-way at the northeast corner of the site, and one well in Hill Street west of the site.

Toluene was detected in UMW-114 at a concentration that exceeded the Class I RO.

Naphthalene was detected in two wells (UMW-113 and UMW-114 at concentrations that exceed the Class I RO.

Phenanthrene and pyrene was detected in UMW-113 at concentrations that exceed their respective Class I RO.

Acenaphthylene was also detected in UMW-114 at a concentration above the Class I RO.

September 2007 Data

Groundwater impact has been identified in two of the on-site monitoring wells and one of the off-site monitoring wells.

Three constituents have been identified that exceed the Tier 1 ROs or the Groundwater Quality Standards for Class I Groundwater. Analytical results for the most recent CSI groundwater sampling event are presented in Table 6-4. As noted previously, groundwater samples were analyzed only for BTEX and PAH constituents. These results were compared to the Class I groundwater standards and exceedances are highlighted on Table 6-4. A groundwater concentration map showing the constituents that exceeded a Tier 1 RO is presented in Figure 6-11.

Benzene was detected in two wells (UMW-107, UMW-114, and UMW-115) at concentrations that exceed the Class I RO.

Ethylbenzene was detected in well (UMW-114) at a concentration that exceeds the Class I RO.

Naphthalene was detected in UMW-107 AND UMW-114 at a concentration that exceeds the Class I RO.

The general trend of benzene shows a slight increase in concentration from December 2004 through September 2007.

The ethylbenzene and naphthalene concentrations stay relatively consistent showing slight increases and decreases between sampling events.

7 CSI SUMMARY AND CONCLUSIONS

Numerous phases of investigation and remediation have been completed at the AmerenIP Champaign MGP site in Champaign, Illinois. This site was the location of manufactured gas production for more than sixty years. Sufficient data has been collected to show that impacted soils exceeding Tier 1 ROs are present on the remediation site that includes both the AmerenIP property and the adjacent railroad. This section provides a summary of degree and extent of impacts and provides several figures to illustrate the extent of MGP residuals present at the site. The figures also incorporate observations made during the various phases of investigation and some interpretation relative to observations.

The extent of impact is based primarily upon a comparison of BTEX and PAH results to Tier 1 ROs. While these constituents are present within MGP residual materials, their presence may also be derived from other non-MGP sources. No attempt has been made to differentiate or determine the possible sources for these constituents.

7.1 Horizontal Extent of Impacts

Figure 7-1 illustrates the results of the Tier 1 ROs comparison for BTEX and PAH constituents for shallow soils at the site. Groundwater Class I exceedances are shown on Figure 6-11. This figure illustrates the wide spread nature of surface soil impacts. Although at least a foot of clean fill has been placed over most of the site and several areas of shallow soil were removed during the IRM activities, the zero to three foot interval remains significantly impacted. Samples from three locations representing potential source material are located in areas proximate to where impacted soils were removed during the IRM. One sample from TP-504 was collected from the inlet/outlet structure of former gas holder GH-1. The other two samples were collected from areas directly between MGP structures known to contain impacted materials and the previous location of monitoring well UMW-101 where DNAPL was observed.

Figure 7-2 illustrates the results of the Tier 1 ROs comparison for BTEX and PAH constituents for the shallow subsurface soils at the site. Potential source material impacts are also shown. This figure shows that the extent of impacts to the three to ten foot interval are well bounded to the south and east of the site; however, the northerly extent is less well defined. Potential source materials within this depth interval are primarily associated with former gas holder GH-2. The potential source sample at location B-516 is most likely localized because the MGP structures previously located south of Hill Street would generally not be associated with tar-like materials. However, observations of materials in the former gas holder GH-3 valve pit structures indicated the presence of MGP residuals. Comparison of Figure 7-2 with

Figure 7-1 shows fewer impacts in the southern area of the site at this depth interval.

Figure 7-3 illustrates the results of the Tier 1 ROs comparison for BTEX and PAH constituents for the deep subsurface soil ten to twenty foot depth interval. This interval is relatively well bounded by non-impacted samples to the south, the east and the northwest. The location of potential source material samples appears to indicate possible lateral migration of impact upon reaching this depth interval. None of these samples are located near MGP structures that would be expected to contain source materials. Three of the samples, B-506, B-507, and B-514, are located within the vacated Hill Street and may potentially represent impacts along the gas main. These three samples may also represent the source of dissolved phase impacts moving laterally toward four of the five impacted monitoring wells; however, the shallow groundwater gradient is not well defined in south, southeast, and east directions. The potential source samples in the railroad right-of-way may represent the approximate pathway from the site structures to the DNAPL observed at UMW-101.

Figure 7-4 illustrates the results of the Tier 1 ROs comparison for BTEX and PAH constituents for the deep subsurface soils at depths greater than twenty feet at the site. Although several impacted samples are identified within this depth interval, the figure illustrates that impacts diminish in the unweathered till material at greater depths. The potential source material samples are relatively close together and are in the shallower portion of the depth interval. These samples are also located in the general pathway between former MGP structures and former monitoring well UMW-101. Well UMW-101 was screened from fourteen to twenty-six feet. Monitoring wells are generally screened into the upper portion to this depth interval.

7.2 Vertical Extent of Impacts

Figures 7-5 through 7-10 are sections through the site and illustrate the vertical and horizontal extent of impact above Tier 1 ROs for BTEX and PAH constituents. These figures show sample depths and CSI probehole and Phase II SI boring locations. Monitoring wells with screened intervals are illustrated. Field PID readings are presented for one-foot intervals for CSI probeholes. The general extent of BTEX and PAH impacts is shown based on comparisons with Tier 1 ROs, field observations, and interpretation of boring log information.

Figures 7-5 through 7-7 are west-east sections with Figure 7-5 representing the northern site area and Figure 7-7 presenting the southern most section. Figure 7-5 shows that the western edge of impact is bounded by two borings west of Fifth Street. It is likely that impacts extend under Fifth Street considering the close proximity of UTB-11 to the corner of the site. Field observations and analytical results indicate that impacts are shallower to the west and increase toward the east to depths greater than twenty-five feet. Although the east is not bounded by soil sample analytical data for UTB-02, groundwater samples from this well are not impacted and no impact was noted during drilling of the boreholes. Potential source material is present at B-553 at both shallow and deep intervals. Higher levels of impacts were identified in samples collected from sandy soils. Attempts to correlate sand lenses in the clayey till unit were unsuccessful.

Figure 7-6 represents the central portion of the site along the north side of vacated Hill Street. As noted for the previous section, impacts appear to extend under Fifth Street and, based on impacted groundwater at UMW-107, impacts may extend into Hill Street west of Sixth Street. Based on site observations and analytical results, impacts along this section are deeper through the middle of the site; however, only one sample (B-507) was identified as potential source material. The eastern extent of impact along this section is not well defined, although analytical results for samples from B-558 indicate concentrations decrease in that direction.

Figure 7-7 represents a section along the southern edge of the AmerenIP property. Although no sample data is present, both the east and west end of this section show that impacts are bounded by monitoring wells with no Class I impacts. Although analytical samples were not collected during installation of these wells (UMW-104 and UMW-106), there were no observations of impacts recorded during drilling activities. Analytical results and observed impacts along this section are generally minor; however, groundwater impacts have been consistent at wells UMW-114 and UMW-115. The depth of impact is limited to about twelve feet bgs.

Figure 7-8 is a south-north cross-section and represents the approximate west edge of the AmerenIP property. Two of four soil samples at the southern end of the section (B-513) are impacted; however, impacts are minor and relatively shallow, indicating that impacts likely do not extend far off-site to the south. The extent of impacts is bounded at the north end of the section by boring UTB-09 and groundwater samples from UMW-109. Both analytical and observed impacts at the middle of the section are relatively shallow and appear to be associated with the former MGP structures located in that area of the site.

Figure 7-9 is a south-north cross section and shows impacts through the approximate center of the site. The extent of impacts is bounded on both the north and south; however, the data points to the north (UTB-01 and UTB-17) are separated by a significant distance. This section illustrates the significant impacts which exist in the north central area of the site, including the impacts under the railroad right-of-way. Six samples identified as potential source materials occur along this section. In addition, some of the deepest impacts identified (approximately twenty-eight feet bgs) are shown on this section.

Boring UTB-01 represents the location of previous well UMW-101, which was abandoned in 1997 due to the presence of DNAPL in the well. This well was screened from fourteen to twenty-six feet, indicating the presence of DNAPL within that interval. Since probehole B-561 was located within a few feet of UTB-01 and did not have significant impacts below nineteen feet, it is likely that DNAPL was entering the well from above nineteen feet bgs.

Figure 7-10 is a south-north cross section and illustrates the extent of impacts on the east edge of the site. Extent of impacts is bounded at the north end of the section by boring UTB-02 and groundwater samples from UMW-102. The extent of impacts is also bounded to the south end of the section by boring UTB-04 and groundwater samples from UMW-104. Both of these monitoring wells have no Class I impacts. Three of the four samples in the center of the section are impacted (B-559, B-560, and B-558). Impacts in boring B-559 and B-558 are relatively minor and shallow. Boring B-560 appears to have impact to the total depth of the boring (27-feet bgs).

8 ILLINOIS LICENSED PROFESSIONAL GEOLOGIST REVIEW

For those portions of the work performed before my involvement:

I have reviewed documentation of the prior investigation and interim remedial measure activities and believed the documentation is suitable for compliance with 35 Ill. Adm. Code 740 developed in conjunction with the use of accepted engineering and geological standards, and the information presented is accurate and complete.

Signature:____________________________

Michael R. Crutcher, P.G.
Licensed Professional Geologist

Date: ________________________________

License No. ___________________________

License Expiration Date: ________________

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List of Abbreviations and Acronyms

BGS – Below Ground Surface
BLS – Below Land Surface
BTEX – Benzene, Toluene, Ethylbenzene, and Xylenes
CN – Cyanide
COC – Constituents of Concern
CSI – Comprehensive Site Investigation
CSIR – Comprehensive Site Investigation Report
CSIWP – Comprehensive Site Investigation Work Plan
DNAPL – Dense Non-Aqueous Phase Liquid
DQO – Data Quality Objective
EDR – Environmental Data Resources
GC – Gas Chromatograph
IAC – Illinois Administrative Code
IEPA – Illinois Environmental Protection Agency
IRA – Interim Removal Action
IRM – Interim Remedial Measures
LUST – Leaking Underground Storage Tank
MGP – Manufactured Gas Plant
NAPL – Non-aqueous Phase Liquid
NFR – No Further Remediation
NGVD – National Geodetic Vertical Datum
NIWC – Northern Illinois Water Company
OCC – Organic Carbon Concentration
PA – Preliminary Assessment
PAH – Polycyclic Aromatic Hydrocarbon
QAPP – Quality Assurance Project Plan
RA – Remedial Applicant
RACR – Remedial Action Completion Report
RCRA – Resource Conservation and Recovery Act
RECs – Recognized Environmental Conditions
ROs – Remediation Objectives
ROR – Remedial Objectives Report
RECs – Recognized Environmental Conditions
SIR – Site Investigation Report
SIWP – Site Investigation Work Plan
SI – Site Investigation
SRP – Site Remediation Program
SSI – Supplemental Site Investigation
SVOCs – Semi-Volatile Organic Compounds
TACO – Tiered Approach to Corrective Action Objectives
TCLP – Toxicity Characteristic Leaching Procedure
TOC – Total Organic Carbon
TPH – Total Petroleum Hydrocarbons
UST – Underground Storage Tank
VOCs – Volatile Organic Compounds

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