

**Off-Site Investigation Report  
Former Manufactured Gas Plant  
Champaign, Illinois  
State ID 0190100008**

July 22, 2008

Prepared for:



ST. LOUIS, MISSOURI



Columbia, Illinois

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**AMEREN SERVICES**  
ST. LOUIS, MISSOURI

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PSC Project 62403053

## Executive Summary

AmerenIP is submitting this Site Investigation Report (SIR) to present an evaluation of the soil and groundwater impact for the surrounding off-site properties adjacent to the former manufactured gas plant (MGP) facility in Champaign, Illinois. The SIR 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 SIR is being submitted as a supplement to the *Comprehensive Site Investigation Report, Former Manufactured Gas Plant, Champaign Illinois, LPC 0190100008* dated December 2007 (CSIR) with the intent to obtain a Comprehensive No Further Remediation (NFR) letter for the remediation site located at 308 N. 5<sup>th</sup> Street, Champaign Illinois and the adjacent properties. Findings of previous investigations indicated the presence of soil and groundwater impact exceeding IEPA Tiered Approach to Corrective Action Objectives (TACO) Tier 1 remediation objectives (ROs) associated with the past operations of the MGP.

The primary objective of the off-site investigation was to define the extent, both vertical and horizontal, of the MGP related impacts surrounding the AmerenIP property. 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 affected property owners to address identified impacts.

### Site Description

The remediation site 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. This investigation also included adjacent residential properties to the north, west and south, and commercial properties to the east. 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 manufactured gas plant on the remediation site from approximately 1869 through the early 1930s. The plant was placed on standby status from the early 1930s to the mid 1950s and was used for meeting peak demand up until the mid 1950s. 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 SIR is being submitted with the intent of the Remedial Applicant (RA), AmerenIP, to obtain a Comprehensive NFR Letter for the remediation site. The objective of the investigation activities was to collect data to determine the extent of potential off-site impacts from the Champaign MGP site and to provide the quantity and quality of data necessary to complete a SIR, Remedial Objectives Report (ROR), and Remedial Action Plan (RAP) under the SRP and TACO. Findings of the site investigation indicated the presence of soil and groundwater impact off-site that exceeds Tier 1 ROs.

## **Technical Approach**

The technical approach for the investigations included reviewing historical data and information from previous investigations 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 on off-site properties. Investigation results indicated the presence of subsurface soil and groundwater impact on properties to the north, east, and west of the MGP, as well as groundwater impact to the south. Although present, there were no indications of past or current human exposure to the impacts.

## **Recognized Environmental Conditions**

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. The former "University of Illinois Gas Experiment Station" was located in the northeastern portion of the site. All structures associated with the MGP have been removed with the exception of the booster house which remains on-site.

## **Constituents of Concern**

The analytical data set was compared to the TACO Tier 1 RO values, the provisional non-TACO ROs, and accepted background levels as an initial screening. Based on this review, 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 on-site soils during the CSI. Eighteen COCs were identified in soils off-site during the 2008 investigation. Eleven constituents have been identified in groundwater at levels exceeding TACO Tier 1 ROs. COCs from the 2008 off-site investigation are listed in Table ES-1. Remedial actions have been performed to address significant levels of impact, however, 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 IEPA's requirements for an NFR letter will be discussed and presented at a later time in the ROR, RAP, and Remedial Action Completion Report (RACR).

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# 1 INTRODUCTION

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This report has been prepared for AmerenIP by PSC Industrial Outsourcing, LP (PSC). PSC was retained by AmerenIP to provide consulting services for the investigation of the former Champaign manufactured gas plant (MGP) site and surrounding properties 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). For the purposes of this report, the “Site” is reference to the AmerenIP – owned property that is primarily located within the fenced boundary. Off-site properties consist of any adjacent property outside the AmerenIP site.

## 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 of both residential and commercial properties. Figure 1-2 depicts the remediation site boundaries and the layout of the surrounding properties.

A single active track railroad right-of-way (Norfolk-Southern) borders the Site to the north and several residential properties are located north of the railroad right-of-way. The Sixth Street right-of-way is adjacent to the east of the Site; however, Sixth Street is closed 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 active alley. North Fifth Street borders the Site to the west and separates the Site from residential properties to the west. At one time, Hill Street approximately bisected the Site in the east-west direction; but the street has been vacated and is now part of the Site owned by AmerenIP.

## 1.2 Project Objectives

The objective of the off-site investigation activities was to collect data to determine the extent of potential off-site impacts from the Champaign MGP site. The investigation activities were designed to address all areas that may be potentially impacted due to former MGP site operations and to supplement data collected during previous investigations and remediation activities completed at the Site. The data obtained will be utilized with the existing data for the evaluation of potential actions required to obtain from the IEPA a No Further Remediation (NFR) letter(s) for the associated properties.

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

- Completion of surface and subsurface soil sampling using a GeoProbe<sup>TM</sup> with a hydraulic hammer;

- Installation of thirteen additional groundwater monitoring wells;
- Collection of groundwater samples;
- Collection of Shelby tubes for geotechnical parameters; and
- Completion of soil and groundwater laboratory analytical program.

### **1.3 Report Organization**

This SIR was prepared for submittal to the IEPA to meet the requirements of IAC Section 740.425 and is organized into eight technical sections and seven appendices.

- Section 1 provides an introduction to the Site and objectives of this report;
- Section 2 presents information on the background of the Site, details relative to Site history and previous investigation activities, and a discussion of Site physical conditions including regional and site-specific geological and hydrogeological conditions;
- Section 3 presents a brief overview of the Off-Site Investigation Work Plan;
- 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; and
- Section 8 presents the Illinois Licensed Professional Geologist review statement and certification.

## 2 SITE BACKGROUND

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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. Additional information regarding the history of the Site is included in the *Comprehensive Site Investigation Report for AmerenIP Champaign, Illinois Former Manufactured Gas Plant, State ID 0190100008* dated December 2007 (CSIR).

### 2.1 Site History

The following 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 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). Gas was produced by coal carbonization, oil gasification, and carbureted water gas methods during various periods of operation. 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, Illinois Power, a predecessor of AmerenIP, maintained ownership of the property until 1979 when it was sold to the American Legion. Illinois Power repurchased the property from the American Legion in 1991 after preliminary environmental investigations indicated the presence of MGP related impacts at the Site. Figure 2-1 illustrates the historical MGP structures at the site through its years of operation.

The 1887 Sanborn map shows a residence located on the southeast corner of 5<sup>th</sup> and Hill Streets, in an area that later became part of the MGP. The map also shows a seminary located at the northwest corner of 5<sup>th</sup> and Hill Streets. The 1892 Sanborn map indicated a residence north of the railroad tracks, in the area that is currently 5<sup>th</sup> and Washington Streets. The 1915 Sanborn map shows the expansion of the MGP to the south side of E. Hill Street. One gas holder is illustrated on the map surrounded by residences. The 1924 Sanborn map indicates the presence of three residences located on the southeast corner of what is now the MGP site, and the 1951 map shows the expansion of the MGP to include the entire block south of E. Hill Street between 5<sup>th</sup> and 6<sup>th</sup> Streets. Refer to the CSIR for details on the Sanborn Maps.

### 2.2 Site Description

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 of both residential and commercial properties. Figure 1-2 depicts the Site boundaries and layout of adjacent properties.

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

### **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 3<sup>rd</sup>. 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.

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 Below Land Surface (BLS). Water table elevations range from 650 feet above Mean Sea Level (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 of the CSIR.

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 and unweathered till units of the Wedron Formation, Upper Glasford Formation, and the sand member of the Lower Glasford Formation. Below the Glasford formations are the Upper and Middle Banner formations, beneath which is the bedrock at an estimated depth of 290 feet bgs in the vicinity of the Site.

### **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 Wisconsin 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.

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. 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 Wisconsin 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 bgs. 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 Illinoian 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.

## **2.7 Site Hydrogeology**

Groundwater hydrology activities completed during the off-site investigation consisted of sampling wells which had been installed during the Phase II activities, and the installation and sampling of thirteen additional wells. The following sections describe the three uppermost water-bearing units beneath the Site.

### **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 uppermost till unit and is currently monitored by nineteen wells. Groundwater in the shallow system beneath most of the study area generally flows in a north/northwest direction with a somewhat radial pattern from the site that may be due to well locations and spacing. The configuration of the shallow water table in May 2008 is shown on Figure 2-2, and the configuration of the shallow water table in December 2006 is shown on Figure 2-3. Depth to the shallow groundwater system typically ranges from 3- to 10- feet bgs. Additional groundwater data from previous events is presented in the CSIR dated December 2007.

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  $9.1 \times 10^{-5}$  cm/sec from the slug tests performed in wells UMW-104 and UMW-106 (Table 2-1). 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  $3.2 \times 10^{-5}$  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 Intermediate Sand Unit**

Eight groundwater monitoring wells were installed at a depth of forty-five feet bgs during the 2008 off-site investigation to encounter an intermediate sand unit. Wells were cased to a depth of approximately 29.5 feet bgs with a screened interval of 35.0 to 45.0 feet bgs. One well was installed off-site to the north and west; three wells were installed off-site to the south, one well was installed off-site to the southeast, and one well was installed off-site to the east. An additional well was installed on-site in the former Hill Street right-of-way. Water levels taken in July 2008 ranged from 25.0 to 28.0 feet bgs. The configuration of the intermediate water table in July 2008 is shown on Figure 2-4. Groundwater generally flows in a southeast direction.

Slug testing was performed in four of the eight intermediate wells (UMW-301, UMW-302, UMW-303, and UMW-304) during the off-site investigations. The horizontal hydraulic conductivity values ranged from  $2.80 \times 10^{-2}$  centimeters per second to  $8.63 \times 10^{-2}$  centimeters per second. The mean hydraulic conductivity calculated using data from the four wells was  $4.85 \times 10^{-2}$  centimeters per second, or 137.5 feet per day. Hydraulic conductivity data is presented in Table 2-3, and field data sheets are included in Appendix A.

### **2.7.3 Deep Groundwater System**

The deepest groundwater system that has been monitored at the Site is a sand and gravel zone within the Lower Glasford Formation beginning at a depth of about 151 feet bgs to a depth greater than 177 feet bgs. The sand and gravel layers encountered in this zone were much thicker and laterally continuous than the silty sand and sand units encountered in the weathered and unweathered till units. The water levels for the three wells screened in this zone stabilized at depths of approximately 120 feet bgs. The regional gradient is to the west-southwest.

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 cross sections were developed during the CSI which illustrate some of the Site features and characteristics. A total of six sections have been constructed. Figure 2-5 is a site plan which shows locations of these six cross sections. Figures 2-6 through 2-8 are west to east cross sections and Figures 2-9 through 2-11 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 of the CSIR.

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 of the CSIR. 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 sites 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. These investigations began in 1986 and 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 2007.

### **2.10.1 Phase IA/IB Investigation**

Warzyn conducted two phases of investigation during 1986. Phase IA consisted of a detailed site inspection and interviews, and Phase IB included soil gas sampling and geophysical exploration. Evidence of buried structures and MGP residuals were observed on the Site. Phase IA/IB activities were used to direct Phase IC/ID RECON Investigation activities.

### **2.10.2 Phase IC/ID RECON<sup>®</sup> Investigation**

Mathes conducted Phase IC/ID RECON<sup>®</sup> Investigation activities on-site and off-site in 1990 to evaluate the nature and extent of MGP impact in shallow soils and groundwater. Soil and groundwater samples were collected at 34 locations on-site and 37 locations off-site for headspace analysis using an on-site gas chromatograph (GC). 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.

### **2.10.3 Phase II Site Investigation**

Phase II site investigation activities began in November 1990, continued throughout 1991, and were completed in January 1992. Phase II 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. Thirty-four soil samples were collected for analysis from 28 boring locations. A groundwater monitoring program began during the Phase II activities and has been continued to the present. 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.

The results of the Phase II SI confirmed the results of the Phase I assessments; 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. AmerenIP conducted additional investigations at the Site beginning in 2004 in order to complete the site investigation according to current Illinois regulations. The data from the Phase II SI as well as newly collected data were the basis for the December 2007 Comprehensive SIR.

### **2.10.4 Supplemental Site Investigation**

A Supplemental Site Investigation 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. SSI activities included geoprobe soil sampling along the Sixth Street right-of-way, test pit excavations near GH-1 and immediately west of Sixth Street, and sampling of liquids within GH-1. 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 migration pathways were discovered during the SSI activities.

### **2.10.5 Interim Remedial Measures**

Interim remedial measures were completed at the Site between October 1997 and May 1998. The objective was the removal of source material from within subgrade gas holder (GH-1), tar wells and a tar separator, and an area of purifier waste. Source materials and residuals were treated on-site to render the materials non-hazardous. These impacted materials were subsequently excavated and shipped off-site for treatment at Illinova Resource Recovery's Baldwin Thermal Treatment (BTT) Facility. Approximately 1,500 tons of MGP impacted material were excavated and disposed of at BTT and an additional 100 cubic yards of concrete and rubble were disposed of at a landfill.

## 2.10.6 Comprehensive Site Investigation

A Comprehensive Site Investigation was completed during June through August 2004 to define the extent of MGP-related impacts on the AmerenIP property. The principal CSI activities completed during 2004 included excavation and sampling of test pits, logging and sampling of probeholes, and groundwater sampling. Nine test pits were excavated to investigate below grade MGP structures not addressed during the interim remedial measures and to evaluate potential off-site migration pathways to the north and east of the Site. Evidence of MGP-related impact was observed in all test pits and six soil samples were collected for chemical analysis. Although heavily impacted material was identified in test pits in the north and east edges of the Site, the relatively shallow depths suggested that they were not likely the pathways for off-site migration.

Twenty-seven probeholes were completed to depths ranging from twenty-four to thirty-two feet. Three probeholes were completed within the vacated Sixth Street right-of-way and seven probeholes were completed within the railroad right-of-way. The remaining seventeen probeholes were completed on the AmerenIP owned parcel. Evidence of MGP-related impact was noted at all probehole locations with the exception of two. 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. RECs determined during the CSI are presented in Section 6. Additional details of the investigation evaluation were discussed in the CSIR.

Fourteen monitoring wells were also sampled for chemical analysis. Water level measurements, total well depths, and presence of MGP-related impact were recorded. Benzene, toluene, ethylbenzene, and xylenes (BTEX) and polynuclear aromatic hydrocarbon (PAH) constituents were identified above detection limits in five samples.

## 2.10.7 Groundwater Monitoring

As noted in Section 2.10.3, 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.

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 residual MGP impact 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 residual MGP impact 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 removed.

The shallow groundwater system at the Site has been impacted by MGP residuals over much of the Site. The volatile organic compounds (VOCs) present in the impacted groundwater include benzene, ethylbenzene, toluene and xylenes. Throughout the duration of sampling activities, various semi-volatile organic compounds (SVOCs) have been detected in 14 of the 18 shallow monitoring wells and piezometers. Table 2-2 presents a summary of groundwater results (BTEX, PAHs) for wells monitored from 1997 through 2008.

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 indicated flow to the northeast, southwest, and northwest. December 2006 water levels indicated flow to the north and 2008 water levels indicate flow to the northwest.

## **2.11 Enforcement Actions**

No enforcement actions have been taken at the Site. AmerenIP entered the Site into the IEPA voluntary program in 1989, which has subsequently become the Site Remediation Program. 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 OFF- SITE INVESTIGATION WORK PLAN**

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This section presents the proposed activities described in the *Off-Site Investigation Work Plan, Former Manufactured Gas Plant, Champaign Illinois*, dated March 13, 2008 (OSIWP). The investigation activities included the collection of subsurface data necessary to complete the delineation of impact to soil and groundwater and to fully characterize the Site. It also included the development of remedial objectives and the preparation of the Remedial Objectives Report (ROR), which will be submitted as a separate document. Based upon the history of the MGP site and surrounding properties, as permitted in IAC Section 740.420(b)(1), the analytical program has been limited to specific MGP chemicals of concern and still satisfies the requirements for a Comprehensive Site Investigation.

The activities described in the work plan were developed to insure a dynamic investigation which could be refined throughout the duration of field activities to consider and address field observations. 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 off-site investigation activities included the following:

- Site preparation and mobilization,
- On-site soil boring and soil sampling,
- Off-site soil boring and soil sampling,
- Evaluation of groundwater conditions,
- Soil and groundwater laboratory analytical program, and
- Shelby Tube collection.

Field activities were managed and completed by PSC and its subcontractors. The IEPA and USEPA provided oversight for field activities. Kelron Environmental of Champaign, Illinois provided oversight for groundwater sampling. Vegrzyn, Sarver and Associates of Champaign, Illinois provided survey services, and Teklab Inc. of Collinsville, Illinois provided analytical laboratory services.

#### **3.1 Site Preparation and Mobilization**

Prior to performing any off-site activities, AmerenIP and/or its site representatives obtained access from the appropriate property owners. In addition, AmerenIP provided each owner and tenant with an explanation of the activities and purpose of the investigation on their applicable tract.

Joint Utility Locating Information for Excavators (J.U.L.I.E.) was contacted by PSC prior to the start of any intrusive field activities. All underground utilities were marked by the respective company, both within the boundary of the Site and within the off-site areas to be investigated. The PSC site engineer/geologist marked the approximate locations to be investigated. As site work progressed, some of these locations were modified and additional locations were included.

Excavation and drilling equipment was mobilized to the Site and a lay-down area established for storage of equipment and supplies. The former MGP booster house was used as both an office and storage facility throughout the investigation activity. A temporary decontamination pad was constructed at the Site for cleaning drilling and sampling equipment. A poly-storage tank was located adjacent to the decontamination pad for temporary storage of decontamination fluids and waste water and a roll-off box was transported to the Site for temporary storage of drill cuttings and other investigation generated solid waste.

All equipment was inspected upon arrival at the Site and decontaminated prior to any on-site use. Augers and sampling equipment were cleaned with a pressure washer after completion of each borehole prior to moving to the next sample location. Sampling equipment was rinsed with a clean water rinse after pressure washing.

### **3.2 Off-Site Investigation Objectives**

Based on a detailed review of previous investigation observations and results, 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 surrounding the Site and to provide the quantity and quality of data necessary to complete an SIR and ROR under the SRP and TACO. The primary objective of the off-site work was to collect additional data to more completely delineate the degree and extent of off-site impacts and to provide data which is complete and of the desired quality to allow subsequent completion of the ROR.

### **3.3 On-Site Soil Boring and Sampling**

Soil borings were proposed at nine locations on-site during the investigation to provide transition data for the proposed off-site locations. In general, soil borings were advanced to a depth of approximately 30.0 feet bgs or to a minimum of eight feet below visual/olfactory impact, using a truck-mounted or track-mounted hydraulic hammer probe rig with Macro-Core samplers. The final boring depth at each location was determined in the field based on observations by the site engineer/geologist using the following criteria:

- Refusal indicating buried structure, contact with impenetrable geologic unit, or limits of the equipment. If refusal was encountered within five feet of the ground surface, the boring location was shifted a few feet and re-drilled.
- Termination in the unweathered till or sand units after eight feet with no apparent MGP impacts.

All borings were continuously sampled using appropriate methods. The site engineer/geologist logged each sample and recorded information on geologic field observation data sheets. Soil type, recovery, and observations relative to odors and impacts were 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 photoionization detector (PID) and the results recorded on the field data sheets.

In general, a minimum of three soil samples were collected from each boring for laboratory analyses. A surface soil sample was collected from the interval from ground surface to three feet bgs at each location. A second sample was collected from the three to ten foot bgs interval and a third from the interval below ten feet at each boring location. In addition, if MGP impacts were observed, at least one sample from the impacted interval was collected. The impacted sample was based on PID readings and/or odor and visual observations. If more than one area of impact was observed in a depth interval, additional samples were collected. The goal of this sampling rationale was to define the degree and extent of MGP impacts in both horizontal and vertical directions.

The surface soil samples (i.e. 0- to 3- foot bgs) were analyzed for BTEX, PAHs, cyanide, metals, organic carbon ( $f_{oc}$ ) and pH. Non-impacted subsurface soils were analyzed for BTEX, PAHs, cyanide, metals,  $f_{oc}$  and pH. Impacted subsurface soil samples were analyzed for BTEX, PAHs, metals, and cyanide. Section 3.11 of this report presents the analytical methods used for this investigation and specific chemical constituents reported.

### **3.4 Off-Site Soil Boring And Sampling**

Twenty-nine off-site boring locations were proposed in the OSIWP. Additional borings were added according to field observations; therefore, a total of forty-five borings were completed off-site. These locations are shown on Figure 3-1. The primary objective of these borings was to define the lateral and horizontal extent of MGP residuals identified off-site in previous investigation activities. These borings were at least 30 feet bgs (or to a minimum of eight feet below visual/olfactory impact) and were drilled using the same methodology as described for the on-site borings in the previous section. Criteria for the depth of termination were the same as for the on-site borings.

Nineteen borings were drilled north of the railroad right-of-way, and ten were drilled along the Fifth Street right-of-way west of the remediation site. Six boreholes were drilled along the south side of the alley to the south, two were drilled south of Church Street, four were drilled east of the Sixth Street right-of-way, one was drilled southeast of the Site near the intersection of 6<sup>th</sup> and Church Streets, and three were drilled northwest of the remediation site. All borings were logged and sampled following the same criteria described in Section 3.3 for the on-site borings. Criteria for soil sample analysis were the same as for the on-site borings.

### **3.5 Monitoring Well Installation**

Based on field observations and analytical data from previous investigation activities, one additional monitoring well was installed on-site, and twelve additional monitoring wells were installed off-site. The locations of the monitoring wells are illustrated on Figure 3-1. The on-site well is located within the vacated Hill Street area near the center of the remediation site, screened in the intermediate depth of 35-45 feet to encounter a suspected sand unit beneath the Site. Off-site wells consisted of five wells installed to a depth of fifteen feet bgs, and seven wells installed to a depth of forty-five feet bgs. To prevent possible cross-contamination issues, the intermediate wells in known or

suspected areas of upper-level impact (UMW-301, UMW-302, UMW-303, UMW-304) were outer-cased to a depth of 30 feet bgs with 10-foot screens. Monitoring well construction depths and descriptions are listed on Table 3-1.

Wells were constructed of two-inch diameter PVC well screens and risers, with well screen slot size of 0.010 inches. The annular space was backfilled with sand pack to two feet above the top of the well screen. A minimum of a two-foot seal of bentonite was placed above the sand pack. The remainder of the annular space was backfilled with bentonite grout. Each monitoring well was completed with a flushmount well protector. Well construction logs are included in Appendix C.

### **3.6 Monitoring Well Development**

After well installation, each monitoring well was developed using pump and surge method to evacuate a minimum of five well volumes of water. Field parameters of pH, conductivity, turbidity, and temperature were measured throughout the development process to ensure that groundwater conditions stabilized. The quantity of water removed, the groundwater conditions, and the beginning and ending groundwater levels were recorded on field data sheets. Copies of the field data sheets are included in Appendix C.

### **3.7 Groundwater Monitoring**

Quarterly groundwater monitoring at the Site has been underway since 1996 and has included fourteen wells on and around the Site. Ten of the thirteen new wells installed during the 2008 off-site investigation and the initial fourteen wells were sampled in May 2008. The later installed wells (UMW-305, UMW-306, UMW-307) were sampled in July 2008. Groundwater sampling activities were initiated approximately two weeks after well installation and development of the new wells had been completed. After collection of water level data and prior to sampling, each of the wells were purged of a minimum of three well casing volumes of water. During purging, field measurements of pH, specific conductivity, temperature, and dissolved oxygen were measured until these parameters stabilized to within ten percent of the previous reading. Each well was outfitted with a dedicated bladder pump.

The procedures for well purging were in general accordance with USEPA Document 540/S-95/504 "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, April 1996 (Low-Flow). The purging rate was performed at a rate of <0.5 Liters per minute (L/m). The water level of the well was monitored during purging to avoid unacceptable drawdown and to prevent water cascading down the well screen. The rate was decreased appropriately to maintain a constant water level to within one foot (1') of drawdown or no more than 10% below the top of the screened interval, once the pump had started. At a minimum, one well casing volume was purged prior to evaluating parameter stabilization, unless low yield dictated otherwise. Calculation data was recorded on the Well Purging Data Form. Copies of the completed forms are included in Appendix B.

Per the guideline, the purging criteria were based primarily on the stabilization of water quality parameters. Water quality measurements of temperature, pH, specific conductance, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity were recorded during purging. All measurements were obtained using a water quality instrument fitted with a flow-through cell connected to the discharge side of a pump. During purging, the flow-through cell was inspected to insure no bubbles formed on the wall. The well was purged until indicator parameters stabilized over three consecutive readings.

Stabilization has been achieved after a minimum of three successive readings, in which pH is within +/- 0.1, conductivity is within +/- 3%, ORP is within +/-10mvs, DO is within +/-10%, and turbidity is within +/-10%. Dissolved oxygen and turbidity usually are the last parameters to stabilize. Therefore, stabilization achievement for turbidity was also based on being <25 ntu's.

Groundwater samples were collected from each monitoring well for laboratory analysis. Groundwater samples were analyzed for BTEX, PAHs, cyanide and metals. Samples to be analyzed for BTEX were collected first followed by PAHs, cyanide and metals. The bottles were labeled and placed on ice in a cooler provided by the laboratory.

### **3.8 Hydrogeologic Evaluation and Testing**

Following the completion of wells, hydrogeologic testing was performed to characterize the hydrogeologic conditions. The testing included performing slug-testing on four of the intermediate monitoring wells for calculating Site hydraulic conductivity. Static groundwater level measurements were recorded and groundwater elevation contours were generated to depict the groundwater flow conditions at the Site. The groundwater contour maps for shallow and intermediate wells are illustrated in Figures 2-2, 2-3, and 2-4.

Slug testing consisted of the instantaneous introduction or removal of a stainless-steel rod or a slug into and out of each monitoring well. The instantaneous change in water level and the subsequent return of the water level to static conditions was recorded. Groundwater levels were monitored with an electronic water level indicator and a pressure transducer and data logger. Groundwater levels were monitored for a minimum of 10 minutes and until groundwater levels reached 90 percent of static conditions. Groundwater levels were not monitored beyond 60 minutes. The recorded data was evaluated using the Geraghty & Miller, Inc. model AQTESOLV™ to calculate a hydraulic conductivity at each well and the Site. AQTESOLV data sheets are included in Appendix D.

### **3.9 Shelby Tube Collection**

Shelby tubes were collected from off-site properties for the preparation of potential vapor intrusion sampling. Shelby tubes were collected from borings B-845 and B-851. The following soil geotechnical parameters were collected using the following methods:

- Porosity – ASTM Method D653
- Moisture Content – ASTM Method D2216
- Dry Unit Weight – ASTM D2937
- Specific Gravity – ASTM D854

The summary of laboratory test results is presented in Table 3-2, and calculation data is included in Appendix G. A vapor intrusion sampling event at a few residential locations will be conducted as a follow up to the off-site investigation. The specific locations will be determined upon completion of the IEPA's review of this SIR and is subject to the approval of the affected property owner(s).

### **3.10 Analytical Program**

As identified in Sections 3.2 through 3.4, both soil and water samples were collected during investigation activities for chemical analysis at an off-site laboratory. During sample collection, soil or water was placed in laboratory provided containers and labeled according to matrix, sample location, date, and analytical method. Duplicate samples were collected to assess the quality of the data resulting from the field sampling program.

Samples were protected from breakage and transported to the laboratory in coolers. Ice was used to maintain a temperature of 4° C. All soil and water samples were delivered under proper chain of custody to Teklab, Inc. in Collinsville, Illinois. The laboratory data, including analytical results and a data quality objective (DQO) level III data package, are included in Appendices D and E.

### **3.11 Soil Sample Analytical**

Soil samples were collected from on-site and off-site soil borings. A total of one hundred sixty-five soil samples were sent to the laboratory for analysis. Due to the amount of analytical data from previous investigations, complete analyses for all parameters was not necessary as a site-specific constituent of concern (COC) list is presented in the CSIR. The total number of soil samples includes a minimum of three samples from most boring locations, and four duplicate samples.

The analytical methods included the following:

- SW-846 Method 5035/8260B (BTEX)
- SW-846 Method 8270 SIMS (PAHs)
- SW-846 Method 9010/9014 (total and amenable cyanide)
- SW- 846 Methods 6010B (chromium, lead, arsenic)
- SW-846 Method 9045C (pH)
- ASTM – D2974-87 ( $f_{oc}$ )

Due to BTEX and PAHs being the primary drivers for remedial action at MGP sites, each soil sample was analyzed for BTEX and PAH constituents. Cyanide and metals were performed on approximately 40% of samples and pH on approximately 10% in a manner to fully represent the overall site conditions. A total of fourteen  $f_{oc}$  samples were collected from three interval depths in non-impacted areas and averaged for Site representation purposes. Soil samples analyzed for metals included arsenic, chromium, and lead.

### 3.12 Groundwater Sample Analytical

Groundwater samples were collected from fourteen pre-existing monitoring wells and thirteen new wells. In addition, two duplicate samples were collected for QA/QC purposes.

The analytical methods included the following:

- SW-846 Method 8260 (BTEX)
- SW-846 Method 8270 SIMS (PAHs)
- SW-846 Method 9010 (total cyanide)
- SW-846 Methods 6010B (chromium, lead, arsenic)

## 4 COMPREHENSIVE SITE INVESTIGATION FIELD INVESTIGATION

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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 April through July 2008. In addition, certain activities defined in IAC Section 740 were performed during earlier investigations completed in 1986, 1990, 1997, 1998, and 2004 which are briefly summarized in Section 2.10. Greater detail regarding previous investigations is provided in the CSIR. Only those activities completed during 2008 are discussed in this section. The principal activities completed during 2008 included logging and sampling of probeholes, groundwater monitoring well installation, and groundwater sampling. The following sections address the activities in detail:

- Soil boring and sampling;
- Monitoring well installation;
- Well development and groundwater sampling;
- Investigation waste management and disposal; and
- Quality assurance / quality control activities.

### 4.1 Soil Boring And Sampling

As noted previously, several phases of soil sampling have been completed at and around the Site since initial investigation activities were initiated in 1986. Brief summaries relative to these previous activities are presented in Section 2. This section presents details relative to field activities completed during April through July 2008. Nine on-site and twenty-nine off-site soil boring locations were originally proposed in the OSIWP. Based on data obtained in the field, a total of fifty-four probeholes were completed (Figure 3-1).

Soil sampling was completed using a truck or track-mounted hydraulic hammer probe rig with Macro-Core samplers. The site engineer/geologist logged each sample and recorded information on field logging forms. Soil type, recovery, observations relative to odors and impacts were 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 1/2-inch diameter MacroCore™ sampler or a 5-foot long, 1 1/2-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 30 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 34 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. 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 F.

Soil sampling rationale was to collect a minimum of three samples from each probehole location; one sample from 0- to 3-feet bgs, one sample from 3- to 10-feet bgs, and one sample below 10-feet. Additional samples were collected based on PID results and visual observations by the field geologist. In general, at least three samples were collected from each location, and four or five samples were collected from several locations. Details relative to the analytical program are presented in Sections 3.10 and 5.1. Table 4-1 presents a summary of soil parameters analyzed. The following paragraphs provide brief descriptions of locations where impact was observed during soil logging activities separated by area.

#### **North of MGP Site:**

*B-802:* Probehole B-802 was completed on April 15, 2008 to a total depth of 30.0 feet bgs at a location on the north side of the railroad right-of-way. Four soil samples were collected for chemical analysis. Two impacted zones were observed; one from approximately 8- to 13-feet bgs, and a second from 14- to 18-feet bgs. Analytical samples were collected from both impacted zones. Based on field measurements, the area with the highest PID reading was at 15.0 feet bgs. No visual or olfactory indications of impact were observed in soils below 25.0 feet bgs; therefore an additional sample was collected from 25- to 26-feet bgs for confirmation purposes.

*B-803:* Probehole B-803 was completed on May 7, 2008 at a location approximately 70.0 feet northeast of B-802. Four soil samples were collected for chemical analysis. MGP-like odors were observed from approximately 7- to 20-feet bgs. Visual impact was noted at a depth of 21- to 22-feet bgs. No odor or impact was observed in soils at 29.0 ft bgs. Samples were collected from 21- to 22-feet bgs and 29- to 30-feet bgs. Based on

field measurements, the interval with the highest PID level was 21- to 22-feet bgs. The boring was terminated at 30.0 feet bgs.

*B-835:* Probehole B-835 was completed on April 2, 2008 in the northern portion of the former MGP site. The boring was placed in approximately the same location as boring B-503 that was advanced during the 2004 CSI; therefore the top eighteen feet of B-835 was not logged. A coal tar-like substance and strong odors were observed in voids and fractures at a depth of approximately 27.0 feet bgs. Based on field measurements, the interval with the highest PID reading was from 28- to 29-feet bgs. The soil boring was terminated at a depth of 30.0 ft bgs.

*B-844:* Impact was observed in probehole B-802 along the railroad right-of-way; therefore, B-844 was drilled approximately forty feet north of B-802 to delineate the extent of impact on that property. B-844 was completed on May 5, 2008 to a total depth of 30.0 feet bgs. Three soil samples were collected for chemical analysis. MGP-like odors were observed from approximately 11.5- to 26-feet bgs. Visual impact was noted in voids and fractures from 15- to 18-feet bgs. Based on field measurements, the highest PID reading occurred at 15.0 feet. Soils below 26.0 feet bgs did not appear to be impacted. Probehole B-845 was drilled approximately thirty feet north of B-844, and no impact was observed.

*B-846:* Probehole B-846 was added during field activities as a result of impact observed in boring B-850 approximately thirty-five feet to the southeast. The probehole was completed on May 7, 2008 to a total depth of 30.0 feet bgs. Three soil samples were collected for chemical analysis. Visual impact was noted from 6- to 12-feet bgs. Based on field measurements, the interval with the highest PID level was 15- to 16-feet bgs. Soils below 18.0 feet bgs did not appear to be impacted. Boring B-848 was placed north of B-846 to delineate the extent of impact in that area. No impact was identified in B-848.

*B-847:* Probehole B-847 was drilled between two properties north of the railroad right-of-way in order to delineate extent of impact in that area. The probehole was completed on May 7, 2008 to a total depth of 30.0 feet bgs at a location north of the railroad right-of-way approximately 60 feet south of Washington Street. Three soil samples were collected for chemical analysis. Impacted soils were observed from 18.5- to 19-ft bgs, and from 22- to 23-feet bgs. The highest PID reading occurred at 19.0 feet bgs. As a result of impacts observed in B-847, two additional borings were drilled approximately 65.0 feet farther north. No impact was observed in either boring.

*B-849:* Probehole B-849 was completed on May 7, 2008 to a total depth of 30.0 feet bgs. The probehole was placed approximately twenty feet north of B-803 to further delineate that property area. Three soil samples were collected for chemical analysis. Coal tar-like odors were observed from 14- to 19-feet bgs. A coal tar staining was noted from 16- to 17-feet bgs. The highest PID reading occurred at 17.0 ft bgs. Soils below 18.0 feet bgs did not appear to be impacted.

*B-850:* Probehole B-850 was completed on May 8, 2008 to a total depth of 30.0 feet bgs at a location in the railroad right-of-way north of the Site. Three soil samples were collected for chemical analysis. Light impacts were noted from 14- to 14.5-feet bgs, and a heavily impacted sand lens was observed at 16.0 ft bgs. A coal tar staining was also

noted in fractures at 18.5 ft bgs. The interval with the highest PID level was at 17.0 feet bgs. Soils below 26.0 feet bgs did not appear to be impacted.

#### **South of MGP Site:**

*B-816:* Probehole B-816 was completed on April 1, 2008 to a total depth of 27.0 feet bgs at a location on-site along the southern property boundary. Slight petroleum-like odors were observed at a depth of 9.0 feet bgs; however, no visual impact was observed. Three soil samples were collected from the boring for chemical analysis.

*B-818:* Probehole B-818 was completed on April 1, 2008 to a total depth of 30.0 feet bgs at a location on-site south of gas holder GH-3 along the southern fence line. A coal tar-like odor and residual staining was observed at approximately 6.5 ft and heavily impacted zones were encountered from approximately 7.5- to 10.5-feet bgs and 12- to 15-feet bgs. Four soil samples were collected for chemical analysis. Based on field measurements, the interval with the highest PID level was 8- to 9-feet bgs. A very slight coal tar-like odor was observed to a depth of 30.0 feet. The boring was terminated at 30.0 feet bgs to avoid possible cross-contamination of soils beneath the till unit.

*B-822:* Probehole B-822 was completed on April 1, 2008 to a total depth of 30.0 feet bgs at a location approximately 130.0 feet west of B-818. A slight naphthalene-like odor was observed at 7.5 ft bgs, and a moderate oil-like odor was noted at approximately 9.5 ft bgs. No odor or impact was noted from 11- to 27-feet bgs. A very slight fuel oil-like odor was noted at approximately 27.0 feet. Four soil samples were collected for chemical analysis. Based on field measurements, the area with the highest PID level was 7.5 feet bgs.

*B-823:* Probehole B-823 was completed on April 1, 2008 to a total depth of 30.0 feet bgs in the southwest corner of the former MGP site. Three soil samples were collected for chemical analysis. A slight fuel-like odor was observed between 10- and 12-feet bgs, and slight residual staining was observed from 13.5- to 14-feet bgs. Based on field measurements, the highest PID level was at 14.0 feet bgs. Soils below 18.0 feet bgs did not appear to be impacted.

#### **West of MGP Site:**

*B-827:* Probehole B-827 was completed on April 2, 2008 at a location approximately 65.0 feet north of B-823. Moderate coal tar-like odors and light staining were observed at a depth of approximately 7.5- to 9.5-feet bgs. Light staining was also observed at a depth of 13.0 feet bgs. Four soil samples were collected for chemical analysis. Based on field measurements, the interval with the highest PID level was 7.5- to 8-feet bgs. Refusal was encountered at 28.5 feet bgs.

*B-828:* Probehole B-828 was completed on April 3, 2008 to a total depth of 26.8 feet bgs at a location east of 5<sup>th</sup> Street near the intersection of 5<sup>th</sup> and Hill Streets. Four soil samples were collected for chemical analysis. Coal tar-like odors were observed from depths of 9.0 to approximately 14.5 ft bgs. Based on field measurements, the interval with the highest PID level was 9- to 10-feet bgs. Soils below 15.0 feet bgs did not appear to be impacted. The boring was terminated at a depth of 26.8 ft bgs due to auger refusal.

*B-829:* Probehole B-829 was completed on April 2, 2008 to a total depth of 30.0 feet bgs approximately 55.0 feet north of B-827. Three soil samples were collected for chemical analysis. Residual staining and odor was observed at 5.5 ft, 11.0 ft, and 13.0 ft bgs. Odors were also noted from 14- to 29-foot bgs. The interval with the highest PID reading occurred at 6.5 feet bgs. Soils at 30.0 feet did not appear to be impacted.

*B-831:* Probehole B-831 was completed on April 3, 2008 at a location approximately 60.0 feet north of the intersection of 5<sup>th</sup> and Hill Streets along the 5<sup>th</sup> Street right-of-way. Four soil samples were collected for chemical analysis. Moderate MGP-like staining and odors were observed from approximately 8- to 11-feet bgs. Soils from 11- to 12-feet bgs were heavily impacted with a coal tar-like material. The highest PID reading occurred at 11.5 feet. A coal tar-like substance was also visible in voids and fractures from 12- to 13-feet bgs. Odors were observed to a depth of 22.0 ft bgs. The boring was terminated at a depth of 30.0 ft bgs.

*B-832:* Probehole B-832 was completed on April 4, 2008 to a total depth of 30.0 feet bgs at a location approximately 60.0 feet north of B-831. Slight hydrocarbon-like odors were observed at depths of 2.0 feet and 5.0 feet bgs, however no visual impact was noted. PID readings remained at zero throughout the entire boring.

*B-833:* Probehole B-833 was completed on April 2, 2008 at a location in the northwest corner of the former MGP site. Five soil samples were collected for chemical analysis. Impacts were noted in the 8- to 12-foot interval, and at 26.5 feet bgs. Based on field measurements, the area with the highest PID level was at 10.5 feet bgs. Soils below 30.0 feet bgs did not appear to be impacted. The boring was terminated at 33.0 ft bgs to avoid possible cross-contamination of soils beneath the till unit.

*B-838:* Probehole B-838 was added during field activities to delineate the area between B-830 and B-821. The probehole was completed on April 4, 2008 to a total depth of 30.0 feet bgs. Four soil samples were collected for chemical analysis. Moderate to heavy impacts were observed from 13.5- to 15-feet bgs. The highest PID reading was taken at a depth of 13.5 feet bgs.

*B-841:* Impact was observed in probehole B-838, however no impact was observed in adjacent probehole B-839. Probehole B-841 was added during field activities to delineate the extent of impact between those two probeholes. B-841 was completed on April 15, 2008 to a total depth of 22.0 feet bgs. The boring was logged from 10- to 22-foot bgs for comparison purposes with boring B-838 and to encounter the contaminated zone. No soil samples were collected for chemical analysis. Impacts were observed between 18- and 21-feet bgs. The interval with the highest PID level was from 18.5- to 19-feet bgs.

#### **Northwest of MGP Site:**

*B-834:* Probehole B-834 was completed on April 4, 2008 to a total depth of 30.0 feet bgs at a location along the west side of 5<sup>th</sup> Street near the railroad right-of-way. Five soil samples were collected for chemical analysis. A diesel-like odor was observed from approximately 4- to 10-feet bgs. Coal tar-like nodules and odors were observed from 14-

to 17.5-foot bgs. No impact was noted below 20.0 ft bgs. Based on field measurements, the interval with the highest PID level was at 17.0 feet bgs.

*B-836:* Probehole B-836 was completed on April 8, 2008 to a total depth of 30.0 feet bgs at a location northwest of the Site. Diesel-like impact was observed in the boring, however, no soil samples were collected for analysis. No MGP-like odors or impact were noted in the boring. Diesel-like odors were noted from approximately 6- through 18-feet in the boring. Light impact was noted at 12.0 feet. The interval with the highest PID reading occurred at 9- to 10-foot bgs. Soil below 18.0 feet bgs did not appear to be impacted.

*Summary:* Fifty-one probeholes were completed to depths ranging from twenty- two to thirty-four feet. One probehole (B-841) was completed to a depth of only twenty-two feet to verify the presence of an impacted depth zone. One probehole (B-835) was logged only from 18.0 to 30.0 ft bgs to verify findings from the 2004 CSI. Visual or olfactory indications of impact were observed in twenty-two of the fifty-one probeholes. Impacted probeholes to the north of the former MGP Site consisted of the following eight probeholes: B-802, B-803, B-835, B-844, B-846, B-847, B-849, and B-850. Four probeholes (B-816, B-818, B-822, and B-823) located south or along the southern boundary of the former MGP Site contained observable impact. Impacted probeholes to the west or along the western Site boundary consisted of the following borings: B-827, B-828, B-829, B-831, B-832, B-833, B-838, and B-841. Borings B-834 and B-836, located northwest of the Site, contained diesel-like impacts not representative of MGP operations. B-834 also contained MGP-like impact at the greater than 10-foot depth interval. Borings completed to the east of the former MGP Site did not contain any observable impacts. Impact tended to be both greater and deeper surrounding the northern and western portions of the Site, including within the railroad right-of-way to the north.

#### **4.2 Monitoring Well Installation**

A total of five shallow monitoring wells were installed off-site to a depth of 15-foot bgs. Three of the wells were placed to the north of the railroad right-of-way (UMW 118, 119, and 120), one was placed approximately forty-five feet to the south of the MGP site boundary (UMW-121), and one well was placed approximately eighty feet west of the MGP (UMW-117). Well locations are illustrated on Figure 3-1. Each of the five shallow monitoring wells were installed using a track-mounted Geoprobe unit with 4.25-inch augers. The wells were screened from 5- to 15-feet in order to contact the shallow groundwater system.

A total of seven intermediate monitoring wells were installed off-site to a depth of 45-foot bgs, and one intermediate well was installed on-site in the former Hill Street right-of-way (UMW-304). One well (UMW-300) was installed approximately 175 feet north of the MGP boundary along Washington Street in the same location as boring B-851. A second well was placed in the former 6<sup>th</sup> Street right-of-way to the east of the Site (UMW-301). A third well (UMW-305) was installed southeast of the Site near the

intersection of 6<sup>th</sup> and Church Streets. Three wells (UMW-302, UMW-306, UMW-307) were installed to the south of the former MGP. Well UMW-302 was placed south of the former MGP in the same area as UMW-121. Wells UMW-306 and UMW-307 were placed along the south side of Church Street. The seventh intermediate off-site well was placed along the 5<sup>th</sup> Street right-of-way west of the Site (UMW-303). The wells were installed using mud rotary with a screened interval from 35- to 45-feet bgs. Four of the wells were outer cased to a depth of approximately 29.5 feet bgs to prevent possible cross-contamination issues.

Wells were constructed of two-inch diameter PVC well screens and risers, with well screen slot size of 0.010 inches. The annular space was backfilled with sand pack to two feet above the top of the well screen. The remainder of the annular space was backfilled with bentonite grout. Each well was surged for 10 minutes after installation, and completed with a flushmount well protector. Well construction logs are included in Appendix C.

#### **4.3 Well Development and Groundwater Sampling**

As discussed in previous sections, groundwater monitoring wells were installed during Site investigation activities completed in 1990 and 1991. An additional thirteen wells were installed during 2008. Since 1990, a total of twenty-nine wells have been installed on and adjacent to the Site. During the intervening period, five of those wells have been abandoned. Figure 3-1 shows the locations of the twenty-four wells currently included in the groundwater monitoring program.

Wells installed during the 2008 investigation were developed prior to sampling. A minimum of three well volumes were purged using whale pumps and disposable tubing. Water quality parameters of temperature, pH, conductivity, and turbidity were recorded during purging. Water was purged until parameters were within +/- 10%. Approximately five well volumes were purged from some shallow wells in order to achieve stabilization. Groundwater samples were collected approximately two weeks after installation.

Since 1999, monitoring wells have been sampled on a quarterly basis and analyzed for select MGP constituents (primarily BTEX constituents and naphthalene). Table 2-2 presents a summary of groundwater sample results from previous monitoring events. A total of twenty-four wells were sampled in May 2008. The wells were sampled using the low-flow technique described in Section 3.7. Twenty six samples, including two duplicate samples, were submitted to the laboratory for analysis. Table 5-11 presents a summary of the groundwater sampling results. Samples were collected in accordance with the OSIWP and the quarterly groundwater monitoring plan. Copies of the analytical results and field data sheets are included in Appendix E.

#### **4.4 Off-Site Laboratory Analytical Program**

The off-site analytical program has been presented in Section 3 along with sample handling procedures and sampling rationale. One hundred sixty one soil samples and four duplicate samples were collected for laboratory chemical analysis from the

proboholes advanced in 2008. Table 4-1 presents a summary of analyses completed for these samples. Twenty-four groundwater samples and two duplicate samples were collected from both on-site and off-site monitoring wells. 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 Sections 5 and 6 of this report.

Samples were protected from breakage and shipped in coolers. Coolers were transported and delivered under proper chain of custody to Teklab in Collinsville, Illinois. Ice was used to maintain a temperature of 4° C. A data quality objective (DQO) level III data package was delivered to PSC 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 investigation activities were containerized and stored on Site:

- Geoprobe – soils materials not used for analytical samples were placed in roll-off boxes;
- Well installation – soils materials and fluids generated during monitoring well installation were placed in roll-off boxes;
- Well development – water generated from development of monitoring wells was contained in 1,000-gallon poly tanks;
- Well purging – purge water from groundwater sampling was contained in 1,000-gallon poly tanks;
- Decontamination fluids – water and other fluids from equipment decontamination were contained on-site in 1,000-gallon poly tanks; and
- Disposable protective clothing and equipment was contained in roll-off boxes.

Upon completion of field activities all liquids and solids were sampled and analyzed for disposal parameters. Copies of the analytical results are included in Appendices D and E. Materials were subsequently disposed of at approved off-site facilities.

#### 4.6 Off-Site Investigation Quality Assurance Activities

During 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 and depth designation. The specific designation for groundwater and soil samples was based upon the monitoring well 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:

- date and time of collection;
- location;
- depth interval (if applicable);
- sample number; and
- requested analyses.

All groundwater characterization samples were placed on ice immediately following field collection to lower the fluid temperature 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 daily field activities and personnel 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;
- personnel log – All PSC personnel, contractors, or oversight present on-site during investigation activities; and
- sampling data log – Documentation of soil impacts observed during logging procedures, pre-sampling well development/evacuation data (applies to sampling monitoring wells).

Site activity entries were completed on a daily basis to record all relevant Site investigation information. 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. The original field data sheets became part of the permanent file for the investigation, and copies are included in Appendix B.

## 5 CHEMICAL ANALYTICAL RESULTS

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Chemical analyses were performed on soil and groundwater samples obtained during off-site investigation activities completed during 2008. Samples were delivered under proper chain of custody to TekLab in Collinsville, Illinois. Analytical parameters included BTEX, PAHs, cyanide, metals (arsenic, chromium, lead),  $f_{oc}$ , and pH. 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.

### 5.1 Analytical Program Summary

The off-site analytical program was developed to provide sufficient data to delineate off-site environmental impacts and facilitate comparison with Tier 1 ROs as presented in Tables 5-1 through 5-6. A third objective was to provide sufficient data to allow subsequent development of remedial objectives and a RAP.

Table 4-1 presents a summary of the offsite soil analytical program. The following is a summary of analyses completed for soil samples during the 2008 off-site investigation:

- BTEX (SW 846, Method 8260B) – 165 analyses
- PAHs (SW 846, Method 8270 SIMS) – 165 analyses
- Metals (SW 846, 6010B Series) – 63 analyses
- Cyanide (SW 846, Method 9010/9014) – 63 analyses
- Fraction Organic Content ( $f_{oc}$ ) (ASTM D2974-87) – 14 analyses
- pH (SW 846 Method 9045C) – 16 analyses
- OA1 (SW 846 8260B) – 1 analysis
- OA2 (SW 846 8015B) – 3 analyses

Based on the subsequent objective of evaluation in accordance with TACO guidance, the soil sample analytical data are divided into three general groups. These groups include surface (0- to 3-feet bgs), shallow subsurface (3- to 10-feet. bgs), and deep subsurface soils (greater than 10-feet bgs). The following subsections present a discussion of analytical results based on these depth intervals. A detailed evaluation of the results as compared to Tier 1 Remedial Objectives and exposure routes are presented in Section 6.

### 5.2 Surface Soil Results

Forty-four samples, not including two duplicates, were collected from the 0- to 3- foot depth interval during the investigation. All samples were analyzed for BTEX and PAHs, and twenty samples were analyzed for metals and cyanide.

### **5.2.1 BTEX and PAH Results**

Table 5-1 presents a summary of BTEX and PAH results for all surface soil samples collected during the off-site investigation activities. Laboratory analytical data sheets for all soil samples are presented in Appendix D.

One elevated benzene concentration was detected on-site in boring B-829 located along the western Site boundary within the area of former MGP operations. No elevated BTEX concentrations were detected in off-site soils in the 0- to 3-foot depth interval.

Elevated or high levels of PAHs were detected in nine (two on-site and six off-site) of the surface soil samples collected. One of the samples was collected on-site along the southern boundary near former gas holder GH-2 from boring B-818. A second sample containing elevated levels of PAHs was collected from boring B-829 located along the western Site boundary. The highest PAH concentrations were detected in a soil sample retained from boring B-831, located on the west side of 5<sup>th</sup> Street approximately seventy feet west of the former main area of operations.

### **5.2.2 Metals and Cyanide Results**

Table 5-2 presents results for metals and cyanide analyses for surface soil samples. Twenty surface soil samples were analyzed for arsenic, chromium, lead, and cyanide. Laboratory analytical data sheets are presented in Appendix D.

An elevated level of arsenic was detected in one surface soil sample collected from boring B-805, located to the north of the Site. Chromium was detected in one sample from boring B-839, located west of 5<sup>th</sup> Street approximately eighty feet west of the former main area of operations. Elevated lead levels were detected in seven soil samples. The highest lead concentration was detected in a soil sample retained from boring B-819, located south of the Site approximately sixty feet south of former gas holder GH-3.

## **5.3 Shallow Subsurface Soil Results**

Fifty-one samples, not including one duplicate sample, were collected from the 3 to 10 ft depth interval during the 2008 investigation. All fifty-one samples were analyzed for BTEX and PAH constituents. Twenty-six samples were analyzed for arsenic, chromium, lead, and cyanide.

### **5.3.1 BTEX And PAH Results**

Table 5-3 presents a summary of BTEX and PAH results for all shallow subsurface soil samples collected during off-site investigation activities. Laboratory analytical data sheets for all shallow subsurface soil samples are presented in Appendix D.

Elevated benzene levels were detected in samples from four off-site soil boring locations and three on-site locations. The highest BTEX concentrations were detected in samples retained from off-site boring B-831 which is located west of the

Site, and from on-site boring B-833 which is located along the western property boundary.

High PAH concentrations were detected in samples retained from borings B-800 and B-802 located to the north of the Site, boring B-831 located to the west of the Site, and boring B-833 located along the western boundary of the Site. Of the four borings, PAH concentrations from B-831 were the highest. No elevated PAH levels were detected to the south or east of the former MGP site in the 3- to 10-foot depth interval.

### **5.3.2 Metals and Cyanide Results**

Table 5-4 presents results of analyses for metals and cyanide for shallow subsurface soil samples. Twenty-six shallow subsurface soil samples were analyzed for arsenic, chromium, lead, and cyanide. Laboratory analytical data sheets are presented in Appendix D.

One slightly elevated chromium concentration was detected in a sample retained from boring B-839, located to the west of the Site. No high levels of metals or cyanide were identified in any other sample from the 3- to 10-foot depth interval.

## **5.4 Deep Subsurface Soil Results**

Sixty-six soil samples, not including two duplicates, were collected from a depth of greater than 10- feet bgs during the 2008 investigation. All sixty-six samples were analyzed for BTEX and PAH constituents. Nineteen samples were analyzed for arsenic, chromium, lead, and cyanide.

### **5.4.1 BTEX and PAH Results**

Table 5-5 presents a summary of BTEX and PAH results for all deep subsurface soil samples collected during off-site investigation activities. Laboratory analytical data sheets for all soil samples are presented in Appendix D.

Elevated levels of one or more BTEX parameter was reported in twenty out of the sixty-eight deep subsurface soil samples. The highest BTEX concentrations were detected in samples retained from boring B-850, located to the north of the Site in the railroad right-of-way.

At least one elevated PAH constituent was reported in sixteen of the sixty-eight deep subsurface soil samples. The highest PAH concentrations were detected in samples retained from soil boring B-850.

### **5.4.2 Metals and Cyanide Results**

Table 5-6 presents results of analyses for metals and cyanide for deep subsurface soil samples. Nineteen deep subsurface soil samples were analyzed for arsenic, chromium, lead, and cyanide. Laboratory analytical datasheets are presented in Appendix D.

No elevated levels of metals or cyanide were detected in samples collected from the greater than 10-foot depth interval.

## **5.5 Total Petroleum Hydrocarbons**

Visual and olfactory observations during logging of four soil borings north and northwest of the Site indicated a diesel-like substance present in surface and shallow subsurface soils. Based upon these observations, three soil samples were analyzed for total petroleum hydrocarbons (TPH).

Diesel fuel and motor oil were detected in soil samples retained from boring B-834. The gasoline range organics (GRO) concentration was 14.90 mg/kg. Diesel fuel was also detected in samples retained from borings B-847 and B-850, as well as motor oil in boring B-850. Copies of the analytical results for the analyses are included in Appendix D.

## **5.6 Groundwater Results**

Twenty-four wells were sampled in May 2008 and were analyzed for BTEX, PAHs, metals (arsenic, chromium, lead), and cyanide. Two duplicate samples were also collected for QA/QC purposes. Analytical results are presented in Table 5-11. Laboratory analytical data sheets are presented in Appendix E.

Samples collected from well UMW-114 (located on-site near former gas holder GH-3) contained elevated concentrations of benzene, ethylbenzene, naphthalene, and cyanide. Samples collected from well UMW-302 located south of the Site also contained elevated levels of benzene and naphthalene.

Groundwater results from the 2004 CSI are presented in Table 5-10 for comparison purposes.

## **5.7 QA/QC Analytical Summary**

Duplicate samples were collected for both soil and groundwater samples. Duplicate soil samples are presented with off-site investigation sample results in Tables 5-1 through 5-6. It is noted that due to the lack of homogeneity of soil materials, duplication of analytical results is virtually impossible. In general, the 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 in the primary sample. Complete laboratory results for all duplicate soil samples are included in Appendix D. Analytical results for duplicate groundwater samples are included in Table 5-11. Laboratory QA/QC reports for all soil analyses are presented in Appendices D and E.

## **5.8 Geotechnical Parameters**

Fourteen samples were analyzed for  $f_{oc}$  and sixteen samples were analyzed for pH during 2008. The laboratory results are presented on tables 5-7 through 5-9. Geotechnical data

will be utilized for a vapor intrusion sampling event at a few residential locations that will be conducted as a follow up to the off-site investigation.

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## 6 ENDANGERMENT ASSESSMENT

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This section presents a summary of the history and findings from previous investigations in addition to the results of the off-site investigation activities as required in IAC Section 740.425(b)(5). 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 during the off-site investigation. 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). Gas was produced by coal carbonization, oil gasification, and carbureted water gas methods during various periods of operation. 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. Additional historical information for the former MGP was presented in the CSIR dated December 2007.

Based on historical data and observations during previous activities, RECs were identified and the 2004 CSI activities were completed to define those conditions. Figure 2-1 illustrates approximate locations of historical MGP structures on the Site. The following sections discuss environmental conditions that exist at the Site as determined during CSI activities.

#### 6.1.1 Former Tar Wells

Three tar wells (TW1, TW2, and TW3) have been identified at the Site. TW1 and TW2 had diameters measuring approximately 10.7 feet. 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 containing metal rebar. The tops of TW1 and TW2 were located approximately two feet bgs, and their bottoms were located at approximately ten feet bgs. The walls and floors were constructed of brick and mortar. Tar well TW3 had a diameter measuring 19.3 feet wide, and a depth measuring 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 each of the three tar wells has been removed; therefore, these structures no longer serve as a source for continued release.

### **6.1.2 Former Tar Separator**

One tar separator was previously identified at the Site. The dimensions of the separator were approximately 10 feet in diameter with depths of 6 to 10.5 feet bgs. The walls and base were constructed of 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 floor of the separator consisted of only native clay till material. 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 previously identified at the Site. Purifier waste consisted mainly of wood shavings, coal, and cinders. Releases from purifiers would primarily have been cyanide and other inorganic constituents. The contents and pad structures have been removed; therefore, they no longer serve as a source for further release.

### **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 prior release of MGP related material could have occurred through the base or sidewalls of the structure or from underground piping going into the structure. The contents of GH-1 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, with confirmed presence of the structures including walls, valve pit, and piping. No solid bottom was encountered. CSI soil sample analytical results indicate significant levels of MGP impacts within the GH-2 gas holder tank. Potential environmental impacts related to this structure will be addressed in the ROR and RAP. This structure will be a primary focus during future remedial activities.

### **6.1.6 Former Gas Holder Tank GH-3**

Gas holder tank GH-3 was constructed between 1909 and 1915. Historical photographs indicate that the tank was constructed above grade on a concrete slab.

The foundation slab and both inlet and outlet valve pits were located during CSI activities. The bottom of the valve pits is about 8.5 feet bgs and both pits contained some tar-like liquid. Potential environmental impacts related to this structure will be addressed in the ROR and RAP.

### **6.1.7 Former Oil and Diesel Storage Tanks**

Seven above grade 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 northern AmerenIP property line extends from Sixth Street just north of vacated Hill Street northeast along the railway to the alley, and continues west along the alley to Fifth Street. 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 the north side of the railroad tracks. Impact was observed north of the railroad right-of-way during the 2008 off-site investigation activities; however, no potential point source was identified.

### **6.1.9 East Property Line and Former Gas Experiment Station**

The eastern property line extends from the railway south down the center of Sixth Street to the active alley. MGP-related impact was identified in a monitoring well 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. The gas main was used for the distribution of gas and is not believed to contain tar, but it will be investigated during the Remedial Action.

### **6.1.10 Vacated Hill Street Right-Of-Way**

Although no actual MGP operations 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 impacts identified during CSI activities in borings and test pits located within the right-of-way, Hill Street is

identified as a REC. 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 off-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 TACO 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 off-site for both soil and groundwater. The following subsections describe the degree and extent of the impacts with respect to depth and location relative to the former MGP site. The first five sections discuss the properties to the north, west, east, south, and northwest of the Site. The sixth subsection presents an evaluation of groundwater.

### 6.2.1 Properties North of the Former MGP

Nineteen soil borings were drilled to the north of the railroad right-of-way north of the former MGP Site as illustrated in Figure 3-1. Samples were collected from each of the three depth intervals (0- to 3-feet bgs, 3- to 10-feet bgs, and greater than 10-feet bgs.) and analyzed for BTEX, PAHs, metals, and cyanide. The following subsections present the Tier 1 screening results for adjacent properties to the north by depth interval.

#### Surface Soil Impact Assessment (0- to 3-Feet)

Analytical results for BTEX and PAH constituents for surface soil samples collected during the 2008 off-site investigation are presented in Table 5-1. Constituents that exceed the Tier 1 ROs for inhalation, ingestion, and/or the soil to groundwater pathway for all property scenarios are identified. Results from the 2004 CSI for this area are included in the table for reference.

The boring B-800 sample from 2- to 3-feet contained ingestion exceedances for benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene. Samples collected from boring B-802 had benzo(b)fluoranthene and dibenzo(a,h)anthracene results that exceeded Tier 1 ROs for ingestion. Analytical results for both borings were marginally higher than the PAH background levels for metropolitan areas published by the IEPA. No BTEX constituents were found to exceed the ingestion RO for surface soils to the north of the MGP Site. Figure 6-1 identifies the boring locations that exceed one or more Tier 1 RO for BTEX and PAHs in surface soils. Given the ubiquitous nature of PAHs in the environment and the presence of several urban sources of PAHs in the immediate vicinity of the site, these PAHs are not necessarily attributable to the MGP.

Table 5-2 presents analytical results for metals and cyanide for surface soil samples. One ingestion exceedance for arsenic was identified in boring B-805 located north of the former MGP Site near the southwest corner of Sixth and Washington Streets.

Exceedances of the soil component to groundwater ingestion pathway for lead were identified at five locations north of the railroad right-of-way from borings B-803, B-804, B-805, B-844, and B-849. Figure 6-2 identifies the boring locations that exceed one or more Tier 1 RO for metals and cyanide in surface soils.

#### Shallow Subsurface Soil Impact Assessment (3- to 10-Feet)

Analytical results for BTEX and PAH constituents for shallow subsurface soil samples are presented in Table 5-3. Constituents that exceed the Tier 1 ROs for inhalation, ingestion, and/or the soil to groundwater pathway for all property uses are identified. Results from the 2004 CSI are also included.

Exceedances of the soil ingestion RO for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were identified in borings B-800 and B-802. Benzo(a)anthracene also exceeded the soil component to groundwater ingestion RO for both samples. Benzene was the only constituent that exceeded the Tier 1 RO for the soil inhalation exposure pathway, at only one location (B-802) with a concentration of 1.92 mg/kg.

One benzene exceedance was identified in boring B-846 from 8.5 to 9.5 feet bgs for the soil component to groundwater exposure pathway. Figure 6-3 identifies the boring locations that exceed one or more Tier 1 RO for BTEX and PAHs in shallow subsurface soils.

Table 5-4 presents analytical results for metals and cyanide for shallow subsurface soil samples collected during the off-site investigation. No exceedances of Tier 1 ROs were identified for shallow subsurface soils north of the MGP Site. Figure 6-4 identifies boring locations that exceed one or more Tier 1 RO for metals and cyanide in shallow subsurface soils.

#### Deep Subsurface Soil Impact Assessment (Greater Than 10-Feet)

Analytical results for BTEX and PAH constituents for deep subsurface soil samples are presented in Table 5-5. 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 from the 2004 CSI are also included. Analytical results for the deep subsurface soil samples identified greater extent of impact than samples from surface and shallow subsurface soils.

Exceedances of the ingestion and soil component to groundwater ROs for at least five constituents were identified at three locations: B-802, B-850, and B-835. Samples from B-802 (14.5'-15.5') and B-835 (28.0'-29.0') also had exceedances for the soil inhalation pathway for four constituents. Samples from B-850 (16.0'-17.0') contained inhalation exceedances for three constituents.

Soil component to groundwater and inhalation exceedances were identified in results from borings B-803, B-844, B-846, B-847, and B-849. Figure 6-5 identifies

the boring locations that exceed one or more Tier 1 RO for BTEX and PAHs in deep subsurface soils.

Table 5-6 presents analytical results for metals and cyanide for deep subsurface soil samples collected during the off-site investigation. No exceedances of Tier 1 ROs for metals or cyanide were identified in deep subsurface soils north of the Site.

### **6.2.2 Properties West of the Former MGP**

Fourteen soil borings were drilled to the west or along the western property boundary of the former MGP Site. Samples were collected from each of the three depth intervals (0- to 3-feet bgs, 3- to 10-feet bgs, and greater than 10-feet bgs) and were analyzed for BTEX, PAHs, metals, and cyanide. The following subsections present the Tier 1 screening results for adjacent properties to the west by depth interval.

#### Surface Soil Impact Assessment

Analytical results for BTEX and PAH constituents for surface soil samples collected during the off-site investigation are presented in Table 5-1. Soil samples collected from boring B-829 (2- to 3-feet) contained ingestion and soil component to groundwater exceedances for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and naphthalene. Benzene was the only BTEX constituent that exceeded the Tier 1 RO for soil component to groundwater in that sample.

Results from B-831 (1- to 3-feet) and B-833 (2- to 3-feet) had exceedances of five PAH constituents for the soil ingestion exposure pathway, and three constituents for the soil component to groundwater pathway. Figure 6-1 identifies the boring locations that exceed one or more Tier 1 RO for BTEX and PAHs in surface soils.

Table 5-2 presents analytical results for metals and cyanide for surface soils collected during the off-site investigation. The only exceedance of the soil component to groundwater pathway for chromium was identified in B-839 (2-to 3-feet). Figure 6-2 identifies the boring locations that exceed one or more Tier 1 RO for metals and cyanide in surface soils.

#### Shallow Subsurface Soil Impact Assessment (3- to 10-Feet)

Analytical results for BTEX and PAH constituents for shallow subsurface soil samples are presented in Table 5-3. Constituents that exceed the Tier 1 ROs for inhalation, ingestion, and/or the soil to groundwater pathway for all property uses are identified.

Exceedances of one or more Tier 1 RO were identified in borings B-828, B-829, B-831, and B-833. The greatest level of impact containing exceedances for the soil ingestion, inhalation, and soil component to groundwater ingestion pathways occurred in borings B-831 and B-833. Samples exceeded Tier 1 ROs for three or more constituents for every exposure pathway. Figure 6-3 identifies the boring

locations that exceed one or more Tier 1 RO for BTEX and PAHs in shallow subsurface soils.

Table 5-4 presents the analytical results for metals and cyanide for shallow subsurface soils. One chromium exceedance was identified to exceed the Tier 1 RO for the soil component to groundwater pathway in boring B-839. Figure 6-4 identifies the boring locations that exceed one or more Tier 1 RO for metals and cyanide in shallow subsurface soils.

#### Deep Subsurface Soil Impact Assessment (Greater Than 10-Feet)

Analytical results for BTEX and PAH constituents for deep subsurface soil samples are presented in Table 5-5. Constituents that exceed the Tier 1 RO for inhalation, ingestion, and/or the soil to groundwater pathway for all property use scenarios are identified. Extent of impact appeared to be greater in deep subsurface soils than in any other depth interval.

The greatest level of impact was identified in samples from B-831, B-833, and B-838. Tier 1 exceedances of eight or more constituents were identified in samples from all three borings. Figure 6-5 identifies the boring locations that exceed one or more Tier 1 RO for BTEX and PAHs in deep subsurface soils.

Table 5-6 presents the analytical results for metals and cyanide for deep subsurface soils. No Tier 1 exceedances were identified for metals and cyanide west of the MGP Site.

### **6.2.3 Properties South of the Former MGP**

Twelve soil borings were drilled south or along the southern boundary of the MGP Site. Samples were collected from each of the three depth intervals (0- to 3-feet bgs, 3- to 10-feet bgs, and greater than 10-feet bgs) and analyzed for BTEX, PAHs, metals, and cyanide. The following subsections present the Tier 1 screening results for adjacent properties to the south by depth interval.

#### Surface Soil Impact Assessment (0- to 3-Feet)

Analytical results for BTEX and PAH constituents for surface soil samples collected during the off-site investigation are presented in Table 5-1. Constituents that exceed the Tier 1 ROs for inhalation, ingestion, and/or the soil component to groundwater pathway for all property scenarios are identified.

Tier 1 exceedances were identified in samples from two borings, B-818 and B-821. B-818 (2.0'-3.0') contained ingestion and soil component to groundwater exceedances for benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. Exceedances for the soil ingestion exposure route for dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene were also identified. One exceedance for naphthalene was identified in B-821 for the soil inhalation exposure pathway. Figure 6-1 identifies boring locations that exceed one or more Tier 1 RO for surface soils.

Table 5-2 presents the analytical results for metals and cyanide for surface soil samples. Tier 1 lead exceedances were identified for the soil ingestion and soil component to groundwater exposure pathways in B-819. A lead exceedance was also identified in boring B-824 for the soil component to groundwater pathway. Figure 6-2 identifies the boring locations that exceed one or more Tier 1 RO for metals and cyanide in surface soils.

*Shallow Subsurface Soil Impact Assessment (3- to 10-Feet)*

Analytical results for BTEX and PAH constituents for shallow subsurface soil samples collected during the off-site investigation are presented in Table 5-3. Constituents that exceed the Tier 1 ROs for inhalation, ingestion, and/or the soil component to groundwater pathway for all property scenarios are identified.

One benzene exceedance for the soil component to groundwater exposure pathway was identified in boring B-818. It should be noted that the method detection limit for the sample is higher than the Tier 1 RO due to matrix interference and the exceedance may not be actual. No other exceedances were identified. Figure 6-3 identifies the boring locations that exceed one or more Tier 1 RO for BTEX and PAHs in shallow subsurface soils.

Table 5-4 presents the analytical results for metals and cyanide for shallow subsurface soil samples. No Tier 1 exceedances for metals and cyanide were identified south of the MGP Site. Figure 6-4 identifies the boring locations that exceed one or more Tier 1 RO for metals and cyanide in shallow subsurface soils.

*Deep Subsurface Soil Impact Assessment (Greater Than 10-Feet)*

Analytical results for BTEX and PAH constituents for deep subsurface soil samples are presented in Table 5-5. Constituents that exceed the Tier 1 RO for inhalation, ingestion, and/or the soil to groundwater pathway for all property use scenarios are identified.

Benzene exceedances for the soil component to groundwater pathway were identified in samples from borings B-817 and B-818. Benzene and naphthalene exceedances for the soil inhalation exposure pathway were also identified in boring B-818. No other BTEX or PAH exceedances were identified.

Table 5-6 presents the analytical results for metals and cyanide for deep subsurface soils. No exceedances were identified south of the MGP Site.

**6.2.4 Properties East of the Former MGP**

Five soil borings were drilled to the east of the former MGP Site during the off-site investigation. Samples were collected from each of the three depth intervals (0- to 3-feet bgs, 3- to 10-feet bgs, and greater than 10-feet bgs.) and analyzed for BTEX, PAHs, metals, and cyanide. The following subsections present the Tier 1 screening results for adjacent properties to the east by depth interval.

#### Surface Soil Impact Assessment (0- to 3-Feet)

Exceedances of the soil ingestion exposure pathway were identified in soil samples collected from boring B-809. The exceedances were for the following four PAH constituents: benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. No other BTEX or PAH exceedances were identified east of the Site during the off-site investigation. Figure 6-5 identifies the boring locations that exceed one or more Tier 1 RO for BTEX and PAHs in surface soils.

Table 5-2 presents the analytical results for metals and cyanide for surface soils. No Tier 1 exceedances for metals and cyanide were identified east of the Site.

#### Shallow Subsurface Soil Impact Assessment (3- to 10-Feet)

Analytical results for BTEX and PAH constituents for shallow subsurface soil samples collected during the off-site investigation are presented in Table 5-4. Constituents that exceed the Tier 1 ROs for inhalation, ingestion, and/or the soil component to groundwater pathway for all property scenarios are identified. No BTEX or PAH exceedances were identified in shallow subsurface soils to the east of the Site during the off-site investigation.

Table 5-4 presents the analytical results for metals and cyanide for shallow subsurface soils. No Tier 1 exceedances were identified east of the Site.

#### Deep Subsurface Soil Impact Assessment (Greater Than 10-Feet)

Analytical results for BTEX and PAH constituents for deep subsurface soil samples are presented in Table 5-5. Constituents that exceed the Tier 1 RO for inhalation, ingestion, and/or the soil to groundwater pathway for all property use scenarios are identified. No BTEX or PAH exceedances were identified in deep subsurface soils to the east of the Site during the off-site investigation.

Table 5-6 presents the analytical results for metals and cyanide for deep subsurface soils. No Tier 1 exceedances were identified east of the Site.

### **6.2.5 Properties Northwest of the Former MGP**

Three borings (B-834, B-836, B-837) were drilled to the northwest of the former MGP Site. Observations made during logging were the basis for performing additional analyses on these borings. A diesel-like substance was observed in the samples; therefore, samples were analyzed for diesel fuel, motor oil, mineral spirits, kerosene, methyl-tertiary-butyl-ether (MTBE) and gasoline range organics. Samples were also analyzed for BTEX and PAHs. Copies of the laboratory data sheets are included in Appendix D.

Exceedances for the soil inhalation exposure pathway were identified in sample B-834 (15- to 16-feet). One exceedance for the soil component to groundwater (benzene) was also identified. Boring B-834 also contained diesel fuel and motor oil above method detection limits as discussed in Section 5.

Boring B-836 was logged during the investigation; however, no samples were submitted to the laboratory for analysis due to its offset location and perceived non-MGP association. Observations by the site geologist during logging indicated diesel-like impact and odor.

No exceedances of Tier 1 ROs were identified in samples from boring B-837.

## 6.2.6 Potential Source Determination

IAC Section 740.420(b)(2) requires characterization of source and potential sources of RECs. This section presents an evaluation of 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 the 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 Tables 6-2 and 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. 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.

## 6.2.7 Groundwater Assessment

Groundwater monitoring wells were installed at and around the Site during the Phase II investigation, and a groundwater sampling plan has been in place since 1996. Thirteen additional wells were installed during the off-site investigation. The following sections present a summary of groundwater results from July 2004, September 2007, and May 2008. Additional groundwater data is presented in the CSIR.

### July 2004 Data

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 CSI groundwater sampling event are presented in Table 5-10. 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 5-10. Historical groundwater samples are also presented in Table 5-10.

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 ROs.

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

Four constituents have been identified that exceed the Tier 1 ROs or the Groundwater Quality Standards for Class I Groundwater. Analytical results are presented in Table 5-10. 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 5-10.

Benzene was detected in three 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.

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

#### May 2008 Data

Groundwater impact has been identified in six of the wells installed during the Phase II investigation and in four of the wells installed during the off-site investigation.

Benzene was detected in five wells (UMW-107, UMW-110, UMW-114, UMW-302, and UMW-304) at concentrations that exceed the Class I RO. Ethylbenzene was detected in well UMW-114 with a concentration of 1.230 mg/L, which exceeds the Class I RO of 0.70 mg/L. No other BTEX constituents were identified above method detection limits.

Benzo(a)anthracene was detected in UMW-110 at a concentration (0.00019 mg/L) that exceeds the Class I RO. Naphthalene was detected above the Class I RO in UMW-114 and UMW-302. No other PAH constituents were identified in groundwater above method detection limits. It should be noted that laboratory method detection limits for some compounds are higher than Class I standards for groundwater.

One lead exceedance was identified in UMW-118, and cyanide exceedances were identified in wells UMW-106, UMW-107, UMW-110, UMW-113, UMW-114, UMW-115, and UMW-121.

## 7 CSI SUMMARY AND CONCLUSIONS

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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 and on adjacent off-site properties. 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 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 Soil Impact

Figures 6-1, 6-3, and 6-5 illustrate the results of the Tier 1 RO comparison for BTEX and PAH constituents for soil by depth interval. Boring locations that exceed Tier 1 ROs for one or more exposure pathway are highlighted in red. These figures illustrate the wide spread nature of soil impact. Impact is present on some residential properties to the north, west, and south and commercial properties to the east of the Site. Off-site impacts appear greater in concentration and area to the north and west of the Site, which is consistent with the direction of shallow groundwater flow.

### 7.2 Vertical Extent of Soil Impact

Analytical results and field observations indicate that the highest levels of impact are present in the deep subsurface soils (greater than 10-feet in depth.) Nine borings north of the Site contained MGP residual impact at greater than 10-feet; four borings had impact in the 3- to 10-foot depth, and three contained impact in the 0- to 3-foot depth interval.

Three borings west of the Site contained impact in the 0- to 3-foot depth interval, four borings were impacted in the 3- to 10-foot depth interval, and five contained impact in the greater than 10-foot depth interval,

Two borings located south of the Site contained MGP residual impact on the 0- to 3-foot depth interval; one boring had impact in the 3- to 10-foot depth interval, and two borings contained impact in the greater than 10-foot depth interval.

Only one boring east of the Site (B-809) had residual impact. Exceedances for four PAH constituents were identified in the 0- to 3-foot depth interval.

Boring B-834 located northwest of the Site exhibited MGP residual impacts in two depth zones: 11.5- to 12.5-feet and 15- to 16-feet.

### **7.3 Groundwater Impact**

Groundwater impact was detected in ten wells during the off-site investigation, including one off-site well to the north and east, two off-site wells to the south and west, and four on-site wells. Impact was identified at both shallow and intermediate depths.

MGP-related constituents identified in groundwater consisted of benzene, ethylbenzene, benzo(a)anthracene, naphthalene, cyanide, and lead. Benzene was detected in three off-site wells at concentrations that exceed the Class I RO for groundwater. Ethylbenzene was detected in only one on-site well (UMW-114) located south of former gas holder GH-3. Benzo(a)anthracene was detected in samples from only one off-site well (UMW-110) located immediately east of the former "Gas Experiment Station of the University of Illinois." Naphthalene was detected in one on-site well (UMW-114) and one off-site well (UMW-302) at concentrations that exceed the Class I RO. Cyanide was detected in seven wells, including four off-site wells and three on-site wells. Lead was detected in only one off-site well (UMW-118) located north of the Site.

### **7.4 Meeting No Further Remediation Requirements**

AmerenIP has presented to the IEPA an evaluation of the extent of off-site MGP impact surrounding the former MGP site at 308 N. 5<sup>th</sup> Street in Champaign, Illinois. The extent is based upon a comparison of analytical results to the TACO Tier 1 Remedial Objectives. Measures that may be implemented to address off-site impact include the following:

- Calculation of Tier 2 or Tier 3 ROs;
- Remediation through excavation and disposal of impacted soils;
- Vapor Intrusion evaluation for residential properties;
- Implementation of engineered barriers, Highway Authority Agreements (HWA) for MGP related impact under 5<sup>th</sup> and 6<sup>th</sup> Streets, Environmental Land Use Controls (ELUCs), and/or prohibiting the use of groundwater underlying the Site.

Proposed remedial activities to be implemented in order to meet NFR requirements will be discussed in detail in the subsequent ROR and RAP.

## **8 ILLINOIS LICENSED PROFESSIONAL GEOLOGIST REVIEW**

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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: \_\_\_\_\_

Derek D. Ingram, P.E., 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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Hydraulic Conductivity Data Sheets

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APPENDIX B

Groundwater Sampling Field Data Sheets

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APPENDIX C

Well Construction and Development Logs

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APPENDIX D

Soil Analytical Data

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Physical Testing Laboratory Data

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