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Prepared for:
Chicago Central & Pacific Railroad
Homewood, Illinois

2007 Site Monitoring and Hydrocarbon Recovery Report

Cedar Rapids Yard - Cedar Rapids, Iowa

PIN Numbers: 2160 IAPR 100119 and 2160 IAPR 100167

ENSR Corporation
April 2008
Document No.: 12440-023-400

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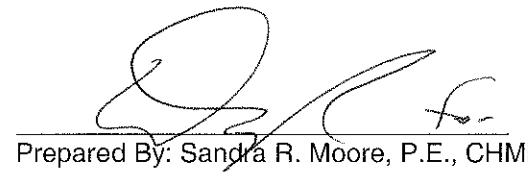

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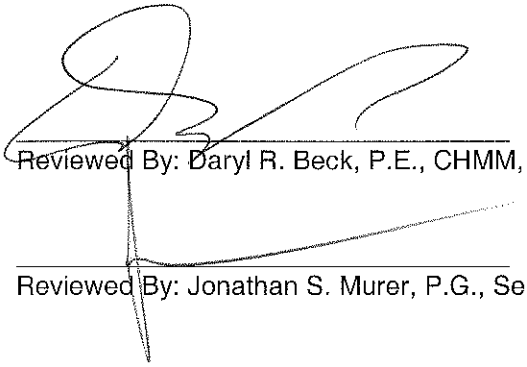

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Executive Summary

On behalf of the Chicago Central & Pacific Railroad (CCPR), ENSR Corporation (ENSR) is pleased to present the results of the Site Monitoring and Hydrocarbon Recovery Activities (2007 Program) for the CCPR railyard located in Cedar Rapids, Iowa (Site).

The scope of the 2007 Program was to monitor the extent and magnitude of petroleum impacted groundwater at two previously identified areas of concern (AOCs), the former fueling area (AOC-3) and the former underground storage tank (UST) area (AOC-5). The Scope of Work for the 2007 Program is based on information obtained from previous Site investigations and the results of the 2004 Supplemental Site Assessment and Hydrocarbon Recovery Program (2004 Program) and the 2005 and 2006 Site Monitoring and Hydrocarbon Recovery Program (2005 and 2006 Program). The 2007 Program is a continuation of the Site-specific plan developed during March 2004 meetings between CCPR and ENSR. The objective of the 2007 Program was to monitor the extent and magnitude of petroleum impacted groundwater, the extent and recoverability of hydrocarbon, the occurrence of natural attenuation processes actively degrading petroleum impacts, and to implement opportunistic free-phase hydrocarbon recovery when warranted.

Summary of 2007 Program Activities

A groundwater monitoring event was completed for both areas in June 2007 and groundwater levels were measured on a monthly basis. Hydrophobic oil recovery socks were installed and maintained in monitoring wells known to contain free phase hydrocarbons.

2007 Program Results – Former Fueling Area

Impacts

OA-1 and OA-2 parameters (i.e., THC as diesel fuel and THC as gasoline) were detected in groundwater samples collected at one well during the June 2007 monitoring activities. Certain PAH parameters were detected in two of the wells. Detected concentrations were below the applicable regulatory standards.

Free-Phase Hydrocarbons

Approximately 5.7 gallons of hydrocarbons were recovered from three wells in the former fueling area during the 2007 Program. The monthly calculated recovery rates for the same period using a passive skimming system per well was estimated to range from 0.03 to 0.6 gallons. The relatively low recovery rate confirms the lack of recoverable hydrocarbons. The presence of mobile and recoverable hydrocarbons would be required to justify the installation of a hydrocarbon recovery system. The gauging and hydrocarbon recovery data indicate free-phase hydrocarbon migration is not occurring.

Natural Attenuation Assessment

Groundwater samples were submitted for laboratory analysis to evaluate the occurrence of natural attenuation processes. An evaluation of the test results indicates the existence of hydrocarbon impacts degradation. This evaluation is based on reduced sulfate concentrations, elevated methane concentrations, and lower oxidation/reduction potential in impacted areas relative to non impacted areas.

2007 Program Results – Former UST Area

Impacts

OA-1 and OA-2 parameters (i.e., THC as diesel fuel and THC as gasoline) were detected in groundwater samples collected at one well during the June 2007 monitoring activities. Certain PAH parameters were detected in six of the wells. Detected concentrations were below the applicable regulatory standards.

Free-Phase Hydrocarbons

Approximately 1.2 gallons of hydrocarbons were recovered from 4 wells in the former UST area during the 2007 Program. The monthly calculated recovery rates for the same period using a passive skimming system per well was estimated to range from 0.11 to 1.7 gallons. The relatively low recovery rate confirms the lack of recoverable hydrocarbons. The presence of mobile and recoverable hydrocarbons would be required to justify the installation of a hydrocarbon recovery system. The gauging and hydrocarbon recovery data indicate free-phase hydrocarbon migration is not occurring.

Natural Attenuation Assessment

Groundwater samples were submitted for laboratory analysis to evaluate the occurrence of natural attenuation processes. An evaluation of the test results indicates the existence of hydrocarbon impacts degradation. This evaluation is based on elevated methane concentrations and decreased dissolved oxygen in impacted areas relative to non impacted areas.

Recommendations

ENSR recommends the continuation of routine fluid gauging activities during 2008, but the suspension of free-phase hydrocarbon recovery efforts to assess effects of the previous recovery activities. Once the monitoring wells containing free-phase hydrocarbons have stabilized, ENSR recommends continuation of passive and manual recovery efforts. An investigation of alternative enhanced bioremediation or chemical oxidation attenuation techniques may be recommended if natural attenuation rates are determined insufficient. ENSR also recommends the continuation of annual groundwater sampling. The additional monitoring well data will improve the ability to evaluate natural attenuation and groundwater quality in the source area.

1.0 Introduction

On behalf of the Chicago Central & Pacific Railroad (CCPR), ENSR Corporation (ENSR) is pleased to present the results of Site Monitoring and Hydrocarbon Recovery Activities (2007 Program) for the CCPR railyard located in Cedar Rapids, Iowa (Site). The scope of the 2007 Program is based on information obtained from previous Site investigations, results of the 2004 Supplemental Site Assessment and Hydrocarbon Recovery Program (2004 Program), and results of the 2005 and 2006 Site Monitoring and Hydrocarbon Recovery Program (2005 and 2006 Program). The 2007 Program consisted of annual groundwater monitoring and monthly fluid gauging and hydrocarbon recovery activities. The 2007 Program is a continuation of the Site-specific plan developed during March 2004 meetings between CCPR and ENSR and progress updates from ENSR to CCPR throughout 2006. Although there is no free-phase hydrocarbon recovery system present at the Site, the 2007 Program was performed in general accordance with the Canadian National Railway's (CN) U.S. Terms of Reference for Operation and Maintenance of Recovery Systems, dated May 1, 2001.

A total of 14 Areas of Concern (AOCs) have been identified at the Site. This report focuses on two of the 14 AOCs (i.e., AOC-3 and AOC-5). The former fueling area (AOC-3) is located within Property Identification Number (PIN) 2160 IAPR 100119. The former underground storage tank (UST) area (AOC 5) is located within PIN 2160 IAPR 100167. Based on information generated during previous assessment activities, the remainder of the Site AOCs do not warrant any further action. The location of the Site is shown on Figure 1, and the general Site configuration and monitoring well network are shown on Figure 2.

1.1 Background

1.1.1 Physical Characteristics

1.1.1.1 Geologic Conditions

Based on available data, three mappable stratigraphic units have been identified in the shallow subsurface at the Site. These geologic units are as follows:

- **Fill Unit.** A surficial, gravelly sandy-type material, the fill unit has been observed in all soil borings completed at the Site, and ranges in thickness from 2 to 15 feet. The fill unit is thickest at the north end of the Site where it reaches 15 feet and is thinnest at the south end of the Site.
- **Native unconsolidated deposits**. The native unconsolidated deposits unit, composed primarily of sand and clay with some silt, has been observed in a majority of the soil borings completed. Where observed, this unit is typically 2 to 8 feet thick. The native unconsolidated deposits were predominant at the north end of the Site, where bedrock is deep. This unit was not observed at the central portion of the Site where bedrock is relatively shallow. This unit was observed at a depth of approximately 2 feet at the south end of the Site.
- **Bedrock**. Where encountered, the top of fractured dolomite bedrock was observed at depths ranging from 6 to 9 feet below ground surface (bgs). Bedrock has not been observed in monitoring wells located in the northern area of the Site. Bedrock is noted to be nearest the ground surface in the central area of the Site.

A representative geologic cross-section for the Site is provided in Appendix A.

1.1.1.2 Hydrogeologic Conditions

Groundwater flow within the unconsolidated and bedrock geologic units in the vicinity of the Site has historically been to the south/southwest towards the Cedar River. In the immediate vicinity of the former fueling area, groundwater flows away from Cedar Lake. Cedar Lake receives a process water discharge from

a nearby Alliant Energy power facility. There are no surface water bodies in the immediate vicinity of the former UST area.

1.1.2 Summary of Previous Investigations

Phase I, Phase II, and Phase IIIA Environmental Site Assessment (ESA) activities have been conducted to characterize environmental conditions at the Site. During the Phase II ESA, free-phase hydrocarbon and dissolved phase impacts were detected in both the former fueling area and the former UST area. Based on these results, a Phase IIIA ESA was conducted and consisted of delineation activities in the subject areas for free-phase hydrocarbon and dissolved phase impacts.

Subsequent to the Phase IIIA ESA, Supplemental Site Assessment (SSA) activities were conducted in 2003. The SSA consisted of additional monitoring well installations and groundwater monitoring activities. A report summarizing the SSA results was provided to CCPR in February 2004. The SSA results indicated the following conditions:

- **Former Fueling Area (AOC-3)** – Dissolved and free-phase hydrocarbon impacts were present. These impacts were generally well defined. Regulatory exceedances were not detected in hydraulically down-gradient monitoring wells. A relatively small volume of free-phase hydrocarbons has been identified within a discrete location.
- **Former UST Area (AOC-5)** – Dissolved and free-phase hydrocarbon impacts were present. The extent of free-phase hydrocarbons, on CCPR property, has been well defined. Free-phase hydrocarbons exist in close proximity to the CCPR property line, but not migrating off-site. Free-phase hydrocarbon evaluation activities conducted to date indicate the free-phase hydrocarbons are not readily recoverable.

Based on recommendations of the SSA, ENSR completed a Supplemental Site Assessment and Hydrocarbon Recovery Program in 2004 (2004 Program). The 2004 Program consisted of supplemental well installation, continued groundwater monitoring, and implementation of a focused and opportunistic hydrocarbon recovery program. The results of the 2004 Program indicated natural attenuation, supplemented with passive recovery of hydrocarbon, is the most appropriate mechanism for groundwater remediation. A report summarizing the 2004 Program results was submitted to CCPR in July 2005.

The 2005 and 2006 Program consisted of continued groundwater monitoring and focused opportunistic hydrocarbon recovery. A report summarizing the 2005 and 2006 Program was submitted to CCPR in September 2006 and January 2008, respectively.

During 2007, monthly fluid gauging, groundwater monitoring, and opportunistic hydrocarbon recovery activities were conducted at both AOCs 3 and 5.

The scope of work for the 2007 Program was developed to address the conditions noted for both of the subject AOCs.

1.2 Objectives

The objectives of the 2007 Program were as follows:

- Further evaluate the extent and magnitude of dissolved hydrocarbon impacts in the vicinity of the former fueling area and former UST area
- Evaluate the occurrence of natural attenuation processes potentially degrading petroleum-hydrocarbons in Site groundwater

- Implement a focused and opportunistic hydrocarbon recovery program for the former fueling area and former UST area, if warranted
- Evaluate the status of the subject areas within the applicable Iowa regulatory programs

To meet these objectives, the following tasks were completed as part of the 2007 Program:

- One groundwater monitoring event was completed at the former fueling area and former UST area to evaluate the extent of dissolved phase hydrocarbon impacts
- Fluid level measurements were conducted on a monthly basis at monitoring wells
- Hydrophobic oil recovery socks were installed in appropriate monitoring wells within the former fueling area and former UST area

1.3 Document Organization

Section 1 of this document provides Site background information pertinent to this report. Section 2 summarizes the scope of work conducted as part of the 2007 Program. Section 3 summarizes the results of the 2007 Program. Section 4 presents a discussion of the results of the 2007 Program and provides recommendations to support future Site management decisions.

2.0 Summary of Work Completed

The fieldwork associated with the 2007 Program was completed between December 2006 and December 2007. The following sections describe the field activities, sample collection methodology, laboratory analyses, and data evaluation activities that were completed as part of the 2007 Program.

2.1 Groundwater Sampling

Groundwater sampling activities were conducted as part of the 2007 Program. Prior to sampling, monitoring wells were purged using low-flow methods and a peristaltic pump until three well volumes of groundwater were removed or the well went dry. Field parameters (i.e., dissolved oxygen, pH, temperature, oxidation reduction potential, and conductivity) were monitored using a flow through cell and a portable water quality meter. Sampling was conducted once pH, conductivity and temperature had generally stabilized. In order to avoid damage to equipment sensors, field parameters were not monitored at monitoring wells where free-phase hydrocarbon was present. At wells exhibiting free-phase hydrocarbon, groundwater samples were collected after three well volumes of water were removed.

Groundwater samples were collected using the peristaltic pump. Samples to be submitted for volatile constituent analysis were collected using a disposable polyethylene bailer.

The following sections summarize the 2007 groundwater analytical program for the Site.

2.1.1 AOC-3 - Former Fueling Area

In June 2007, one groundwater monitoring event was conducted for seven monitoring wells (i.e., MW-10, MW-11, MW-12, MW-13, MW-14, MW-19 and MW-28). Groundwater samples were submitted to Pace Analytical for the following analyses:

- OA2 Parameters consisting of diesel fuel, fuel oil, jet fuel, kerosene, mineral spirits, motor oil, and total petroleum hydrocarbons (TPH) – Iowa Method OA2
- OA1 Parameters consisting of benzene, toluene, ethylbenzene, and xylenes (BTEX) and total hydrocarbons (THC) as gasoline – Iowa Method OA1
- Total Recoverable Phenolics – Method 420.1
- Polycyclic Aromatic hydrocarbons (PAHs) – Method 8270 SIM
- Natural Attenuation Monitoring (NAM) Suite consisting of total kjeldahl nitrogen (TKN), nitrate/nitrite, ferrous iron, methane, sulfate, and total organic carbon – Various Methods

One duplicate sample and one trip blank sample were submitted during the June 2007 groundwater sampling event for quality assurance/quality control (QA/QC) purposes. The trip blank was submitted for the analysis of OA1.

Field observations and measurements collected during the groundwater sampling program are summarized on groundwater sampling forms maintained for each monitoring well location. Copies of these forms are provided in Appendix B.

2.1.2 AOC-5 - Former UST Area

In June 2007, one groundwater monitoring event was conducted for nine monitoring wells (i.e., MW-2, MW-15R, MW-18, MW-22, MW-23, MW-24, MW-25, MW-26, and MW-27). Groundwater samples were submitted to Pace Analytical for the following analyses:

- OA2 Parameters consisting of diesel fuel, fuel oil, jet fuel, kerosene, mineral spirits, motor oil, and TPH – Iowa Method OA2
- OA1 Parameters consisting of BTEX and THC as gasoline – Iowa Method OA1
- Total Recoverable Phenolics – Method 420.1
- PAHs – Method 8270 SIM
- NAM Suite consisting of total kjeldahl nitrogen (TKN), nitrate/nitrite, ferrous iron, methane, sulfate, and total organic carbon – Various Methods

It should be noted that wells MW-2, and MW-24 were not evaluated for NAM Suite Parameters. One duplicate sample and one trip blank sample were submitted during the June 2007 groundwater sampling event for quality assurance/quality control (QA/QC) purposes. The trip blank was submitted for the analysis of OA1.

Field observations and measurements collected during the groundwater sampling program are summarized on groundwater sampling forms maintained for each monitoring well location. Copies of these forms are provided in Appendix B.

2.2 Hydrocarbon Recovery Program

As part of the 2007 Program, hydrophobic oil recovery socks were installed in monitoring wells known to contain free-phase hydrocarbons. Hydrophobic oil recovery socks were inspected and emptied, or replaced, on a monthly basis in 2007 (between the period of December 2006 and December 2007). Upon removal, each hydrophobic sock was weighed to determine an approximate volume of LNAPL removed. Fluid level measurements were also collected at the Site on a monthly basis. A summary of the monthly fluid level measurement information is provided in Appendix C. When free-phase hydrocarbons were observed to accumulate beyond the absorptive capacity of the recovery sock, the hydrocarbons were manually removed using a disposable bailer or using a peristaltic pump and disposable tubing. The volume of free-phase hydrocarbons recovered from each monitoring well was recorded during each Site visit. Spent oil recovery socks and recovered free phase hydrocarbons were placed in a drum staged at a central location within the Site. The drum and its contents are periodically disposed of at an appropriate off-Site waste management facility. Hydrocarbon recovery socks were used in 2007 at the following monitoring wells:

Former Fueling Area (AOC-3)

- MW-5
- MW-19
- MW-20

Former UST Area (AOC-5)

- MW-2
- MW-15R
- MW-21
- MW-22

2.3 Variations in 2007 Planned Work

There were no modifications to the 2007 Program.

3.0 Results

This section presents the results of the activities conducted as part of the 2007 Program.

3.1 Groundwater Flow

Table 1 summarizes the fluid level measurement data collected during the June 2007groundwater sampling event. These data were used to estimate the groundwater flow direction at the Site. Figure 3 presents a water table elevation map based on data collected during the June 2007sampling event. As indicated on Figure 3, the direction of groundwater flow at the former fueling area is generally towards the south. The direction of groundwater flow at the former UST area is to the south and east. These groundwater flow patterns are consistent with the groundwater flow characteristics observed during previous Site assessment activities.

Groundwater levels and free-phase hydrocarbon measurements were collected monthly during the 2007 Program (i.e., December 2006 through December 2007). Monthly fluid level measurement data for 2007 is summarized in Appendix C. These data were used to support certain free-phase hydrocarbon recovery efforts. Historic fluid gauging data is provided in Appendix D.

3.2 Analytical Results

The laboratory analytical data generated during the June 2007 groundwater sampling event was tabulated and compared against applicable regulatory standards promulgated by the IDNR. Separate standards were applied to each AOC based on the nature of historical operations that were conducted at each location.

Because the former fueling area is not an UST site, it falls under the Iowa Land Recycling Program (ILRP). Therefore, the Statewide Standards for Non-Protected Groundwater (SSNGW) are the applicable regulatory standards for groundwater quality. As no standard exists for diesel fuel (as part of total extractable hydrocarbons (TEH)) in the SSNGW regulations, Leaking Underground Storage Tank (LUST) Tier 1 values were applied to evaluate groundwater quality at the former fueling area. Laboratory analytical data associated with former fueling area groundwater samples, and the applicable regulatory standards, are summarized in Table 2.

Due to the historic operation of USTs at the former UST area, LUST Tier 1 values were utilized to evaluate TEH and BTEX parameters. As no standard exists for PAHs in the LUST program, SSNGW values were used to evaluate laboratory data obtained from groundwater samples collected in the former UST area. Laboratory analytical data associated with the former UST area groundwater samples, and the applicable regulatory standards, are summarized in Table 3.

Copies of the laboratory analytical reports and chain-of-custody forms are provided in Appendix E.

3.2.1 Data Validation

Upon receipt of the analytical reports, ENSR performed a QA/QC review (data validation) of the data. The data validation was based on currently applicable USEPA guidance. The purpose of the data validation effort was to ensure data generated during the sampling event was valid for its intended use. The results of the data validation program are presented in Appendix F. The data validation effort assessed the precision, accuracy, method compliance, and completeness of the data. The Relative Percent Difference (RPD) evaluation for the data is also provided in Appendix F.

The data validation results for this project indicate the subject data set is of acceptable quality and is valid for its intended use. During the data validation process, certain discrete data were qualified as estimated due to the data not meeting certain validation criteria. However, these data qualifications did not affect the overall

data completeness objective for the project. Therefore, the data set can be used to characterize the Site. A summary of the data qualifications applied to the subject data set is provided in Appendix F.

3.2.2 2007 Program Laboratory Analytical Results

The following sections summarize the results of the laboratory analytical program for the two AOCs evaluated during the 2007 Program.

3.2.2.1 Former Fueling Area (AOC-3)

The June 2007 groundwater sampling results for the former fueling area (AOC-3) are presented in the following subsections.

Iowa Method OA2 Analysis – THC as Diesel Fuel

A total of seven groundwater samples were evaluated using Iowa laboratory analytical method OA2 for diesel fuel related parameters. As indicated in Table 2, THC as diesel fuel was detected in one of the samples collected from well MW 19 at a concentration of 1.1 milligrams per liter (mg/L), below the applicable regulatory standard is 75 mg/L. In general, the results of the 2007 OA2 analytical program were consistent with results associated with previous sampling events.

Iowa Method OA1 Analysis – THC as Gasoline and BTEX

A total of seven groundwater samples were evaluated using Iowa laboratory analytical method OA1 for THC as gasoline and the BTEX parameters. As indicated in Table 2, THC as gasoline was detected in the sample collected from well MW-19 at a concentration of 1030 micrograms per liter (ug/L). There is no applicable regulatory standard for THC as gasoline. In general, the results of the 2007 OA1 analytical program were consistent with results associated with previous sampling events.

Total Recoverable Phenolics Analyses

A total of seven groundwater samples were evaluated for total recoverable phenolics using EPA laboratory analytical Method 420.1. As indicated in Table 2, total recoverable phenolics were not detected in any of the samples collected.

PAH Analyses

A total of six groundwater samples were evaluated for PAHs using EPA laboratory analytical Method 8270 SIM. Groundwater samples collected from well MW-13 were not analyzed for PAHs. As indicated in Table 2, certain PAH parameters were detected in the samples collected from wells MW-11 and MW-19. The PAH concentrations detected in these samples are below the applicable regulatory limits. In general, the results of the 2007 analytical program were consistent with previous sampling events.

Groundwater Natural Attenuation Assessment Parameters

Groundwater samples were submitted for laboratory analysis of various natural attenuation parameters including sulfate, ferrous iron, nitrate/nitrite, TKN, methane, and total organic carbon. The results of the natural attenuation parameter laboratory analyses are summarized in Table 2. Groundwater samples were also field-tested for additional natural attenuation parameters, including dissolved oxygen (DO) and oxidation-reduction potential (ORP). The natural attenuation field measurements are summarized in the groundwater sampling forms provided in Appendix B.

Certain laboratory analytical results and field measurements provide a strong indication of on-going hydrocarbon biodegradation processes in the subsurface. Descriptions of these results are as follows:

- **Sulfate** – Lower sulfate concentrations are generally found in and near the source area, represented by wells MW-11, MW-19 and MW-28, relative to concentrations upgradient and downgradient of the

source area, represented by wells MW-10, MW-12, and MW 14. This distribution of sulfate concentrations in groundwater provides evidence that sulfate is being used as an electron acceptor to support anaerobic biodegradation of petroleum constituents, where present, in the subsurface.

- **Methane** – Higher concentrations of methane are found in and near the source area, represented by wells MW-11, MW-19, and MW-28, relative to concentrations upgradient and downgradient of the source area, represented by MW-10, MW-12, MW-13, and MW 14. The presence of methane is a strong indicator of biological degradation processes.
- **ORP** – Lower concentrations of ORP are generally found in the source area, represented by wells MW-11 and MW-19, relative to concentrations downgradient of the source area, represented by wells MW-12 and MW-14. Suppressed concentrations of ORP are a strong indicator of biological degradation processes.

Other natural attenuation evaluation parameters (e.g., nitrate/nitrite, TKN, TOC, ferrous iron, DO) do not provide a conclusive pattern of data indicating biological activity.

3.2.2.2 Former UST Area (AOC 5)

The June 2007 groundwater sampling results for the former UST area are presented in the following subsections.

Iowa Method OA2 Analysis – THC as Diesel Fuel

A total of ten groundwater samples including one duplicate sample collected from well MW-25, were evaluated using Iowa laboratory analytical method OA2 for diesel fuel related compound parameters. As indicated in Table 3, THC as diesel fuel was detected in the sample collected from monitoring well MW-2 at concentration of 7.1 mg/L, below the applicable regulatory standard is 75 mg/L. In general, the results of the 2007 OA2 analytical program were consistent with previous sampling events.

Iowa Method OA1 Analysis – THC as Gasoline and BTEX

A total of ten groundwater samples, including one duplicate sample collected from well MW-25, were evaluated using Iowa laboratory analytical method OA1 for THC as gasoline and the BTEX parameters. As indicated in Table 3, THC as gasoline was detected in the sample collected from well MW-2 at a concentration of 999 ug/L. There is no applicable regulatory standard for THC as gasoline. In general, the results of the 2007 OA1 analytical program were consistent with results associated with previous sampling events.

Total Recoverable Phenolics Analyses

A total of eight groundwater samples including one duplicate sample collected from well MW-25 were evaluated for total recoverable phenolics using EPA laboratory analytical Method 420.1. Groundwater samples collected from wells MW-2 and MW-23 were not analyzed for total recoverable phenolics. As indicated in Table 2, total recoverable phenolics were not detected in any of the samples collected.

PAH Analyses

A total of ten groundwater samples, including one duplicate sample collected from well MW-25, were evaluated for PAHs using EPA laboratory analytical Method 8270 SIM. As indicated in Table 3, certain PAH parameters were detected in the samples collected from wells MW-2, MW-15R, MW-22, MW-23, MW-24, and MW-25. The PAH concentrations detected in these samples are below the applicable regulatory limits. In general, the results of the 2007 PAH analytical program were consistent with previous sampling events.

Groundwater Natural Attenuation Assessment Parameters

A total of seven groundwater samples were submitted for laboratory analysis of various natural attenuation parameters including sulfate, ferrous iron, nitrate/nitrite, TKN, methane, and total organic carbon.

Groundwater samples collected from wells MW-2 and MW-23 were not analyzed for the natural attenuation parameters. The results of the natural attenuation parameter laboratory analyses are summarized in Table 3. Groundwater samples were also field-tested for additional natural attenuation parameters, including DO and ORP. The natural attenuation field measurements are summarized on the groundwater sampling forms provided in Appendix B.

Certain laboratory analytical results provide a strong indication of hydrocarbon biodegradation processes in the subsurface. A description of these results is as follows:

- **Methane** – Methane concentrations detected in samples within and immediately downgradient of the source area, represented by wells MW-15R, MW-22, and MW-25, were greater than concentrations detected upgradient and downgradient of the source area, represented by MW-18, MW-27 MW-24, and MW-26. The presence of methane is a strong indicator of biological degradation processes.

- Dissolved Oxygen – Dissolved oxygen concentrations were generally lower within and downgradient of the source area, represented by wells MW-15R, MW-25, and MW-22, compared to DO concentrations in wells upgradient and significantly downgradient of the source area, represented by wells MW-12, MW-18, and MW-24. The decrease of DO across the source area is a strong indicator of biological degradation processes.

Other natural attenuation evaluation parameters (e.g., nitrate/nitrite, TKN, TOC, ORP, sulfate, ferrous iron,) do not provide a conclusive pattern of data indicating biological activity.

3.3 Free-Phase Hydrocarbon Recovery

3.3.1 AOC-3 - Former Fueling Area

Approximately 5.7 gallons of hydrocarbons were recovered from the former fueling area over a during the 2007 Program. Hydrocarbon recovery data for each removal event are presented in Table 4. The relative hydrocarbon mobility, as presented in Figure 4, is illustrated by the volume of hydrocarbon recovered over a 12-month period at each of the area wells. A summary of the hydrocarbon volume recovered during the monthly inspection events is provided in Appendix C. Historical gauging data for each event are provided in Appendix D.

3.3.2 AOC-5 - Former UST Area

Approximately 1.2 gallons of hydrocarbon were recovered from former UST area during the 2007 Program. Hydrocarbon Recovery data for each event are presented in Table 4. The relative hydrocarbon mobility, as presented in Figure 4, is illustrated by the volume of hydrocarbon recovered over a 12 month period of each of the wells. A summary of the hydrocarbon volume recovered during the monthly inspection events is provided in Appendix C. Historical gauging data for each event are provided in Appendix D.

4.0 Discussion

4.1 Groundwater

4.1.1 AOC-3 – Former Locomotive Fueling Area

The extent of groundwater impacts at the former fueling area have been adequately defined. Based on the data available, groundwater impacts are restricted to a localized area. This area is represented by monitoring wells MW-5, MW-11, MW-19, and MW-20.

Regulatory exceedances were not detected in groundwater samples collected from the area monitoring wells during the 2007 groundwater sampling event. The results of certain natural attenuation parameter analyses indicate hydrocarbon biodegradation processes are occurring in impacted groundwater. These biodegradation processes are likely limiting the potential migration of dissolved hydrocarbon impacts in groundwater.

4.1.2 AOC-5 – Former UST Area

The extent of dissolved groundwater impacts at the former UST area has been adequately defined. Impacted groundwater (i.e., groundwater where measurable free-phase hydrocarbon is present or groundwater concentrations are above applicable regulatory standards) is observed only in former UST area monitoring wells located on CCPR property. Regulatory exceedances were not detected in groundwater samples collected from the area monitoring wells during the 2007 groundwater sampling event. Results of certain natural attenuation parameter analyses clearly indicate hydrocarbon biodegradation processes are occurring in groundwater. These biodegradation processes are likely limiting the potential migration of dissolved hydrocarbon impacts in groundwater.

4.1.3 Regulatory Status

To date, no information regarding the environmental status of the former fueling area has been submitted to the IDNR. Groundwater monitoring activities are consistent with the applicable regulatory programs each AOC are being compared and managed with.

4.2 Free-Phase Hydrocarbon Recovery

4.2.1 Free-Phase Hydrocarbon Recovery Analysis for AOC-3

As summarized in SSA, the estimated recovery rate per well as determined by baildown test data and other recoverability testing information for the identified free-phase hydrocarbon plume at AOC-3 ranged from 0.03 to 0.6 gallons per month (gpmth). The total amount of free-phase hydrocarbon recovered at AOC-3 from the three wells (i.e., MW-5, MW-19, and MW-20) where free-phase hydrocarbons are observed during 2007 was approximately 5.7 gallons. The average recovery rates for those three wells during 2007 as well as previous years are summarized in Table 5. Table 5 also provides a range of expected initial recovery rates for wells located at AOC-3 as determined during the SSA. As shown on Table 5, all three well are within the expected recovery rate range, but generally indicate a decline in recovery rate. Appendix G provides a copy of the free-phase hydrocarbon recoverability rate estimate test results from the SSA.

4.2.2 Free-Phase Hydrocarbon Recovery Analysis for AOC-5 – Former UST Area

As summarized in SSA, the estimated recovery rate per well as determined by baildown test data and other recoverability testing information for the identified free-phase hydrocarbon plume at AOC-5 ranged from 0.11 to 1.7 gallons per month (gpmth). The total amount of free-phase hydrocarbon recovered at AOC-5 from the four wells (i.e., MW-2, MW-15R, MW-21, and MW-22) where free-phase hydrocarbons are observed during 2007 was approximately 1.2 gallons. The average recovery rates for those four wells during 2007 as well as

previous years are summarized in Table 5. Table 5 also provides a range of expected initial recovery rates for wells located at AOC-5 as determined during the SSA. As shown on Table 5, all four wells fall below the low initial recovery rate estimate. The reduction in recovery rates noted in 2007 likely indicates that hydrocarbon recovery in all four of the wells is experiencing the recovery rate decline that would be expected as the volume of mobile hydrocarbon continues to decrease over time. Appendix G provides a copy of the free-phase hydrocarbon recoverability rate estimate test results from the SSA.

4.2.3 Regulatory Status

ENSR prepared a Tier 2 Site Closure Report (SCR) for the former UST area in early 2006 for submittal to CCPR only. The results of the Tier 2 SCR assessment classified the groundwater impacts as no further action, even though free-phase hydrocarbons are still present in some of the wells. However, sites classified as no further action under the IDNR RBCA program, yet still exhibit free-phase hydrocarbons, require recovery activities on a minimal monthly basis.

According to the IDNR Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (Section 567—135.7(5) – Free Product Assessment and Removal), recovery efforts may be suspended when the amount of free-phase hydrocarbons recovered is equal to or less than 0.1 gallon each month for a year. Inspections must be continued monthly for one year to measure fluid levels in recovery wells. Only one well MW-20 had a recovery rate that exceeded the 0.1 gallons per month criteria If free-phase hydrocarbons thicknesses exceed 0.02 feet, recovery efforts must be reinitiated. Of the three wells where free-phase hydrocarbons were recovered at AOC-3 (i.e., MW-5, MW-19, and MW-20), all exceeded the 0.02 feet free-phase hydrocarbon thickness threshold during the 2007 monitoring program. Of the four wells where free-phase hydrocarbons were recovered at AOC-5 (i.e., MW-2, MW-15R, MW-21, and MW-22), all exceeded the 0.02 feet free-phase hydrocarbon thickness threshold during the 2007 monitoring program.

5.0 Recommendations

Based on previous investigation results, and on the data collected in 2007, it is likely that the dissolved hydrocarbon impacts to groundwater at the Site are associated with relatively immobile free-phase hydrocarbon. Recovering the mobile portion of the free-phase hydrocarbon is unlikely to be an effective means of groundwater remediation because the estimated mobility of hydrocarbon at the Site is very low. Therefore, the most appropriate mechanism for groundwater remediation is natural attenuation supplemented with an IDNR compliant passive hydrocarbon recovery program. If CCPR desires, a potentially more aggressive approach would consist of using chemical oxidation, or enhancing natural attenuation, to reduce the hydrocarbon source volume and further reduce the risk of potential off-site migration.

The following sections provide detailed recommendations related to the former fueling area and the former UST area.

5.1 AOC-3 - Former Fueling Area

Based on applicable IDNR guidance for sites with hydrocarbon-impacted groundwater, ENSR recommends the following activities for the former fueling area:

- Free-phase hydrocarbon recovery
  - Allow all wells to recover to static thicknesses to evaluate the impact of recovery efforts effects on site LNAPL thicknesses (i.e., suspend recovery activities until LNAPL thicknesses remain at consistent thicknesses for approximately 2 consecutive months)
  - Resume free-phase hydrocarbon recovery operations after thicknesses have been allowed to stabilize. Inspect and maintain hydrophobic socks on a monthly basis as required under IDNR regulations for free-phase hydrocarbon recovery
  - Once recovery operations have resumed, manually remove free-phase hydrocarbons opportunistically at wells were significant thicknesses are measured
- Groundwater monitoring
  - Continue to analyze groundwater samples for petroleum related and natural attenuation parameters in order to support a case for long-term natural attenuation as the appropriate groundwater remedy

At the end of the 2008 monitoring and hydrocarbon recovery program, the effectiveness of these activities will be reevaluated.

5.2 AOC-5 - Former UST Area

Based on IDNR recommendations for sites with hydrocarbon-impacted groundwater, ENSR recommends the following activities for the former UST area:

- Free-phase hydrocarbon recovery
  - Allow all wells to recover to static thicknesses to evaluate the impact of recovery efforts effects on site LNAPL thicknesses (i.e., suspend recovery activities until LNAPL thicknesses remain at consistent thicknesses for approximately 2 consecutive months)

  - Resume free-phase hydrocarbon recovery operations after thicknesses have been allowed to stabilize. Inspect and maintain hydrophobic socks on a monthly basis as required under IDNR regulations for free-phase hydrocarbon recovery

  - Once recovery operations have resumed, manually remove free-phase hydrocarbons opportunistically at wells were significant thicknesses are measured

- Groundwater monitoring
  - Continue to analyze groundwater samples for petroleum and natural attenuation parameters in order to support a case for long-term natural attenuation as the appropriate groundwater remedy

The 2007 EIS Sheet is provided in Appendix H. Previous Executive Summaries and EIS Sheets are provided in Appendix I.